ISSTE'2018

Plant Biotechnology Research Team (EBV), FS Tetouan,
Information Systems Engineering Research Team (ERISI)
ENSA Tetouan and the Club of Doctors in Science and Technology
Organize the

Second Edition of the International Symposium

Science and Technology at the service of the Environment

23rd and 24th June 2018 **at the faculty of sciences, Tetouan**

Symposium Proceeding Abstracts

www.ciste2018.docst.uae.ma

About STE'18

The Science, progress, the technique and technology can (and must) be put at the service of Humanity, of the improvement of its conditions of existence.

In the face of the environmental problems, many seek to find technological solutions capable of transcending the limits of our current model. The environmental concerns and environmental issues are increasingly strong, and today it is consensus that our current model of development must be transformed if it wishes to avoid the multiplication of environmental problems.

But the technology, can it truly respond to the ecological issues? , How this question structure-t-it the ecological debate?

In this second edition of the international symposium "Science and Technology at the service of the Environment" (STE'18), which will be held on 23rd and 24th June 2018 at the Faculty of Sciences of Tetouan, Morocco, you will have the opportunity to disseminate your research and to share experiences with other research experts in all areas in relationship with the environment. This international symposium will address a range of important themes in all major areas of activity.

The subjects of the International Symposium STE'18 cover a wide spectrum of the environment and its application in all areas of science, namely:

- Biomolecules and Environment
- Biotechnology and Sustainable Development
- Climate Change and Challenges for the Environment of Tomorrow
- Conservation, Valorization and Exploitation of Natural Resources
- Smart City and Objects Conn
- Technological innovation at the service of the Environment

Acknowledgments

This event would not have been possible without the effective contribution of:

- The honorable guest speakers
- All participants and scientific contributors
- The Scientific Committee
- The Organizing committee
- The Local Support Committee
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The second edition of the international symposium "Science and Technology at the service of the Environment" (CISTE'18), received more than 100 abstract submissions which were put through a blind, peer-reviewed process carried out by an international and national panel of reviewers who play a critical role in designing a strong scientific program. More than 20 specialists, who we extend our special thanks for the time they dedicated to the success of the conference and their expertise to serve as peer reviewers, helped to ensure that the abstracts presented were selected on the basis of rigorous review and were of the highest scientific quality.

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- Pr. Lotfi CHRAIBI, Professor of Environmental Management, ENSA, Tangier, Morocco.

WORKSHOPS

- **Science, Communication and Consciousness** by Mr. Khalid ZAOUCH, Coach in personal development, coach in accompaniment of young lecturer.
- **Soft Skills for PhD Students** by Mr. Youssef El FAKIR, US Embassy Alumni: Resilient Societies: Civil Society Capacity Building, Founder of Junior Chamber International, City - Tetouan, Co-Founder at CMERES Moroccan Center for Studies and Research on Social Enterprise.
- **Systems of Geographical Information System** by Mr. Jad TAHOURI, President of the Scientific Commission of the Moroccan Association for the Protection of Heritage and Monkey loot "PPSM" and vice-president of PPSM.

WELCOME TO STE'18

A friendly thought to all of colleagues who didn't have time or who didn't have sufficient funds to attend to the STE'18 Symposium.

We wish to meet you in future in the next STE International Symposium.

Thank you for coming, all of you who make the journey to Tetouan.

Have a great conference!

Symposium Program

Saturday 23rd June 2018

At Prestige Hotel, Avenue 9 Avril, Tetouan

08h00-09h00 Registration of participants

09h00-09h30 Speech

- **Pr. AMEZIANE Hodaifa** : President of the UAE
- **Pr. EL MOUSSAOUI Ahmed** : Vice-president in charge of the Scientific Research
- **Pr. MOUKRIM Abdellatif** : Dean of the Faculty of Sciences of Tetouan
- **Pr. KERKEB Mohamed Larbi:** Dean of the Polydisciplinaire Faculty, Larache
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- **Pr. LAMARTI Ahmed** : Chairman of STE'18, FS, UAE, Tetouan, Morocco.
- **Pr. KHOULJI Samira** : Chairwoman of STE'18, FS, UAE, Tetouan, Morocco.

09h30-11h00 Plenary conferences

- **Pr. MOUKRIM Abdellatif** : "The evaluation and the bio monitoring of the state of health of coastal ecosystems".
- **Pr. KERKEB MOHAMED Larbi** : " Environnemental Information Systems".
- **Pr. HABOUBI Khadija** : "The use of green technologies for the preservation of the environment: the case of the solid waste management".

11h00-11h30 Coffee Break

11h30-13h00 Plenary conferences

- **Pr. TEMSAMANI Khalid**: "The role of the Non State Actors in the implementation of the National and Global Climate Policy".
- **Pr. KHOMSI Kenza** : "Science and Technology in support of the follow-up to the quality of the air in Morocco: of the observation to the forecast".
- **Pr. LOTFI Chraïbi** : "Circular Economy in Morocco: issues of sustainable development and prospects".

13h00-13h30	Questions & Discussions
13h30-15h00	Lunch Break
15h00-18h00	Parallel sessions of Oral and Poster Presentations
18h00-19h00	Distribution of Certificates of Participation

Sunday 24th June 2018

At Prestige Hotel, Avenue 9 Avril, Tetouan

09h00-10h00	Registration
10h30-12h30	Workshops Session

- **Mr. ZAOUCH Khalid** : "Science, Communication and Consciousness ".
- **Mr. EL FAKIR Youssef** : "Soft Skills For Phd Students".
- **Mr. TAHOURI Jad** : "Systems of Geographical Information System (GIS ".

12h30-13h00	Distribution of Certificates of attendance in workshops
13h00-15h00	Lunch Break
15h00-16h00	Closing of the Symposium

Biomolecules and Environment

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Under-fractions valorization of *Nigella sativa* acetone extract

Since earliest times, people have gathered plants substances to create herbal medicines to treat certain diseases. Many of the powerful drugs used in modern medicines originated in plants. Today's plant-based drugs treat a range of diseases, from headaches to cancer. That is why we try to explain plant activity and how can we exploit it at most.

In this work, we focused on *Nigella Sativa* L. plant, which is much known in Islamic Arabic culture. We have fractionated acetone extract collected under-fractions and evaluated the antioxidant activity with DPPH assay [1] and beta-carotene bleaching assay [2]. For each under fraction, finally, we have done a phytochemical test in order to identify active under fractions.

The separation of warm extract by soxhlet has given ten under-fractions that we have evaluated the antioxidant activity. In DPPH assay, E, F, and G under fractions have given better IC50% than acetone fraction. For beta-carotene bleaching assay, we have had the same results as DPPH assay for E and F under-fractions but not G. We can claim that some under-fractions are more active when they are separated. In another hand, phytochemistry [3] have allowed to identify then explain the antioxidant activity based on family of chemical group responsible for under-fractions activity.

In conclusion, we have separated acetone extract of *Nigella sativa*, which have shown the importance of separating under-fractions due to their activities, which exceeds raw extracts ones. In fact, these under-fractions could be more valued by corrosive, antibacterial and antifungal assays.

Keywords: *Nigella sativa,* DPPH, Beta-carotene.

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Optimization and validation of a paralytic toxin assay method in bivalve molluscs by post-column high performance liquid chromatography (HPLC-FD)

In the presence of several factors, the ocean surface forms blooms that result from the multiplication of micro-algae. The proliferation of certain genera of these microorganisms produce paralytic toxins (Paralytic Shellfish Poisons (PSPs)) that are likely to accumulate in filtering organisms, such as bivalve molluscs. Paralytic Seafood Poisoning (PARF) (or Paralytic Shellfish Poisoning (PSP)) results from human ingestion of seafood contaminated with these toxins. PSPs act by blocking the voltage-gated sodium channels, thereby preventing the spread of nerve impulses, thereby causing paralysis [1].

The first case of intoxication in Morocco due to the ingestion of shellfish accumulating these toxins was recorded in 1961 [2]. In order to cope with the health risks related to these biotoxins, the National Institute for Halieutic Research (INRH) has set up, since 1992, a network for monitoring the safety of the coast. The role of this network is to monitor the level of contamination by these biotoxins, by taking regular samples of water and shellfish samples, and prohibit fishing in contaminated areas until the concentration of these biotoxins is reduced.

The official method used for the detection of PSP is a biological test on mice (bioassay). Nevertheless, this method remains qualitative and non-specific since it does not give an idea about the nature of the toxin present. Thus, the use of other more sensitive and accurate confirmation analysis methods becomes necessary.

Our study consists in developing and validating a HPLC liquid chromatography method for the research of PSP in sea products, at the Regional Laboratory for Analysis and Research, ONSSA, Tangier.

The work consists, initially, in the development of PSP analysis method with the HPLC / FD, carrying out a series of tests for each toxin to fix their retention time and then for mixtures of toxins since the standards are rare and expensive. This

validation will take into account the nature of the matrices used (clams, hulls or mollusc mixtures) and their condition (fresh or preserved products).

In order to reach the first objective, we have worked with standards of STX and its derivatives to fix the various parameters of the method such as the retention time, the mobile phase and so on. Then we proceed to the doping of the matrix to study its effect.

In the end, the exploitation of the results obtained by the implementation of the method as well as the optimization of the protocol and those obtained after the validation of the method makes it possible to describe the advantages of the technique and to verify the achievement of the goals.

Keywords: PSP, HPLC/FD, validation, bivalve molluscs.

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One-pot synthesis of Thiocarbamates from Cellulose and Cellulose Acetate Biopolymers

Cellulose is a renewable, inexhaustible, non-toxic rigid biopolymer with excellent chemical resistance and mechanical strength [1]. Moreover, cellulose natural fibers were widely used to enhance the physico-chemical properties of composites with a modest cost and variable morphology [2] [3]. In addition, the biodegradation and biocompatibility characters make this biopolymer to be the promising fiber over the others, and they widen the surface of industrial applications in a perpetual way. Indeed, cellulosic fibers were been applied in many fields such as: food, paper, clothes, medical and membranes [4]. Its derivatives, such as cellulose acetate, have been used in a broad field of applications such as adhesive, film base in photography or in separation processes. In contrast to cellulose, cellulose acetate possesses a much less crystalline structure and thus exhibits better solubility in common organic solvents such as acetone [5]. Cellulose acetate is obtained by reacting cellulose with acetic acid and acetic anhydride, in the presence of a strong acid acting as a catalyst [6].

In this work, an easy method was developed to modify cellulose and cellulose acetate using a typical and traditional approach transforming the hydroxyl groups existing on the surface of these raw materials. Firstly, a precursor with a free isocyanate group (HDI-thiol) is prepared and thereafter is used for modifying these raw materials homogenously in one-pot, minimizing toxic solvents and expensive reagents. The obtained derivatives are characterized using Fourier Transform Infrared spectroscopy (FTIR), Nuclear Magnetic Resonance spectroscopy (NMR) and thermal analysis (TGA, DTG) techniques. It is noted that a sustainable raw materials and one-pot procedure employed lead to 100% economy atom and environmental factor. Among the objectives of this contribution are the environment protection and the development of green chemistry discipline. The thiocarbamate compounds showed better solubility in comparison with cellulose and cellulose acetate and can drive to wide game of applications in different industrial fields.

Keywords: Cellulose, cellulose acetate, raw material, carbamate, thiocarbamate, one-pot synthesis.

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Antifungal activity of *Lavandula pedunculata* (Mill.) Cav. essential oil

Moroccan agriculture is the pillar of the national economy. Unfortunately, the crop production is decreasing by phytopathogenic fungi. To overcome this constraint, farmers are abusing chemical pesticides, and this may have negative consequences especially on the human health and environment.

The objective of the present study was to evaluate the antifungal activity of *Lavandula pedunculata* (Mill.) Cav. essential oil sampled from the Moroccan High Western Atlas. The biological tests were carried out in laboratory on *Rhizopus stolonifer, Aspergillus brasiliensis* and *Penicillium expansum,* using different concentrations of the essential oil.

The results showed that there is a significative difference in the response of the three pathogens used; *P. expansum* was the most sensitive strain; the reduction of mycelial growth was observed for all the tested concentrations with a dose dependent effect, reaching 85% at the essential oil concentration 0.5 µl/ml. *A. brasiliensis* was also sensitive, but less than *P. expansum* and its inhibition was about 65% for 0.5 µl/ml dose.

Whereas, with *R. stolonifer*, there was no significant effect at low essential oil concentrations (0.125 µl/ml and 0.25 µl/ml); the unique dose which gave a good affect was 0.5 µl/ml, which showed a complete suppression of the fungal development.

Keywords: *Lavandula pedunculated,* essential oil, antifungal activity.

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Anaerobic biological treatment combined with physicochemical treatment by coagulation-flocculation of the fuel wash water from a thermal power plant in Mohammedia

This work focused on the waste water treatment of a thermal power plant in the city of Mohammedia, which uses fuel in the production of electrical energy.
The present work focuses on the characterization and treatment results of the fuel wash water.

We applied the anaerobic biological treatment followed by a physicochemical treatment by coagulation-flocculation to effectively reduce pollution and subsequently optimize the operating conditions of this technique at very low cost, on the other hand to study or to test the two techniques of treatment of the fuel wash water and the influence of certain parameters on the treatment technique (pH, temperature, conductivity, COD, BOD5, NO2-, turbidity, phenol, phosphorus T, etc.) and optimize the operating conditions of these processes [1] [2].

Finally establish a comparison between the two different treatment techniques from the point of view of the optimal concentration as well as the performance of each process.

Keywords: Fuel wash water; anaerobic biological treatment; physicochemical treatment; thermal power plant; coagulation-flocculation.

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Moroccan grape pomace: Evaluation of phenolic contents, chromatic and antioxidant properties

Grapes are one of the world's largest fruit crops, with approximately 75 million tons produced each year [1]. About 53% were mainly used for wine production. In Morocco, annually the wine industry produces large quantities of solid waste called grape pomace (GP), which consists of pressed skins, seeds and stems. It represents approximately ≈ 20% of the weight of processed grapes that ends up as pomace [2]. The large amounts of grape pomace constitute a serious problem for wineries. It constitutes an ecological and economical waste management issue [3]. The grape pomaces are characterized by high levels of phenolic compounds due to an incomplete extraction during the winemaking process [4]. Phenolic acids, stilbenes, lignins, anthocyanins and proanthocyanidins are the principal phenolic constituents of grape pomace [4] [5] [6].

The polyphenolic potential of grapes pomaces generated by wine cellars in Morocco is not yet evaluated. Therefore, the aim of this study was to characterize the phenolic compounds and evaluate the coloring and antioxidant properties of four grape pomaces issues from Château Roslane (*Arinarnoa, Cot*, and *Cabernet-Sauvignon* before and after fermentation). In cellar of Château Roslane (Meknès, Morocco), the grape pomace samples were collected from white and red grapes winemaking to evaluate their phenolic composition, coloring and antioxidant capacity. Proanthocyanidins (PAs) were quantified by UPLC ESI/MS after fractionation/chemical depolymerization (thioglycolysis), anthocyanins by HPLC-DAD at 520 nm and antioxidant capacity was measured by Cyclic Voltammetry (CV), FRAP, ABTS and DPPH assays. The seed proanthocyanidins concentration was always higher than the concentration in the skin and ranged from 56.1 ± 0.3 mg/g Dry Weight (DW) in *Cot* F to 88.4 ± 2.3 mg/g DW in *Cabernet-Sauvignon* and the distribution had the highest concentration at a degree of polymerisation (DP) of 8-10 in all grape pomace representing around 72-89% of the total PA. *Cabernet-Sauvignon* skin contained higher levels of PA (22.1 ± 0.3 mgg^{-1}DW) and showed distribution of fraction proanthocyanidin as follows: 12% of 15-20 DP and 87% of 40-45 DP. The maximum total anthocyanins amount and antioxidant activities were found in *Cot* skin extract (32.8 mg/g DW, DPPH: 0.23 mM trolox/g DW; ABTS: 0.38 mM trolox/g DW and CV: 1.73×10^{-3}m.AV) followed by *Arinarnoa* F skin extract which had the highest color potential (152 ± 4.6 Unit color) than the other grape varieties. Skin phenolic contents are specifically associated with CV and DPPH antioxidant

activity. Grape pomaces represent an important potential source of bioactive molecules which can found their application in food, cosmetic and chemical industry.

Keywords: Grape pomace, proanthocyanidin, thioglycolysis, anthocyanin, antioxidant assay, cyclic voltammetry, château roslane.

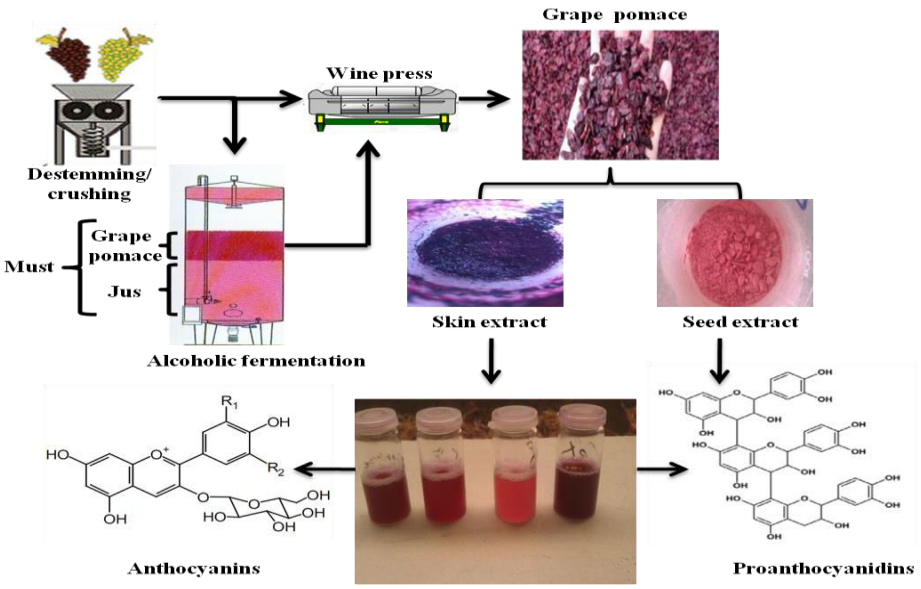

Figure: Graphical abstract (grape pomaces production, seed and skin phenolic extracts)

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Evaluation of antibacterial and antioxidant activity of some α-aminophosphonate derivatives.

Since ancient times, essential oils have been recognized for their medicinal value and therapeutic benefits [1]. They are very powerful natural plant products that have many uses, both in pharmacology and aromatherapy [2].

Nowadays, these natural compounds increasingly attract the interest of chemists and biologists due to their multiple functions, especially antioxidant [3] and antimicrobial [4] activities. However, these volatile compounds also have certain limits, in particular their minimal amount, and the processes for extracting these oils or the purification of their active molecules. That is why several researchers have used fine chemistry as a tool to discover new entities (molecules), more effective, stable and widely available. This new moleculs are produced by total synthesis or hemisynthesis [4].

The objective of this work was the synthesis and characterization of four α-aminophosphonates derivatives: 4a, 4b, 4c and 4d. The synthesized compounds were tested against three pathogenic strains (*E. coli, S. aureus, and L. monocytogenes*), and their antibacterial action is performed by well diffusion method.

Then we evaluated for the first time the antioxidant activity of these products *in vivo* after induction of oxidative/nitrosative stress using a eukaryotic organism as an experimental model: it's the freshwater protozoan *Tetrahymena pyriformis* [5].

The results of the antibacterial test (figure 1) revealed that the three multi-resistant strains are sensitive to all synthesized compounds (4a, 4b, 4c) except 4d products which have a moderate antibacterial activity.
In the other hand, we study the effect of two products among the four synthesized and we conclude that both products own a protective effect against oxidative and nitrosative stress (figure 2). It's the 4.a and 4.c compounds which plays an antioxidant role but at the same time endowed with a powerful antimicrobial activity.

Keywords: Antioxydant; antibacterial, Tetrahymena, α-aminophosphonates, stress.

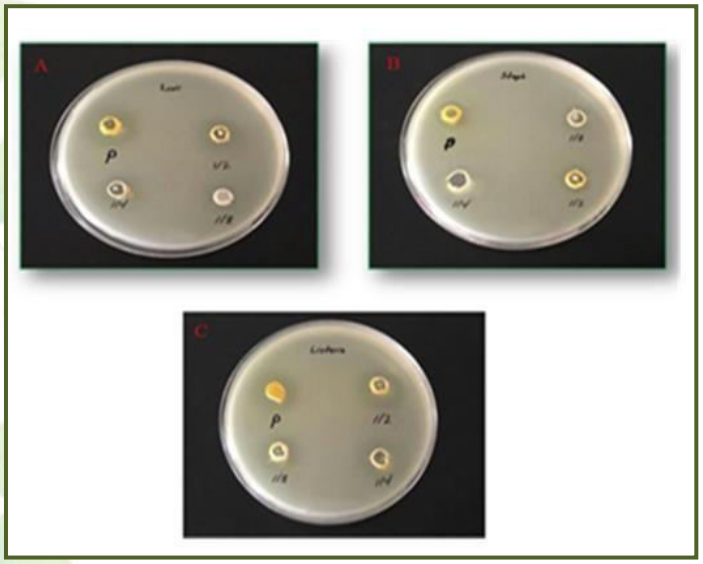

Figure 1: sensitivity of 3 strains (*S. aureus*, *E. coli and L. monocytogenes*) to 4.c product.

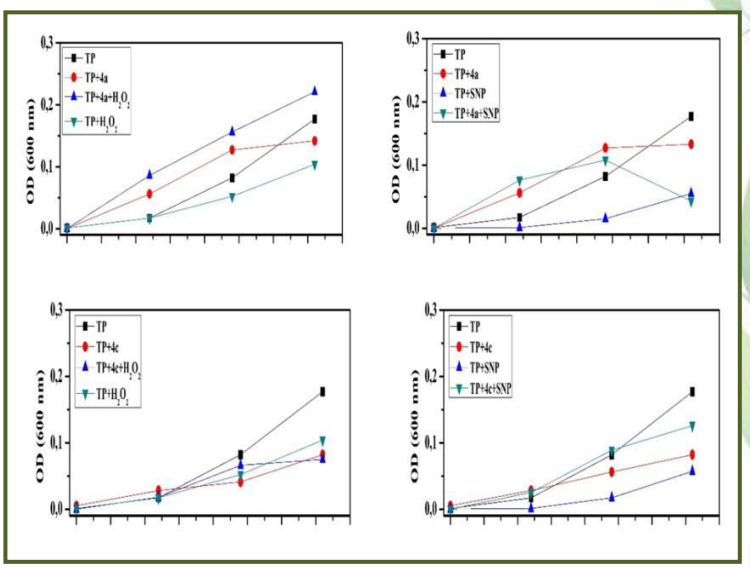

Figure 2: Test *in vivo*: antioxydant activity of 4.a and 4.c product.

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Monitoring the bacteriological quality of the marine waters of the Anza-Taghazout sector beaches following the installation of wastewater treatment plants (Anza and Aourir)

The city of Agadir, the pearl of Souss, is known for its many economic sectors generating significant revenues for the country's economy, especially the tourism sector. It is considered as the second most attractive city for tourists thanks to its beautiful beaches. However, these beaches are notorious for their deteriorated condition because of untreated industrial water discharge, port and domestic wastewater discharges, especially in the Anza - Taghazout sector [1]. To solve this problem, decision-makers have built two wastewater treatment plants since March 2016. The first was set up in the Anza city with a 2.5 km outfall at sea that discharges treated wastewater and the other was installed at Aourir for the treatment of Aourir and Tamraght wastewater. The objective of this study is to evaluate the impact of this new situation on the area.

To monitor the condition of this maritime sector; the Aquatic Systems: Marine and Continental Research Laboratory has initiated a research project aimed at evaluating its current condition at three sites; the first located at the Anza beach, the second located near the wastewater treatment plantof Aourir and the third located in Tamraght beach. This is a multidisciplinary study that includes monitoring of the physiochemical and microbiological quality of water and sand, and studying the biology and population dynamics of the sentinel species used in several international programs for monitoring the marine environment: *Mytilus galloprovincialis* (Lmk, 1819) [2-4] and ecotoxicological monitoring via the response of four biomarkers of pollution: AChE, MDA, Catalase and GST at the same mollusk in the three sites.

The bacteriological analyses of marine water samples collected monthly at the three sites during the period from January 2017 to December 2017 are based on two bacterial species indicating fecal contamination: Fecal coliforms and fecal streptococci. These waters are collected aseptically in sterile bottles of 1000 mL and are transported to the laboratory in a cooler at 4°C and in the dark. Microbiological analyses are carried out in the first three hours following the sampling by the membrane filtration method [5].

The results show the existence of a seasonal fluctuation of the bacterial number. The quantification of fecal contamination flora allowed us to follow the evolution of the ratio fecal coliforms/fecal streptococci to know the origin of the fecal contamination in the waters taken from the three sites studied and classified beaches of ANZA – TAGHAZOUT sector according to Moroccan standards.

Keywords: Agadir Bay, Anza, Aourir, sewage, marine ecosystem, Fecal coliforms, Fecal streptococci.

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Evaluation of total phenolic content and phytotoxic activity of fruits of *Capparis spinosa*

In the objective of valorization of spontaneous and Mediterranean plants, as well as the rationalization of their use, our choice fell on the species *Capparis spinosa* for its many therapeutic and culinary virtues. It is a plant widely used in the pharmaceutical industry, in modern and traditional medicine [1] [2] [3], as well as in agri-food as a food additive and sensory stimulant taste or natural conservative. Indeed, its nutritional values and its antimicrobial, anti-inflammatory and antioxidant properties make it one of the most appreciated medicinal and aromatic plants.

Based on the qualitative and nutritional importance of this plant, our contribution, with a view to its valorization and rationalization, is to evaluate *in vitro*: on one hand, the total phenolic content of ethanolic and aqueous extracts of fruits of *C. spinosa*, harvested from western Morocco. Which is determined by the method of Follin-Ciocalte. On the second hand, we have proceeded to test the cytotoxicity by the seed germination inhibition test of *Lepidium sativum*.

The different extracts have revealed high content in total polyphenols about 20 mg GAE / g dry matter.

In referring to the results of the bibliography on quantifying polyphenols total in extracts fruit of *C. spinosa*, we note a difference of their values that depends on the type of solvent and the origin of the plant. However, Allaith [2] found a content of 120 mg GAE / 100g fresh weight. As for Aliyazicioglu *et al.* [4] the content was 37.01 ± 0.03 mg GAE / 100 g extract. Comparing those values to ours, we conclude that the fruit of Moroccan *C. spinosa* is more riche in phenolic compound.

The most important percentage of germination is observed in ethanolic extract. Concerning the vigor of seedling, after 7 days of incubation, the results reveal that the length of the radicle was reduced by nearly 66 and 10% respectively for the ethanolic and aqueous extracts. But after rehydration of the seeds of *Lepidium sativum* during two days of incubation in the extracts, it gives a resumption of growth

of rootlets in a normal way, so in the second day, the inhibition of germination was not detected, so we can say that those results indicate that the toxicity of this plant is negligible.

We observed that the alcoholic extract of the fruits affects the division and the cellular elongation. These antimitotic and stimulatory activities of the cell growth induced by the extracts studied previously can be considered as important characteristics of this plant, implying an anti-cancer and healing bioactive capacity, a very promising therapeutic value which must be confirmed by more relevant studies.

In conclusion*, Capparis spinosa* is a plant of nutritional qualities particular for its total phenolic content, and pharmaceutical quality by its antimitotic effect.

Keywords: *Capparis spinosa*, fruits, ethanol extract, 10% decoction, total phenolic content, antimitotic effect, germination, *Lipidium sativum* seeds.

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Emulsifying and antioxidant activities of exopolysaccharides produced by halophilic bacteria isolated from Moroccan hypersalins environments

Exopolysaccharides produced by bacteria are high molecular weight polymers that can have a great potential for application in different industrial areas due to their emulsifying, viscosifying and antioxidant properties [1].

Halophilic bacteria are considered as an important source for exopolysaccharides because they survive in extreme environments and might produce new polymers with a great interest for biotechnological applications [2].

In this context, exopolysaccharides were produced from halophilic bacteria isolated from Moroccan hypersalins environments. The production was carried on MY at 5% sea salt solution.

The antioxidant activity of exopolysaccharides was studied by DPPH free radical scavenging and total antioxidant assay. The emulsifying activity was investigated by mixing equal volumes of the exopolysaccharides dissolved in water (0.5% w/v) and different hydrophobic substrates (diesel oil, paraffin oil and sunflower oil).

The results showed that all the studied exopolysaccharides exhibited antioxidant and emulsifying activities with the exopolysaccharide from *Marinobacter* sp. forming the highest and most stable emulsions and exhibiting the best antioxidant activity in comparison with other exopolysaccharides produced by *Halomonas* strains. These results prove that the studied exopolysaccharides are bioactive molecules that can be used as emulsifying and antioxidant agents in the cosmetic, food and pharmaceutical industries.

Keywords: Exopolysaccharide, Antioxidante activity, Emulsifying activity

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Antibiofilm activity *of Salvia officinalis* extracts

Bacterial biofilms pose cruel health risks especially in the food industry in clinical environments and drinking water systems where they touch the food chain and public health. The increased biofilm resistance to conventional treatments enhances the need to develop new control strategies.

In the present study, we investigated *in vitro* antibiofilm activity of plant extracts (hexane and dichloromethane) of *Salvia officinalis* (Lamiaceae family) against biofilms Gram-positive (*Staphylococcus aureus*) and Gram-negative (*Escherichia coli*) bacteria formed on stainless steel. Before that, Minimum Inhibitory Concentration assay (MIC) was evaluated using micro-dilution method against these bacteria.

Very interesting results were revealed and all extracts tested showed significant degradation of *Staphylococcus aureus* and *Escherichia coli* biofilms. Ten minutes of contact significantly (<0.05) reduced adhered bacterial populations for both extracts tested.

Keywords: Plant extracts, S*alvia officinalis*, antibacterial, antibiofilm.

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Theoretical study of the mechanism and regioselectivity of nitration reaction of the 3-isopropyl-1,6-dimethyl-naphthalene and ar-himachalene: DFT STUDY

In this work we studied the mechanism and the regioselectivity of the nitration reaction of ar-himachalene and 4-nitroar-himachalene (Figure 1) employing the MEDT theory at the DFT B3LYP/6-31G (d) computational level. These nitration reactions evolved through non-concerted mechanism. The examination of the energies related with the diverse reaction pathways indicates that the nitration reactions of ar-himachalene and 2-nitroar-himachalene are highly regioselective, in conformity with the experimental conclusions [1], in addition our study show that the best solvent for nitration reaction are ether and chloroform, and the best catalyst is AlCl3.

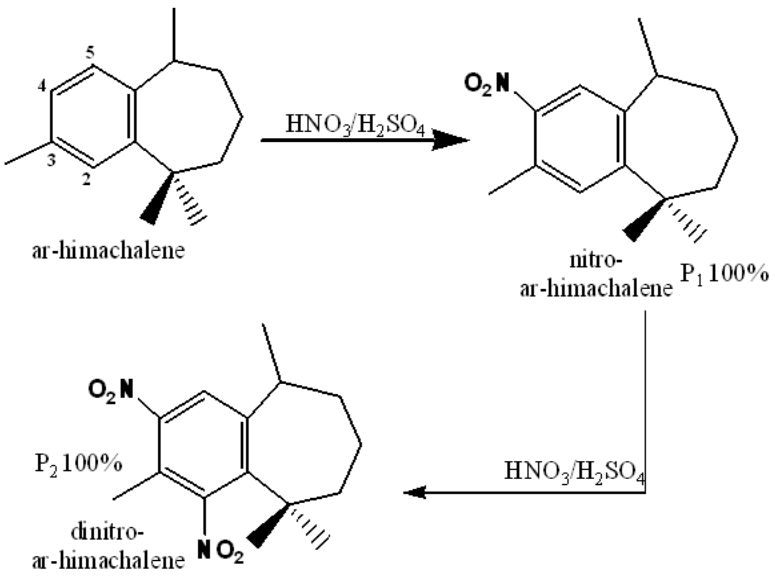

Figure 1: Reaction of the 3-isopropyl-1,6-dimethyl-naphthalene and ar-himachalene

Keywords: Regioselectivity, ar-himachalene, DFT, MEDT, solvent

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Isolation and identification of halophilic bacteria producing exopolysaccharides

Halophilic bacteria are microorganisms that live in hypersaline environments. They are considered a valuable source of new exopolysaccharides with properties of interest for industrial applications [1]. In this work, a screening was carried out to isolate exopolysaccharides producing halophilic bacteria from four Moroccan hypersaline environments. Isolated strains have undergone biochemical characterization and a study of their susceptibility to antibiotics. The selected strains were identified by sequencing and comparing the 16S rRNA gene sequence with the reference sequences present on the NCBI database.

From a total of 193 isolates of halophilic bacteria, 12 isolates were found to produce exopolysaccharides. The identification based on the comparison of the 16S rRNA gene sequences showed that 11 strains belong to the genus *Halomonas* and one strain belongs to the genus *Marinobacter*. The 16S rRNA sequences of the isolates were deposited on NCBI. The strains showed sensitivity to the majority of antibiotics tested which proves that they are safe for use in biotechnological applications. In addition, biochemical characterization has shown that some of these strains are capable of producing hydrolytic enzymes, which demonstrates their potential as a source of bioactive molecules.

Keywords: Halophilic bacteria, Exopolysaccharides, Hypersalins environments

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Biotechnological Upgrading of Umbrina waste: Swim bladder

As part of the development strategy of the fishery sector in Morocco, the National Development Strategy Halieutis seems sensitive and rational to develop new technology to upgrade marine biomass co-products towards high value-added products rather than the low interest waste.

Given the abundance of *"Umbrina cirrosa"* swim bladders, this study aims to develop a method of a biopolymer extracting from this biomass and to evaluate its protein content as well as its antioxidant activity. The biopolymer developed during this study has very high protein content compared to the same biopolymer extracted from the duck feet [1] and a satisfactory antioxidant activity better than other biopolymers who do not hold any radical scanning activity determined by TEAC or have very little activity [2].

The biopolymer of fish skin has certain antioxidant properties but whose mechanism is uncertain [3].

Keywords: *Umbrina cirrosa*, swimming bladder, extraction, antioxidant activity, biopolymer.

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Biotechnology and Sustainable Development

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Screening of new allelic variation for drought tolerance genes in EMS- mutants durum wheat population (*Triticum turgidum* L. subsp. *durum* Desf.)

Durum wheat (*Triticum turgidum ssp.durum*) is the second most important wheat species and is cultivated in about 21 million hectares. Durum production has been a part of people's diet, for a long time [1]. In spite of its economic importance, the ability to modify and understand gene function in wheat is still not fully developed due to several limitations. Recently, genome sequencing programs for many plant species [2] [3] has led to the availability of a large number of genomic sequences in public databases which subsequently has encouraged the development of reverse genetics tools [4]. Several techniques are currently used for this purpose. T-DNA or transposon insertional mutagenesis has been used successfully in rice and Arabidopsis to assemble large gene knockout collections [5] [6], but has not been extended to wheat.

This present study aims to screen for mutations generated by the mutagen EMS on the population of TILLING durum wheat in genes associated with tolerance to drought. Screening of mutations was based on a very simplified detection system non-denaturing agarose gel and mutant sequences were screened thereafter to determine the exact mutation it carries.

We identified 31 novel alleles in 5 targeted genes related of drought tolerance (SNAC; DHNWZ; DHN 11 and RUBISCO) in TILLING population of durum wheat. Results from the first screens in conventional agarose gels 1.5% of the targets of five candidate genes indicate that the mutagen treatment has been effective with an average mutation of at least one mutation per 19 -47 kb. The 0.6% EMS–treated population had about 1 mutation per 35.92 kb.

Keywords: *Triticum durum*, TILLING, genes, drought tolerance.

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Physiological analyses of limited transpiration rate under high evaporative demand during durum wheat domestication

To satisfy increasing wheat demands, scaling up wheat production will require boosting yield in suboptimal, drought-prone areas. This increase will be particularly challenging since in several major agricultural regions of the world, yield stagnation has been observed during last decades. In addition to soil drought, drought-prone environments tend to exhibit high levels of atmospheric vapor pressure deficit (VPD), which is an additional driver of crop water loss via transpiration (TR). Recently, it was hypothesized that "water-saving" cultivars displaying TR decreases in response to high VPD, or in response to the soil drying, should lead to enhanced drought tolerance under terminal drought conditions by increasing the availability of stored soil moisture during the critical grain filling phase. It is likely that during breeding, breeders favored high-yielding but more water-consuming genotypes, and disfavored/excluded low-yielding but more conservative species. For this purpose, we have examined the evolution of TR traits in a domestication series of durum wheat. TR response to an artificial increase in vapor pressure deficit (VPD) of 3 species was evaluated: *Triticum turgidum* L. subsp. *Dicoccoides*, *Triticum turgidum* subsp. *Dicoccon* and modern elite lines of durum wheat (*Triticum durum* Desf.). Our findings reveal a large diversity of responses especially in wild and primitive wheat. Such considerations will be particularly useful to breeding and introgression of useful traits from crop wild relatives.

Keywords: Domestication, drought, VPD, transpiration, water conservation traits.

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Contribution to the rehabilitation of degraded pastoral lands using *Bituminaria bituminosa* (L.) Stirton. and the application of biofertilizers

Rangelands and silvopastoral systems in the middle Atlas are under a heavy pressure, which led to pasture degradation, invasion by non-palatable and toxic species and edaphic aridification due to the regression of the global vegetation cover. In this situation, the introduction of multipurpose leguminous shrubs such as *Bituminaria bituminosa* (L.) Stirton., commonly known as bituminous clover, could be a promising socio-ecological alternative for the rehabilitation of these degraded areas. The application of biofertilizers like plant growth promoting rhizobacteria (especially phosphate solubilizing bacteria) can ensure a successful installation of this plant in the selected degraded areas.

The main objective of the present work is to produce well inoculated seedlings using the best efficient PSB strains in the greenhouse to increase their ability to resist to environmental constraints once transplanted to the field in the central Middle Atlas.

Keywords: Rehabilitation, *Bituminaria bituminosa*, phosphate solubilizing bacteria, biofertilizers, Middle Atlas.

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Contents of trace metal elements in the row goat's milk from Northern Morocco

Goat's milk production has always been a fundamental part of the economy, diet and cultural heritage in the mountainous regions of Northern Morocco. Today, the consumer is becoming more demanding and requires foods with good nutritional quality and without health risk to humans [1]. Therefore, determination of the residual concentrations of metals in milk could be an important ''direct indicator'' of the hygienic status of the milk and/or of its derived products, as well as an ''indirect indicator'' of the degree of pollution of the environment in which the milk was produced [2]. The present study was designed to analyze heavy metals (Cd, Ni, Pb, Cr) in goat milk samples collected in one of the most productive regions in Morocco. Trace element analysis in milk was performed using mass spectrometry. The highest concentrations were observed on the level of the Pb content which varies between 48.7µg/kg and 120.75µg/kg. The lowest content was recorded for Cd, in the most areas this concentration is of 0.25µg/kg, but it exceeded 1µg/kg in area A. Concerning Cr, its concentration is in lower part of the threshold of detection for the area H, but the maximum content arrives at 26.63µg/kg. We should mention the absence of Ni in milk in all the sites of sampling.

The technological progress, the various industrial material and the agricultural activities are considered to be the important sources of the environment's and the food chain's contamination.

Keywords: Goat's milk, Northern Morocco, heavy metals, essential metals.

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Study of safety aspects and probiotics potential of lactic acid bacteria isolated from Moroccan traditional dairy products (lben, jben, lemon and olives) and goat fecal microbiota

Probiotic industries strive for new, efficient, and promising probiotic strains that impart a positive impact on consumer health. Challenges are persisting in isolation, screening and selection of the new indigenous probiotic strains.

The stress gastro-intestinal tract represents a physiological condition crucial encountered by the probiotic bacteria during digestive transit. In effect, these bacteria ingested must survive and express their specific metabolic functions under acidic conditions in the stomach, and in the presence of bile in the intestine [1].

In the present research, we explored the probiotic potential of 30 lactic acid bacteria isolated from Moroccan traditional dairy products (lben, Jben, lemon and olives) and goat fecal microbiota, in a series of *in vitro* tests. We also demonstrated their health benefits, Dnase and gelatinase activities, bile esculin, bile salt concentration (0–4% with increments of 1%) [2].

Principal component analysis revealed that all strains were able to survive in the presence of 4% bile salt. Several strains could be considered promising probiotic candidates since they showed good growth capacity and survival under simulated gastro-intestinal conditions.

These strains need to be further investigated in details for their application in the development of novel probiotic preparations for the improvement of public health.

Keywords: Lactic acid bacteria, probiotics, gastro-intestinal tract, bile salt, dairy product.

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Traditional cheeses "JBEN" and fermented milk "LBEN" in Tangier, north region of Morocco as a source of potential probiotic strains

LAB stands among the most important groups of microorganisms used in food fermentations. They play an important role in the production of fermented foods because of their long and safe history of application and consumption in the production of fermented foods and beverages, their presence in foods is correlated with their role as starter cultures, as probiotics or as bio-preservatives.

The present study's goal is to characterize a collection of LAB isolated from traditional cheeses "JBEN" and fermented milk "LBEN" of Tangier Morocco. Furthermore, technological and functional properties are determined in order to select strains with relevant industrial traits for possible use as starter or protective cultures or also as probiotics. The development of starter cultures and new biotechnological processes for improving the organoleptic quality of traditional cheeses "JBEN" and fermented milk "LBEN", its safety aspects and thus avoiding important economic losses related to several problems will be of great importance considering the natural and empirical fermentation process of traditional cheeses and fermented milk [1].

A collection of 19 *Lactobacillus Spp* (n=11 are *Lactobacillus plantarum,* n= 4 are *lactobacillus paracasei,* n=2 are *Lactobacillus Rhamnosus,* n=2 *Lactobacillus curvatus*) were selected on the basis of their potential technological and evaluated for safety aspects, antibacterial activity, survival under different gastric conditions, aggregation properties and biofilm formation [2].

Under gastric conditions, different viability rates were shown depending on the strains. All *Lactobacillus* strains were able to survive in the presence of 4% of bile salts while different viability rates were shown for the capacity to survive at low pH (1.5). At (t=0 min), the maximum survival rate was observed for L*actobacillus plantarum* (104.57 log UFC/mL), followed by 102.83±4,24 log UFC/mL, 102.70 log UFC/mL and 100.63 log UFC/mL for *Lactobacillus parcasei*, *Lactobacillus rhamnosus* and *Lacobacillus casei* respectively, and finally *Lactobacillus curvatus* with a rate of 98.42 log UFC/mL. Concerning the capacity to survive at pH (2), also the maximum survival rate was observed for L*actobacillus plantarum* (104.57 log UFC/mL), followed by *Lactobacillus parcasei (*100.92 log UFC/ml), *Lactobacillus rhamnosus*

(100.00 log UFC/ml) and *Lactobacillus curvatus* (96.68 log UFC/ml). However *Lactobacillus plantarum* showed a maximum survival rate at t=30 min with a rate of 116.26 log UFC/ml, followed by *Lactabacillus paracasei* (100.20 log UFC/ml) and *Lactobacillus curvatus (*100.00 log UFC/ml).

Auto-aggregation of *lactobacilli* belonging to the same strain is an important feature especially in the human gut. It showed that *Lactobacillus* strains exhibited different auto-aggregation abilities ranging from high *Lactobacillus casei* (41.19%), *Lactobacillus plantarum* (41.21 %), medium (37.33% and 31.42%) for *Lactobacillus paracasei*, *Lactobacillus plantarum* respectively, and low for *Lactobacillus plantarum* (13.41 –9.51%).

Co-aggregation of lactobacilli with pathogenic bacteria was variable and statistically significant depending on the lactobacilli and pathogenic strains used. High co-aggregation capacity (41 –100%) of *Lactobacillus plantarum* (three strains) was detected with *E. coli*, while two of *Lactobacillus paracasei*, one of *Lactobacillus plantarum*, and one of *Lactobacillus rhamnosus* had a high co- aggregation with *Listeria innocua* (41 - 50%). Regarding biofilm formation, eight of *Lactobacillus* strains were able to form biofilms although with different degree being 2 of 16 strains with high capacity (0.74 -0.72) for *Lactobacillus rhamnosus* and *Lactobacillus plantarum* respectively. Medium capacity for the rest of the trains (0.43- 0.58) was observed.

Strains of *Lactobacillus* isolated from traditional cheeses "JBEN" and fermented milk "LBEN" could be considered as probiotic candidates, since they showed good growth capacity and survival under different environmental and gastrointestinal conditions, good ability of auto-aggregation and of coagulation with pathogenic bacteria, and they also exhibited different functional properties determining their efficacy not only in the gastro-intestinal tract but also in food matrices.

Lactobacillus casei, *Lactobacillus plantarum, lactobacillus paracasei* and *lactobacillus rhamnosus* were selected as the most robust probiotic strains according to their high potential in several probiotic tests.

Keywords: Lactobacillus, probiotic, gastric conditions, human gut.

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Identification of the antibacterial effect of lactic acid bacteria and their reactions to antibiotics

The uncontrollable use of antibiotics in recent years has led to a big problem; there is much-needed antibiotic resistance, in the medical and hospital fields, to find an effective solution to fight these infections bacteria resistances.

In this context, this work aims to study, *in vitro,* the inhibitory potential of 24 lactic acid bacteria isolated from the "Leben" and traditional cheese from the northern region of Morocco. The lactic acid bacteria (LAB) were characterized by phenotypic criteria, and then the inhibitory capacity of the LABs was demonstrated by testing them by the agar diffusion method inoculated with 5 different pathogenic bacteria: *Staphylococcus aureus, Salmonella typhimurium, Escherichia coli, Listeria monocytogenes* and *Enterococcus faecalis*, and LAB resistance to 5 antibiotics (Cephalothin, Kanamycin, Ampicillin, Chloramphenicol and Amoxicillin).

The 24 LABs demonstrate low antibacterial activity *in vitro* against both *Staphylococcus aureus* and *Listeria monocytogenes*, while there is a total absence of antibacterial activity against the other three pathogenic bacteria (*Salmonella typhimurium, Escherichia coli* and *Enterococcus faecalis*). In addition, the characterizations of our LABs revealed a high sensitivity towards four antibiotics: Cephalothine, Kanamycin, Ampicillin and Chloramphenicol, while absolute resistance to Amoxicillin.

This study demonstrated the inhibitory potential of LAB for some pathogenic strains, as well as their ability to combine with antibiotics, such as Amoxicillin, to reduce the presence of multi-resistant bacteria in the environment.

Keywords: Antibacterial activity, antibiotic, lactic acid bacteria, inhibitory capacity and resistance.

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Nitrification and denitrification of leachate from El Jadida landfill in Morocco

In Morocco, the production of household waste and industrial waste causes critical problems of pollution; one of the major problems is the production of liquid effluents rich in organic and mineral matter called leachates [1].

Leachate treatment facility is required before discharging leachate into the environment and this depends on several factors such as the characteristics of leachate, and costs. Specific treatment techniques can be used to treat this hazardous wastewater in order to protect the ecosystem [2].

In this study, we worked on the removal of NH^{4+} and NO^{3-} produced by the landfill of the El Jadida city using aerobic and anaerobic treatment.

The biological treatment by aeration removed 47% of NH_4^+ and increased the concentration of NO^{3-} from 961.5 mg/L to 4006 mg/L after 30 days, this is called the nitrification effect. Biological treatment by anaerobic removed just 3% of NH^{4+}, but 73% of NO^{3-} which is transformed into N_2 gaz, this is called the denitrification effect. Indeed, after 30 days of anaerobic treatment, the concentration of NO^{3--} and NH_4^+ are respectively 256.4mg/L and 741mg/L.

Keywords: Leachate, nitrification, denitrification.

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Biocontrol of strawberry anthracnose caused by *Colletotrichum acutatum* using *Bacillus amyloliquefaciens* and *Trichoderma harzianum*

All living organisms are subject to predation, parasitism or to the competition of other agencies. The study of these interactions has helped to identify many opportunities for the use of living organisms to protect crops against plant pathogens. When they are used as agents for the protection of cultures, the organisms have been described as biopesticides.

The worldwide production and use of biopesticides are increasing rapidly. Organic agriculture and the agricultural products free of pesticides would justify without doubt an increase in the adoption of biopesticides by farmers. We think that the biological pesticides may be less vulnerable to genetic variation in populations of plants that cause problems related to the resistance to pesticides. If they are deployed in an appropriate manner, biopesticides have the potential to ensure the sustainability of the world's agriculture for food security and animal. Agriculture is negatively affected by many parasites, leading to a reduced performance and a poor quality of products. The most common method to combat the phytopathogen is the intensive use of phytosanitary products of chemical origin.

Although the use of agrochemicals has contributed greatly to the increase in agricultural productivity; they have caused adverse effects on the environment, the toxic residues of feed and food for animals. In addition, the dependence on chemical pesticides and their indiscriminate use have caused several detrimental effects on the environment.

Our work focuses on the biological control which constitutes an alternative to chemical pesticides for use in agriculture, with the benefits of a greater acceptance by consumers and a reduced environmental impact. The selection of the antagonists planned for the biological control of plant diseases usually implies to collect and examine a large number of microbial isolates and to increase the probability of discovering a strain highly effective on the surfaces of the host (roots and fruit). The purpose of our work is to assess the potential of biocontrol of *Bacillus*

amyloliquefaciens and *Trichoderma harzianum* against *Colletotrichum acutatum* the causal agent of strawberry antharcnose.

The results obtained suggest possibilities of application interesting on the biological control of anthracnose disease of cultivated strawberry *(Fragaria x ananassa* Duch.).

Keywords: Antagonism, biological control, phytopathogen, biopesticides, anthracnose.

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Contribution to the rehabilitation of *Acacia gummifera* Wild. and restoration of agrosylvopstoral ecosystems degraded in Morocco by microbial biotechnologies

The reintroduction of native plants, combined with good management of microbial symbionts communities, is an effective biotechnological tool for the recovery of degraded ecosystems. *Acacia gummifera* is a multiple use leguminous tree which is characterized by its resistance to drought and salinity. Through its symbiotic association with compatible rhizobia, it is able to fertilize the soil. This endemic species of Morocco is exposed to intense degradation.

The present study is based on a microbial engineering approach that consists in formulating efficient biofertilizer to enable a good establishment of this tree in the degraded sylvo-pastoral ecosystems.

The results of the molecular identification of strains isolated from nodules of *Acacia gummifera* showed a variability of strains belonging to the genera Rhizobium, Ensifer and Acinetobacter, where 80% of these isolates were able to form root nodules and the symbiotic efficiency reached 114% six months after planting.

Keywords: Rehabilitation of *Acacia gummifera*, restauration, microbial biotechnology**.**

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Optimization of the biological treatment of brassware wastewater and physicochemical characterization

The industrial effluents present a considerable Impact on the environment because of their content of organic matters.

Among these effluents, the effluent of brassware constitute a potential source of pollution because they are rich of heavy metals, for that a preliminary treatment adapted to its nature is necessary. The biological treatment of these effluents is an interesting alternative, because it allows an effective depollution without the use of chemical products.

The choice of biological process SBR as treatment is based on several advantages which this kind of treatment have. The performance of this process is studied at the level of the laboratory with low and medium load 0.3kg and 0.7kg COD m^{-3} j^{-1} respectively and with a daily cycle (24 hours). The evaluation of the process is judged by the abatement of the COD and BOD_5 and discoloration, as well as the abatement of heavy metals which were followed during the operation of the engine. These biological outputs showed significant rates of abatement for the COD, BOD_5, discoloration and metallic pollution.

Keywords: Biological treatment, SBR, brassware wastewater, organic matters, metallic pollution.

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Valorization and optimization of the leachate treatment of the controlled landfill of the city of Fes in a Sequencing Batch Reactor coupled to a filtration system.

Waste disposal sites are a potential source of contamination of ground and surface water by percolation or leaching of materials deposited there.

The leachate or waste juice is a liquid that flows through the matter, extracts of soluble or suspended solids, or any other component of the material through which it has passed. And it is a highly polluting factor because of its organic matter, its heavy metals and its pathological microorganisms.

This work aims to eliminate the chemical and microbiological load in order to have an effluent that meets the standards of rejection in force. The leachate treatment system is composed of a filtration column packed with a natural support and coupled to a sequential batch reactor (SBR).

After the start of this project, analyzes at the laboratory showed an elimination rate of 100% of the biological oxygen demand (DBO5) and 90% of the suspended matter (MES). Concerning the microbiological analyzes, the treatment system has shown a reduction rate that varies between 98% and 100% of fecal contamination germs.

Based on these results, our treatment system has proved its effectiveness, and the treated leachates have reached Moroccan discharge standards and could be reused for irrigation.

Keywords: Leachate, biological treatment, filtration, Sequencing Batch Reactor

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Biological Treatment of Tannery Wastewater

Although most of the physico-chemical processes used in the clarification of sites contaminated by the trace metals remain effective, however, they raise the problem of the high cost and the scalability of the processes.

The objective of this study is to isolate bacteria able to reduce chromate-containing effluents. Bacteria were assayed for their ability to reduce Cr(VI). Cr(VI) reduction was assessed using the diphenyl carbazide (DPC) reagent. Additionally, soil samples were used to carry out physico-chemical analyses. The bacterial isolates were morphologically and biochemically characterized. Yet, the isolates Have been tested for tolerance to various trace metals including Cr(VI), Hg, Cd, Pb, Cu, Co, Zn, Ni, Mn and Li. Consequently, we were able to select high-performance isolates, basically, for their ability to tolerate high Cr(VI) concentration in combination with other trace metals, as determined by the Minimal Inhibitory Concentration (MIC) against Cr(VI) in liquid medium using the microdilution technique. Finally, the antagonistic effect between the isolated bacteria was studied on agar medium by the disk diffusion technique.

Soil characterization showed alkaline pH and high content of lead, chromium, copper, magnesium and zinc. Ten out of 50 isolates showed high MIC ranging from 350 to 700 mg/L. The antagonistic assay allowed us to select 4 isolates to constitute our treatment consortium. Using such process, we have recorded a reduction up to 70% of chromium starting from a sample of 50 mg/mL of chromium.

Keywords: Bacteria, tannery effluent, chromium (VI)

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Ultrasonic Influence on Carob tree (*Ceratonia siliqua* L.) rooting under *in vitro* conditions

The carob tree (*Ceratonia siliqua* L.) is a long-lived evergreen and thermophilous tree thriving in habitats with mild Mediterranean climates. It is an important aromatic and medicinal tree that belongs to the family of *Leguminoseae* [1]. Due to its particular biological and agro-ecological features, such as resistance to salinity, adaptation to poor soils and minimal cultural requirements, the carob tree was included in the national list of priority as important forest resources for conservation in Morocco.

Adventitious root formation in cuttings is an essential step for successful vegetative propagation of many woody plants. However, in several tree species, rooting is still a major problem. The potential of *Ceratonia siliqua* cuttings to form adventitious roots decreased with increasing plant age. Plant Acoustic Frequency Technology (PAFT) is the treatment of plants with a specific sound frequency. This treatment was found to increase crop yield and quality, and strengthen disease-resistance [2].

The objective of this work is to find the biological effect of audible sound on the growth and the rooting of the carob tree and also to establish a model protocol aiming to apply this potential technology on the rooting recalcitrant plants.

The mature carob seeds were scarified and disinfected under aseptic conditions, then the seeds were germinated on agar medium, and all cultures were maintained in the growth room at 26±2°C under 16/8 h photoperiods of cool-white light at 1500 lux. After 10 days of *in vitro* germination, hypocotyls cuttings were taken from young plants and used as explants.

Four parameters were tested: the first concerns the duration of exposure to ultrasound (15 or 30 min); the second concerns the concentration of IBA (0.5; 1 & 2 mg/L); while the third one concerns the effect of ultrasonic treatments before and after IBA addition; and the fourth concerning the incubation temperature (5°C or 30°C). All the explants were transferred to a pre-sterilized glass bottle containing 50 mL of agar medium. Cultures were maintained in the growth room at 25±2°C under 16/8 h photoperiods of cool-white light at 1500 lux.

Compared with controls, the present study shows that the stimulation of carob seedlings by ultrasound has a positive effect on plant growth, roots number and length. The ultrasonic treatment for 15 min improved the root growth of the carob seedlings compared to the control; the same treatment combined with 2 mg/L of IBA, while the incubation temperature of 5°C shows significant results compared to 30°C, which help better to develop and improve cellular responsiveness to rooting.

This study was conducted to evaluate the effects of ultrasound on the growth of carob seedlings, root quality and quantity. Ultrasound as a form of stress role has important effects on plant growth and development. Ultrasonic treatment with some frequencies can help a plant to better absorb water and nutrients in its culture medium, and can influence the growth of some plants organs.

Keywords: *Ceratonia silique*, ultrasound stimulation, *in vitro* culture.

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Diversity of halophilic and halotolerant bacteria producing extracellular hydrolytic enzymes isolated from salt marshes in Morocco

As adaptive strategies against harsh salt stresses, the majority of halophiles and halotolerants microorganisms living in Hypersaline environments often synthesize valuable extracellular biomolecules, including extracellular hydrolytic enzymes [1]. These enzymes have a great interest in several biotechnological applications [2]. The aim of this study was to determine the diversity of the halophilic and halotolerant bacteria with hydrolase activities.

Determination of extracellular hydrolytic activities was performed as follow: cellulolytic activity of each strain was revealed as described by Sadfi-Zouaoui *et al* [3]. DNase activity was tested according to Jeffries *et al.* [4]. Amylolytic, lipolytic and proteolytic activities were revealed according to the methods described by Cowan [5], Sierra [6] and Sadfi-Zouaoui *et al.* [3], respectively.

Screening bacteria from two hypersaline environments in Center and South of Morocco led to the isolation of a total of 166 halophilic and halotolerant bacteria able to produce at least one extracellular hydrolytic enzyme. A total of 95, 74, 72, 53, and 32 strains produced cellulases, amylases, DNases, lipases and proteases, respectively. These bacteria are able to grow optimally in media with 5–10% salts and in most cases up to 15- 20% salts. The optimal pH and temperature for growth of all strains were determined as 7.5 and 30°C respectively. The present study indicated that most of the Gram-positive bacteria isolated from salt marshes studied belonged to *Staphylococcus cohniicohnii, Staphylococcus warmeri, Staphylococcus epidermidis, Staphylococcus haemolyticus and Staphylococcus christinae.*

Keywords: Extremophiles, halophiles, extracellular hydrolytic enzymes, screening.

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Optimization of growth and cellulase enzymes (CMCase, FPase) production by the yeast *Trichosporon sp*

A cellulosic yeast isolate *Trichosporon sp* has been extracted from the gut of a coprophage "*Gmnopleurus sturmi"* on a semi-synthetic medium containing carboxymethylcellulose (CMC) as the only carbon source. The culture conditions were modified in order to optimize the growth and the production of two cellulosic enzymes (CMCase and FPase), which are able to catalyze the degradation of CMC and filter paper. Our work consisted of diversifying the composition and the concentration of the medium, including the carbon source concentration, the organic and inorganic nitrogen sources, the initial pH of the medium, the cell concentration, and the agitation of the culture medium. The obtained results show that the cellulase enzyme production was optimal (0.194 IU/mL) for CMCase and (0.078 IU/mL) for FPase with a concentration of CMC of 10 g/L. The organic nitrogen sources provide a good biomass and enzymes production with yeast extract and peptone with a concentration of 10% each. Among the various inorganic nitrogen sources tested, ammonium sulfate, ammonium nitrate and urea gave a maximum biomass and enzyme production. Thus, the optimum cell concentration for inoculation of the culture medium is 1% (OD = 1). The yeast strain studied is more active in a medium with a pH of 5 to 6. Moreover, the agitation of the culture has improved cellulase production; Maximum production noted at 320 rpm (0.196 IU/mL) for CMCase and (0.106 IU/mL) for FPase; and the production of cellulases is promoted by some oligosaccharides, but the best induction was observed by arabinose at 0.5%.

Keywords: *Trichosporon sp*, CMCase, FPase, culture medium.

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Evaluation of three Pest Management Programs Based on monitoring, Mass-Trapping, sanitation and insecticide treatment against the Mediterranean Fruit Fly *Ceratitis capitata* on Citrus Orchards in Berkane (Morocco)

The Mediterranean fruit fly (medfly), *Ceratitis capitata*, is one of the world's most destructive agricultural insect pests due to its global distribution and history of rapid and devastating outbreaks [1] [2]. Until now, the chemical treatments have been the main measure used against this pest [3] [4]. Some efforts have been made to substitute chemical treatments by environment respectful methods such as mass-trapping and orchards sanitation. In three citrus orchards of Berkane, the mass-trapping technique, combined with cultural control and chemical treatments sprays, was included in an IPM program. The treatments sprays have been applied essentially by ground way using Spinosad and Lambdacyhalothrine. The efficiency of these programs has been estimated by calculating the rate of punctured fruits during October-December 2016 (Figure 1). The applied programs revealed good performances especially in the orchard in which the mass-trapping was applied combined with Spinosad and lambdacyhalothrine ground spray and cultural control (orchard sanitation). With that program, the damages were about 0.85% of punctured fruits at harvest. In the orchard where ground spray treatments were applied, the damages reached 2.38% and in the witness this rate reached 4.84%. Based on this trial, we conclude that the citrus areas treated only by insecticides against the Medfly and the number of chemical spray can be gradually reduced by applying IPM programs including mass trapping technique as supplementary measure.

Keywords*: Ceratitis capitata*, chemical treatments, cultural control, IPM, mass-trapping,

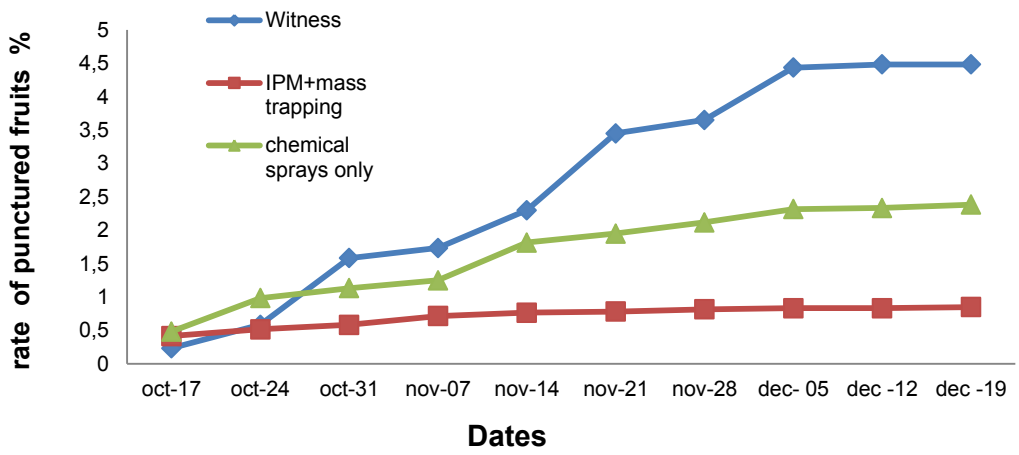

Figure 1: Evolution of punctured fruits in different

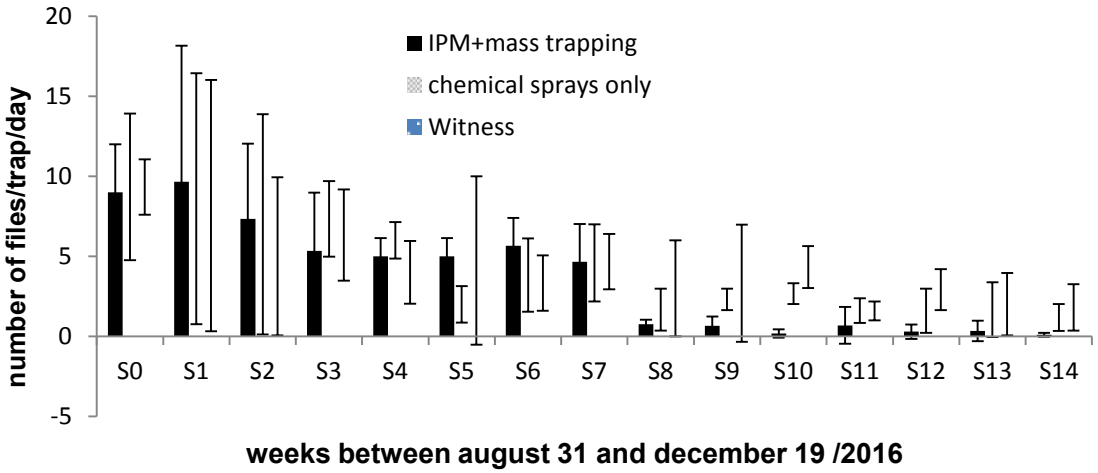

Figure 2: Evolution of medfly males captures in orchards

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Evaluation of fungal interactions between *Candida albicans*, *Aspergillus*, *Fusarium*, and some antagonists

Fungi of the genus *Aspergillus*, *Fusarium*, and *Candida* are among the ubiquitous fungi of the environment. *Aspergillus fumigatus* has emerged as one of the most common and most dangerous nosocomial fungal pathogens, particularly in immunocompromised patients. *Candida albicans* is the causative agent and the most associated with a serious fungal infection, accounting for more than 90% of cases [1] while the genus *Fusarium* and *Alternaria* are molds harmful to both plants and humans. They produce mycotoxins that can affect human health; their attacks can cause serious damage to agricultural products, thus causing socio-economic problems that can be serious [2]. These fungi are the most resistant to antifungals due to intensive use. The search for new antifungal agents with fewer side effects is an important approach for better control of fungal pathogens and phytopathogens.

In vitro direct culture-medium (EMA) assays between these pathogens and microorganisms isolated from different substrates revealed that: five yeasts inhibited *Candida albicans* with different zones of inhibition (14.7, 14.3, 12.7, 10.7 and 10.3mm), while an isolate inhibited *Aspergillus fumigatus* (33%). The study of the inhibitory effects of the supernatant of the cultures of the antagonistic isolates showed different inhibition according to the tested isolates and pathogens studied.

Keywords: *Candida albicans*, *Aspergillus*, fungal interaction

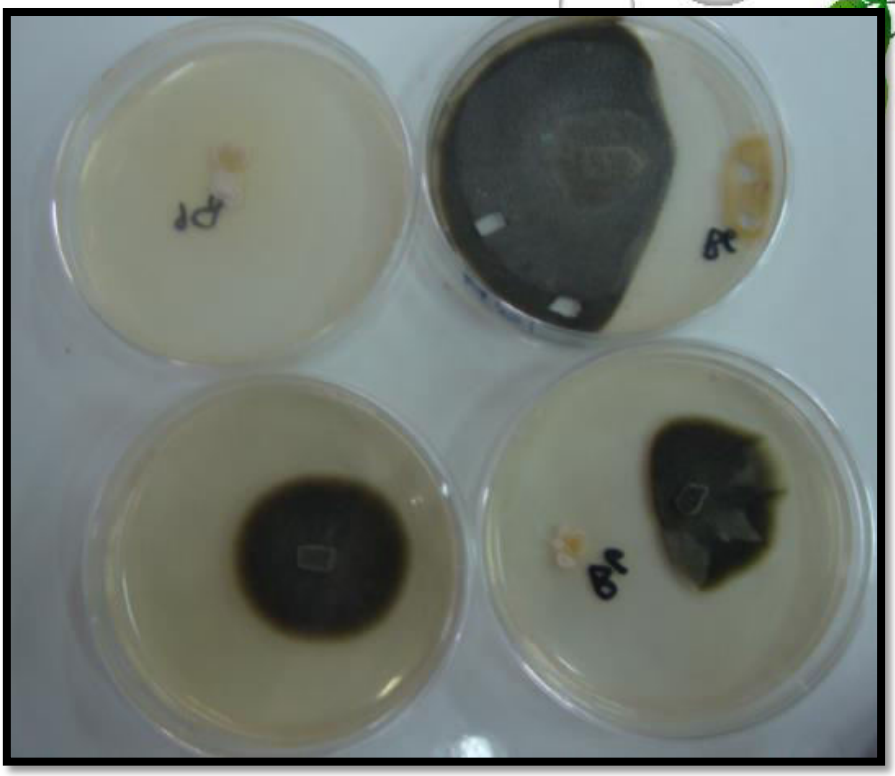

Figure 1: Evaluation of fungal interaction

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Phenotypic characterization of Rhizobium from root nodules of *Trigonella foenum-graecum* in northwest region of Morocco

Because of their economic, agronomic, ecological and pharmacological importance, legumes (Fabaceae) constitute a strategic issue for several countries. In Morocco, wild and cultivated legumes occupy an important place and are characterized by great diversity. Among them, species of the genus Trigonella.

In Morocco, most of the research on Rhizobium-legume symbiosis is limited to certain legumes, namely, chickpea [1], Acacia [2], Peanut [3], Cytise triflore [4], Sulla [5]. So far, no serious study has been done on *Trigonella foenum-graecum*.

Fenugreek (*Trigonella foenum graecum*) is an herbaceous plant, frequently used in veterinary and human medicine; it plays a fundamental agronomic role as a pioneer plant capable of improving the biological fixation and organochemical fertility of the soil thanks to its micro symbionts.

Our work consists in carrying out a phenotypic study from a bacterial collection derived from nodules of *Trigonella foenum graecum* harvested from different regions of north-west of Morocco (Ksar sghir, Bni aros, Arbiea aicha, Dokala, Ahad gharbia).
A collection of 48 bacterial isolates obtained from fenugreek nodules was subject to phenotypic characterization where we were able to evaluate the tolerance of these isolates to different salt concentrations (0.5%, 1%, 1.5%, 2% and 3%), pH tolerance (3; 3.5; 4; 5; 6.8; 9 and 10) and temperature (4 °C, 28 °C, 37 °C and 40 ° C).

We also determined generation time, Bromothymol Blue Test, hydrolysis of urea, antibiotic resistance and resistance to heavy metals.

The phenotypic study showed that the 48 strains are very heterogeneous, where 81% of strains can tolerate very high concentrations of NaCl (3%), 19% of the strains can grow at 4 °C and 81% of the strains grow at 37 °C. The results show that the majority of strains use a broad spectrum of carbohydrates as the sole source of carbon. In contrast, most strains show sensitivity to the antibiotic Kanamycin and nickel as a heavy metal.

Numerical analysis of the results was used to group the strains studied according to their phenotypic properties, so that 20 highly abiotic stress-tolerant strains were chosen for their particular characterization compared to the 48 strains studied.

Keywords: Rhizobium, *Trigonella foenum-graecum*, phenotypic characterization.

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Microbial interactions between two lactic acid bacteria in fresh and reconstituted milk

In this study, we were interested in comparing the growth of *Streptococcus thermophilus* (IST) in the presence or absence of *Lactobacillus bulgaricus* (ILB) in milk. The strains used were isolated from a concentrate provided by the Dairy: Cooperative Laitière du Maroc Oriental (COLAIMO). The obtained results indicate that the acidification of fresh milk is more important than reconstituted milk for both strains. Indeed, the IST strain acidified milk better than ILB strain.

A synergistic effect was demonstrated in the two culture media. The acidity produced in fresh milk by the mixed culture (IST + ILB) was 101 °D, while each of the two pure culture strains produced only 92°D. In reconstituted milk, the same phenomenon was observed, but with lower acidity values, which were 63 °D and 52 °D respectively for mixed culture and pure culture strains. These differences are significant at the probability level of 99% according to the Student test. The filtrate of the ILB strain culture stimulated the lactic acid production of IST strain.

Keywords: Interactions, *Streptococcus thermophilus*, *Lactobacillus bulgaricus*, Lactic acid.

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Impact of gamma irradiation on morpho-agronomic parameters of three varieties of groundnut (Arachis hypogaea L.)

The induction of mutation of crops is a key element of mutation breeding and has been an important tool for plant breeders to increase the genetic diversity of plants and derive new mutant lines with improved characteristics, such as groundnuts (*Arachis hypogaea* L.).

In this context, our aim is to improve the morpho-agronomic characteristics of three groundnuts varieties (Kp29, Jambo and Fleur 11). This study was conducted to evaluate the effect of different doses of gamma irradiation on different morpho-agronomic characteristics. For this, Peanut seeds were treated with various doses of gamma rays (40, 60, 80 and 100 Gy). Different parameters have been studied such as plant height, leaves number, root length, number of pods per plant and seed yield.

The results have shown that the gamma-ray treatment at 100 Gy has increased seed yield particularly for Kp29 and Fleur11. In fact, gamma irradiation at 100 Gy has significantly increased plant height and root length by 10% for Kp29 and by 4% for Fleur11. Besides, the number of pods per plant was increased by 6% for Kp29 and Fleur11. For the Jambo, a slight variation has been observed for 60 Gy. However, the 40 gamma ray treatment showed a very important seed yield.

Keywords: *Arachis hypogaea* L., doses, gamma ray, mutation.

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Physicochemical and microbiological characterization of a food based on the remains of meal

The household wastes production does not cease increasing these last decades. One of the sources of this increase, the production in restaurants.
Indeed, the production rates of this kind of waste and its valorization ways are growing concerns.

Among the objectives of the National plan of domestic and Comparable Waste management [1];

- To ensure the collection and the cleaning of household wastes to reach a professionalized collection rate (deputy management) of 90% in 2022.
- To carry out the Centers of landfilling and Valorization (CEV) of household and similar waste to the profit of all urban centers (100%) in 2022.
- To develop the sector of “Sorting-recycling-valorization”, to reach a rate of 20% of recycling and 30% pennies of other forms in 2022.

Concerning this last objective, the interest to use a food based on the remains of kitchen of the restaurants of the town of Oujda in the poultry feed is a new nudge in the right direction for a better valorization, as well as to reduce the rejections of household wastes in the environment.

This feed is intended for the poultries. The chicken breeding tests that were made during our study show that the gain of weight in chicks are weak despite that the indices of consumption respect the index of evaluation recommended by the Interprofessional Poultry Sector Federation FISA, and which should be ranging between 1.9 and 2.1; that is to say a median value of 2 [2]. What pushed us to

characterize our food by making microbiological and physicochemical analyses in order to increase weights gain in chicks.

Keywords: Household wastes, valorization, remains of kitchens, microbiological analyses, physico-chemical analyses.

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In vitro pathogenicity test of *Podosphaera aphanis* strains the causal agent of strawberry Oidium

Podosphaera aphanis is the pathogen responsible for the disease of Oidium or Powdery Mildew of the strawberry plant. This fungus belongs to the branch line of the Ascomycota and the order of the Érysiphales. The members of this Order are biotrophs, obligate parasites, which infect only of the angiosperms [1]. The former name of *Podosphaera aphanis* was *Sphaerotheca macularis*.

In Anatomical term, the mycelium presents itself as a Comforter white on the surface of the epidermis of the infected tissue. The hyaline hyphae are anchored through the haustorium which feeds of epidermal cells [2].

A strawberry plant infected with the white is identifiable by the presence of typical signs of the pathogenic agent: mycelium, conidiophores and conidia on various structures of the plant. Generally, the sign is initially on the abaxial surface of leaflets, but subsequently, the adaxial surface as well as the fruits, stolons, Buckles and flowers can become infected by oidium [3].

Infected fruits are covered of the mycelial duvet and are unfit for consumption. A winding upwards in the shape of a spoon is observable in infected leaflets. A common symptom among some cultivars is the presence of purple spots on the adaxial surface of the leaflets [3].

The aim of this study is *in vitro* evaluation of pathogenicity of 18 strains of *Podosphaera aphanis* isolated from strawberry's leaves and fruits in laboratory on Strawberry leaves. After *in vitro* inoculation and incubation of the seedlings, all isolates caused severe symptoms related to Powdery Mildew on leaves of the studied strawberry plants and the pathogenicity degree change from one isolate to another.

Keywords: Oidium, Powdery mildew, *Podosphaera aphanis*, pathogenicity, strawberry

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Climate Change and Challenges for the Environment of Tomorrow

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Morocco's Climate Diplomacy: State of Play and Issues

With the advance of the 21st Century, the ecological dimension has become increasingly rooted in the apparent and implicit talks of the global space to such an extent that it has taken a prominent place in the mechanisms and criteria of decision-making beyond the diversity of topics in the order of discussion. To this end, the climate aspect is approached from two complementary points of view knowing that the first campaign for the protection of the environment and the fight against climate change while the second addresses the issue of the environment through the trend alternative of renewable energies. With regard to Morocco, an environmental consciousness quickly took place in this global dynamic through the setting up of public policies preceded by strategic directives emanating from the highest decision-making level in the Kingdom as regards the strategic priority of the ecological component. To this end, the scale and vitality of this dimension has even been transposed to the foreign policy of the country through which Morocco defends its interests while enhancing its image and reputation through climate diplomacy capitalizing its efforts accelerated in this regard. Factual evidence, Morocco has become a regional model and a global reference in terms of environmental initiatives in general and renewable energy production in particular.

Keywords: Morocco, climate, diplomacy, ecology, strategy, renewable energy.

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Modeling the emergence of spatial periodic vegetation patterns in water limited environment: case of *Stipa tenacissima* L.

Desertification due to climate change is a central ecological problem and constitutes a major risk to the biological productivity of arid and semi-arid landscapes, which cover about half the terrestrial earth area. Each year, the degradation of semi-arid and arid zones results in a 4 to 8 percent decrease in gross national product in developing countries. A spontaneous shift from a uniform cover of vegetation into a fragmented ecosystem constituted by gaps or patches is a recurrent feature of arid and semi-arid landscapes. This process occurs in water limited resources or nutrient poor territories.

At the level of individual plant, the water scarcity provokes a hydric stress that affects both the plants survival capacity and the below-ground/above-ground plant growth. At the community level, this hydric stress promotes clustering behavior, which induces spatial landscape fragmentation.

We present a generic interaction-redistribution model [1] that focuses on plant-plant facilitative and the competitive interactions between individual plants that are responsible for the formation of periodic vegetation patterns. This approach assumes a single specie vegetation community settled on a flat landscape under isotropic environmental conditions [2] [3]. To simplify further the description of the system, we also assume that all plants are mature by neglecting age classes. The state variable is the vegetation density, which is defined at the plant level. The resulting equation governing the space-time evolution of the vegetation density or biomass consists of an integro-differential model. All measurements have been performed in the Enjil's commune located in the steppe plains of north-central Morocco [4].

The results of a linear stability analysis show that when increasing the aridity parameter, the homogeneous uniform cover of vegetation exhibits a fragmentation and leads to a self-organized vegetation patterns. We have analyzed the biomass as a function of the aridity parameter (Figure 1). Transition from a uniform cover solution to a self-organized vegetation pattern occurs when the aridity parameter exceeds a

critical value the spatial profile of the biomass associated with a self-organized gap is observed. When further increasing the aridity parameter, numerical simulations of the model, show transition to self-organized patches of vegetation. From our numerical results, we can clearly observe the change in the wavelength. In addition, a single patch may exhibit deformation and splitting [5].

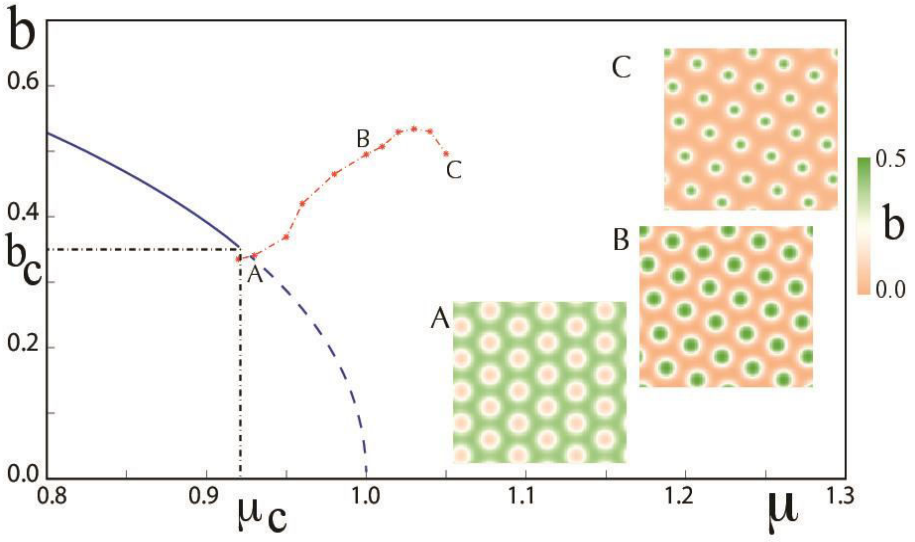

Figure 1. The biomass b as a function of aridity μ. A, B, and C presents the 2D plot of transition to self-organized patches of vegetation

In agreement with field observations, our model supports the fact that the wavelength of vegetation patterns increases as the aridity parameter increases. This observation assumes that all plants are mature by neglecting age classes [4]. These approximations may be justified by the fact that the plants grow on a much smaller time scale compared to the time scale of the regular vegetation pattern formation.

Keywords: periodic vegetation patterns, *Stipa tenacissima* L., water limited environment, interaction-redistribution model, self-organized patches, pattern formation.

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Food security challenges to climate change

Nothing is more important for humanity and the stability of societies than access to sufficient, safe and nutritious food. One of the great challenges of the twenty-first century will be to increase the food supply to meet the needs of a world population that is expected to reach 9 billion by 2050, while developing the agricultural sector within environmental limits compatible with those of the planet [1].

Nonetheless, climate change threatens progress. It is the most important challenge to achieving sustainable development, and it affects food security in complex ways. It affects food production directly through changes in agro-ecological conditions and indirectly by affecting growth and distribution of incomes.

In 1996, the FAO-sponsored World Food Summit challenged food security as a "situation that exists when all people have, at all times, physical and economic access to healthy, sufficient food and nutritious to meet their energy needs and dietary preferences for a healthy and active life "[2].

According to Capone, 2014 [3] Food security is influenced by four key dimensions: availability of sufficient food; physical, economic and social access to the resources needed to acquire food; stability of this availability and access; and utilization, including nutrition, food safety and quality.

Millions of people are undernourished because they lack access to enough food. They live mainly in rural areas of the tropics and their vulnerability is increased by socio-economic, demographic and political trends limiting their ability to adapt to climate change [4].

Climate variability is one of the causes of instability; it can also affect the quality of food: crops cereals and fodder, for example, have lower concentrations of protein and micronutrients if atmospheric concentrations in CO_2 increase [5].

Agriculture is intimately linked to climatic conditions and therefore very exposed to its evolutions. The climate system is now moving beyond the limits of its natural variability over the past millennia.

To feed 9 billion people nutritiously by 2050, we need climate-smart agriculture that increases yields and incomes, build resilience and reduce emissions while potentially capturing carbon.

Many innovations will be needed. Agroecological engineering will need to be developed, it will also be necessary to develop eco-technologies to better collect and save water, produce renewable energy and aggressively reduce food waste.

Climate change is not just a long-term issue. It is happening today, and it entails uncertainties for policy makers trying to shape the future.

Keywords: Climate change, food security, sustainable development, Climate variability, agroecological engineering, climate-smart agriculture

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Influence of forest composition on organic carbon stocks in forest soils of the Middle Moroccan Atlas in the context of climate change

Forests in the Middle Atlas Central Morocco store significant amounts of carbon (C) in the form of soil organic C (SCOT). However, the integrity of these SOC stocks is threatened by climate change, but also by changes in forest composition. Indeed, each tree species has different functional traits allowing it to have a singular influence on its environment, processes of storage and release of organic carbon. Learning about forest soil carbon stock dynamics is fundamental for predicting and mitigating the consequences of such changes. The objective of this study is to explore the influence of forest composition including indigenous species of Morocco (Atlas cedar, maritime pine, green oak and Zen oak) on the total amount of organic carbon sequestered in forest soils and to identify the factors involved in this variation in the three selected forests: Jbel Aoua South Forest, Azrou and Jaaba.

Keywords: Middle atlas, organic carbon, climate change

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Climate change and challenges for the environment of tomorrow

Climate change represents a major challenge with which is confronted the humanity of today. It is a reality qualifies by certain authors of major problem for the 21st century. All implications are going to appear gradually [1].

The impacts of climate change are multiple; the increase of the precipitation (Rain and snow), the rise of the sea level, the sudden floods and the more frequent coastal floods, the increase of the temperatures, the heat waves, the rarefaction of water resources, periods of drought, landslides and greater frequency of storms. One of the most important questions concerning the possible impact of the climate change on the human health, more than thirty-six new infectious diseases were listed since 1976 by the WHO among which several reappear in regions from where they had previously disappeared as it is the case for the malaria and the dengue.

The first article of the master agreement of Nations United on climate change: defines being the latter as changes of climate which are attributed (awarded), directly or indirectly, to a human activity, distorting (altering) the composition of the world atmosphere, and which come to be added to the natural variability of the climate observed during comparable periods. The consequences of climate change are multiple, irreversible and exceed (overtake) the capacity of answer of the ecosystems and the human beings who risk to be distorted (altered) or definitively destroyed [2].

The climate change will affect (allocate) the fundamental elements of the life, for whole pieces of populations, throughout the world, the access to the water, the production of food " the man has a fundamental law, in satisfactory living conditions, in a healthy environment on which the quality allows him (her) to live in the dignity and the good (property) to be ", we could increase this list today by widening him (it) in the rights of the peoples for the self-determination even in the exercise of their ancestral culture, today threatened by the global warming.

Problem: what are the concrete steps and the public actions organized to face climate change? And in what relevant scale? Our communication will focus on the following points: · the climatic justice. · Adaptation to the impacts of climate change. · the scientific proof and the role of the judge. · The damage bound to the emissions of

the GES. · Uncertainty and link of causality. · The Community public politics of fight against climate change.

Besides the question of the climate change is a historic stake in the sustainable development, it is the phenomenon anchored territorially, that it is from the point of view of the efforts of reduction of broadcasts (emissions, issues) as from the point of view of the physical demonstration (appearance) of the impacts.

Keywords: Climate change, sensitivity, adaptability, prevention, precautionary principle, awareness, raising empowerment of actors, climate justice, responsibility, mitigation, health

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Climate study of the Sidi Slimane region, Morocco

The region of Sidi Slimane, located in northwest Morocco, is part of the plain of Gharb which is characterized by a Mediterranean climate [1]. This region is the subject of our study which consists of visualizing its climate throughout the year and determining the water balance, calculating the various climatic parameters required, from a database of temperatures and precipitation for the year 2016.

Descriptive analysis of the results obtained showed that:

- The rainfall collected in the Sidi-Slimane region is significant for the year 2016 and reaches an annual average of 779.8 mm, with an autonomous rainy season and a drier summer season [2 [3] [4] [5],
- The average monthly precipitation is 64.98 mm. The two months, November and July, are respectively the month with the highest watering and the month with the lowest water level [2 [3] [4] [5],
- For temperatures, March is the coldest month while August is the warmest. The average annual temperature is 15.90°C [2 [3] [4],
- The combination between temperature and precipitation is done by:

1- Calculation of the **degree of aridity** (I=) [6], showed that the Sidi-Slimane region, globally, under a semi humid to humid climate.

2- **GAUSSEN ombrothermal diagram** (figure 1) [6], showed that the dry period spreads over six months (April, May, June, July, August, September) while the wet period extends from October to March. November is the wettest month of the year with an average of 94.8 mm.

3- **Diagram of Emberger** (figure 2) [6], shows that the Sidi Slimane region extends over the subhumid bioclimatic domain.

- The calculation of actual evapotranspiration by Turc and Thornthwaite methods gave an average value of 445.83 mm. However, this value is still lower than the average annual precipitation of 779.8 mm. The resulting surplus (333.97 mm) will contribute to groundwater recharge and/or surface runoff recharge.

Keywords: Sidi Slimane, Morocco, subhumid climate, precipitation, temperature, water balance, degree of aridity, ombrothermal diagram, Emberger digram, evapotranspiration.

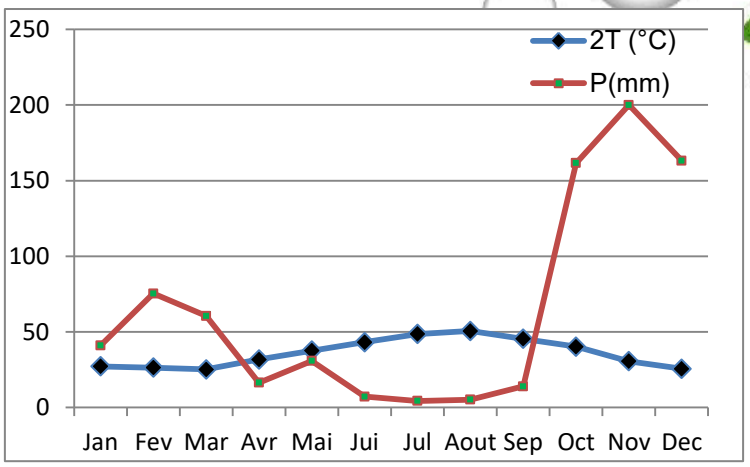

Figure 1: Umbrothermal diagram (Sidi Slimane 2016).

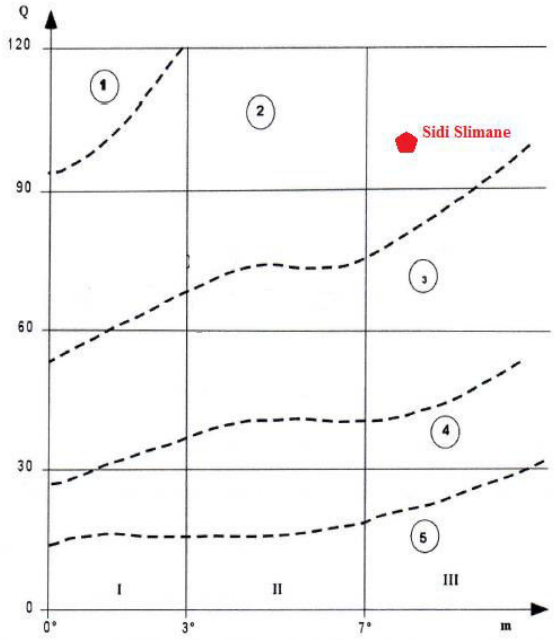

Figure 2: Emberger diagram

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Pesticides: Ecotoxicology and Health risk, Situation of Triffa plain

Triffa, an area of 6100 Ha, is one of the most fertile and productive plain in the east of Morocco (Oriental). Despite the benefit of fertilizers and phytosanitary in the increase of agriculture productivity, there over use present a real danger on groundwater contamination and potential risk on human health [1] [2]. Yet, in Morocco, there are no enough studies and data on environment contamination by pesticides residues (groundwater, soil, food...) [2].

Thus, the aim of this study is to identify and evaluate the contamination of groundwater, soil and food production, by pesticides. Hence, samples of groundwater, soil and food, issued from a different part of Triffa plain have been analyzed.

The results show that different active ingredients have been detected, namely, the chlorpyriphos (0.05); lambda-cyalothrine (0.02); dimethoate (0.03); endosulfan (0.02) in the most of soil and food oranges samples, and that the dose of these active ingredients do not respect the international regulations and norms (0.01 mg/L).

Keywords: Pesticides, environment, health.

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Climatic and eustatic control of sedimentary dynamics and contribution of sequential stratigraphy in the Jurassic evolution of the central Middle Atlas (Morocco)

The Jurassic of the central Middle Atlas is represented by very varied deposits (thicknesses and facies) to which are subordinated various types of discontinuities of different scales, organized in sedimentary bodies. To trace the evolution of the studied region, during the Lias and the Dogger, we chose two examples which are located in the regions of Tagnamas (Ait Watfil section) and Boulemane (Recifa section), whose ages are complementary to counting from Domerien to Bathonian.

The Jurassic evolution of the central Middle Atlas is governed by various factors (climate and eustatism). The use of the concepts of sequential stratigraphy in the regions of Tagnamas and Boulemane allowed interpreting the geometry and the vertical sequence of sedimentary sets. Twelve sequences are identified and delimited by sedimentary discontinuities. The lithostratigraphic division adopted in this study is synchronous with thecoastal aggradation charter of Haq *et al.* [1] and Rioult *et al.* [2]. The correlations on a regional scale, between different Jurassic lithostratigraphic units is possible, whose the major factors controlling the evolution of intraplate basins are climate and eustatism.

Keywords: Sequential stratigraphy, discontinuity, eustatism, Jurassic, Middle Atlas, Morocco.

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The reuse of treated wastewater for agricultural purposes at the Oujda WWTP

Wastewater treatment has become as major priority to preserve human health and the environment, as well as to produce water that could be used in agriculture, industry and other human activities. Irrigation with wastewater leads to improved performance in comparison to drinking water due to their richness in nutrients and organic matter. Based on the nutrient needs of crops, it can be said that wastewater can be an alternative to mineral fertilization, provided that it undergoes adequate purification beforehand to reduce both their pollutant load and their degree of pollution and contamination to the level required for reuse for agricultural purposes.
Inaugurated in 2011, the waste water treatment plant (WWTP) in the city of Oujda, whose purification process is aerated lagoons, covers a target population of nearly 530,000 people. It has a treatment capacity of about 40,000 m^3 of wastewater per day (15 Mm^3 annually) (RADEEO, 2015).

For the city of Oujda, aerated lagoon purification could represent a solution likely to improve their physicochemical and bacteriological quality. In addition, the upgrading of sludge is recommended for the production of methane gas capable of generating electrical energy.

Indeed, although there is a whole platform at the level of the new ecological park of Oujda, recognized demanding in terms of irrigation, these treated waters are, until now, evacuated to Bounaim-wadi without any recovery.
With a view to reusing wastewater treated at the WWTP to irrigate more than 1,500 hectares of neighboring agricultural land, a project has just pushed the various stakeholders to strengthen the effectiveness of treatment its various lagoons, ranging from the phase of screening to tertiary treatment with other widening of this station to reach a daily production capacity of 65,000 cubic meters.

Keywords: Wastewater treatment plant (WWTP), valorization, irrigation, Oujda, Oriental of Morocco.

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Preparation and extraction of data for spatial hydrological modeling against the risk of flooding in the watershed of high Sebou (Morocco)

In this period of increased vulnerability of our country to floods, there is a strong social demand to prevent and predict these natural disasters that pose serious human and economic problems. To minimize the effects of exceptional rainfall and contribute to the protection of the population against the floods that may be caused by these rains, it is necessary to have operational and reliable forecasting tools. This work focuses on the collection and preparation of data for hydrological modeling in the watershed of high Sebou from upstream of the Allal El Fassi dam which is located in the high part of the big watershed of Sebou and which knew catastrophic floods, like that of the floods of October 10th, 2008 of Oued Sebou [1]. This study aims to describe a methodology for combining space technologies, including geographic information system (GIS), of remote sensing and digital elevation model (DEM), with hydrological models from a perspective of preparing a spatialized hydrological modeling that is used for flood forecasting [2]. The methodology followed for the realization of this study declines in several phases: The collection and processing of geographic data was the first phase of this project. This approach consists, at first, automatic extraction of sub-basins and drainage network, the evaluation of the quality of this extraction, as well as the implementation of some solutions for improving the results. Then, the formatting of these data for the schematization of the basin. And finally, the preparation of occupancy and soil type data for the development of a map of the Curve Number (CN) by the SCS-CN method [3] and importing the basin model to HEC-HMS.

Keywords: Spatial Hydrological Modeling, GIS, Remote Sensing, Curve Number (CN), HEC-HMS.

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Hydrological and climatic study in the Ouergha watershed

This work consists in studying the hydrological and hydroclimatic regime of the Ouergha watershed and frequency analysis of extreme flows and extreme rainfall for peak estimation and return periods in order to prevention and forecasting against risks (flood...). Hydrological regime analysis showed a regime of the rain type, characterized by rainfed abundance with very high winter flows, so strong floods [1]. The annual module and the different coefficients show hydroclimatic fluctuations in relation to a semi-humid climate [2]. The water balance has highlighted the importance of the volumes of water conveyed upstream than downstream, thus confirming the morphometric parameters of watershed and the lithological nature [3]. Frequency study of flows and extreme rainfall showed that these flows governed by dissymmetrical laws based on methods Gumbel, GEV, Gamma and Log Pearson III [4].

Keywords: Flows, Floods, Hydrological, Hydroclimatic, Watershed.

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Conservation, Valorization and Exploitation of Natural Resources

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Valorization of lignocellulosic waste. Formation of carbonates from CO_2

Biomass and materials derived from biomass are generated from available atmospheric CO_2, water and sunlight through biological photosynthesis. Therefore, biomass has been considered the only sustainable source of organic carbon in the earth and the perfect equivalent of oil to produce fuels and fine chemicals with zero net carbon emissions. In this context, lignocellulosic biomass, which is the most abundant and bio-renewable biomass on earth, is of crucial importance. Many studies have shown that lignocellulosic biomass has enormous potential for the sustainable production of chemicals and fuels. In addition, it is a renewable raw material in abundance and available worldwide [1].

Moreover, the use of CO_2 as a carbon source can be an expensive and renewable alternative given the impending depletion of fossil fuels.

In this work, we will present the study of a new application of lignocellulosic biomass as a catalyst, in combination with salts containing halide ions, for the formation of carbonates from CO_2. This study is part of new trends in sustainable development in a global context of environmental protection, as it use carbon dioxide considered as the main greenhouse gas [2].

Keywords: Carbon dioxide, lignocellulosic biomass, carbonates

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The effects of hydric and saline stress on the growth of embryonic axes of marrams grass seeds (*Ammophila arenaria* L.)

Under the optimum temperature of germination (20°C), the maximum development of the embryonic axes is carried out in distilled water. The tests of stress showed on one hand the great resistance of the radicle to the hydric stress and on the other hand the great sensitivity of the coleoptile to the saline stress. The growth of the radicle and the coleoptile is affected much more by the saline stress than by the hydric stress.

The culture of marram grass seeds at 20°C in distilled water makes it possible to obtain many seedlings with a good development of the embryonic axes. These seedlings could be used for the restoration and the rehabilitation of the degraded coastal dunes.

Keywords: Seeds, germination, embryonic axes, marram grass, hydric stress, saline stress.

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Petrographic characterization and valorization of phosphates from the Benguerir deposit (Morocco)

Morocco is world leader in the field of phosphates. The work presented in this paper is part of OCP's exploration and evaluation of resources in the Ganntour basin, located in the Benguerir area, 70 km north of Marrakech and 60 km east of Youssoufia. This study deals with the petrographic characterization of representative phosphate layers and specifies their mineralogical characteristics. We do not have samples of all phosphate levels. Only seven samples could be the subject of a petrographic study under the polarizing microscope. Phosphatic rocks of Maastrichtian - Ypresian age form in the Ganntour basin layers and furrows interspersed with sterile levels. The petrographic study has revealed facies composed of biogenic skeletal debris, coprolites, phosphatic grains and composite grains. These components form facies such as biophospharenite, nubephospharenite or pelphospharenite. These petrographic characteristics were defined on samples either harvested directly on the outcrops or using the data from exploration wells. These data made it possible to propose a detailed stratigraphic column representing the different layers of the sector of North Benguerir.

Keywords: Phosphates, Ganntour Basin, Benguerir, Maastrichtian – Ypresian, exploration, phosphate layers.

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Mineralogical and geotechnical characterization of bentonite deposite from the Kert bassin (Northern Morocco)

From a perspective of sustainable local development, this study focuses on the characterization of clay materials in the northeastern zone of Morocco [1]. It is characterized by a high content in very diverse useful substances including clay deposits which have a wide range of composition and properties which are the origin of their multiple applications such as construction, industrial and craft ceramics, pottery, the pharmaceutical, cosmetic and chemical industries, oil purification, etc. This study has the advantage of contributing to the promotion of local building materials while improving the quality of artisanal ceramics produced. In this region, the terracotta clay-based are used mainly for the manufacture of traditional and modern building materials (bricks, tiles) and for making many pottery items.

Most Moroccan bentonite deposits are located in northeastern Morocco, in the Nador region [2]. This natural resource is linked to the volcanic activities of Gorougou and its satellites. The present work focuses on the study of Trebia bentonite deposit located 18 km west of the city of Nador, on the western flank of the volcanic massif of Tidiennit. Tight sampling was carried out [3]. The raw samples were subjected to several analytical tests such as geotechnical identification tests, namely water content, organic matter, calcimetry and sand equivalent. The granular repair was carried out using the laser particle size. The extracted clay fraction was prepared as a powder and oriented aggregate and then analyzed with DRX [4]. The clay procession was

differentiated by comparison of the three routine test diffractograms (Normal, ethylene glycol, heating to 500 °C). The analysis of the disoriented powder spectrum allowed the mineralogical characterization of the raw samples.

Keywords: Characterization, clay, DRX, laser granulometry, Northeast Morocco.

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Extraction and characterisation of NaCl sea-salt by evaporation process from T=25°C to T=100°C: Prediction and application of seawaters from El Jadida bay and Rabat coast: Atlantic-Morocco

Seawater is a complex multicomponent system where almost all chemical elements are present in different concentrations (macro, micro and trace) and forms (simple and complex ions, dissolved gases, etc.). Therefore, seawater can be used as a source for the extraction of useful substances by different desalination processes such as reverse osmosis or distillation processes [1]. NaCl sea-salt is one of the principal substances extracted from seawater. Numerous studies have described the various techniques used in separating brine to crystallized NaCl salt, but few, if any, have attempted to quantify the physico-chemical and thermodynamic processes of evaporation. Apart from the few areas where salt mining is possible, nearly all forms of salt production require evaporation of seawater to concentrate brine and ultimately produce salt crystals [2], especially NaCl salt.

This study aims to extract and characterize NaCl sea-salt mineral and the main objective of this work is the determination of the optimal conditions of the extraction of NaCl sea-salt mineral through the prediction of the liquid-solid equilibrium of seawaters at each stage by evaporation process. Hence, the physicochemical and thermodynamic properties of evaporation were exploited through the calculation codes Frezchem and PhreeqcI3 to quantify the effect of the ionic composition of raw and concentrated seawater on the evaluation of salinity and on the qualitative and quantitative separation of NaCl salt. Moreover, the results obtained by the used calculation codes were validated by experimental studies. The results obtained from simulation modeling for different temperatures (25°C, 50°C, 75°C and 100°C) and different compositions (table 1) were in good agreement with the experimental results.

Then, sodium chloride (NaCl) is the second mineralogical phase precipitated after gypsum. For T=25°C, the precipitation of sodium chloride is carried out at a salinity range between 306.50 and 401g/Kg and a remaining volume of 9.75%. The maximum mass is 22.357 g for each liter of sea water. For T=50°C, the precipitation of sodium chloride is deposited during a salt concentration varies between 310 and 400 g/L and a remaining volume of

9.25%. The maximum mass is 22.26 g for one liter of seawater. For T=75°C, the precipitation of sodium chloride is carried out at a salt concentration ranging between 315 and 426 g/L and a remaining volume of 9.05%. The maximum mass is 21.82 g for each liter of sea water. For T=100°C, sodium chloride precipitation is deposited at a salinity between 318 and 460 g/kg and a remaining volume of 8.85%. The maximum mass is 21.6 g for each liter of sea water. The results were confirmed by characterization of NaCl sea-salt by different physico-chemical techniques and the quality and quantity of NaCl is more than 90% of the extraction salts.

Keywords: seawater, evaporation, extraction, NaCl, characterization.

Table 1: Composition of raw and concentrated seawater

	The % volume of water remaining after evaporation of El Jadida seawater									Raw seawater	
	10%	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**El Jadida**	**Rabat**
X(mS/cm)	180.2	177.3	148.2	124	117.8	98.5	84.6	76.5	71	60.8	51.6
pH	8.02	7.99	7.98	7.95	7.93	7.91	7.89	7.86	7.8	8.08	8.12
[Ca^{2+}](g/L)	6.135	5.654	5.493	5.132	4.491	3.849	3.208	2.5264	1.924	1.203	0.191
[Mg^{2+}](g/L)	2.381	2.284	2.235	2.0655	1.992	1.968	1.871	1.7982	1.749	1.531	0.670
[Cl^{-}](g/L)	75.26	63.19	51.83	37.985	34.79	32.66	22.01	19.7	18.1	18.366	20.170
[SO_4^{2}](g/L)	12.877	12.396	11.532	9.225	7.985	7.2	7.12	5.35	4.76	4.51	1.412
[K^{+}](g/L)	1.19	1.04	0.85	0.73	0.61	0.55	0.43	0.33	0.24	0.011	0.013
[Na^{+}](g/L)	56.50	48.89	41.39	32.19	32.22	29.02	22.51	12.63	12.17	10.72	11.614
S(g/L)	154.34	133.45	113.3	87.33	82.08	75.24	57.15	42.34	38.95	36.34	34.07

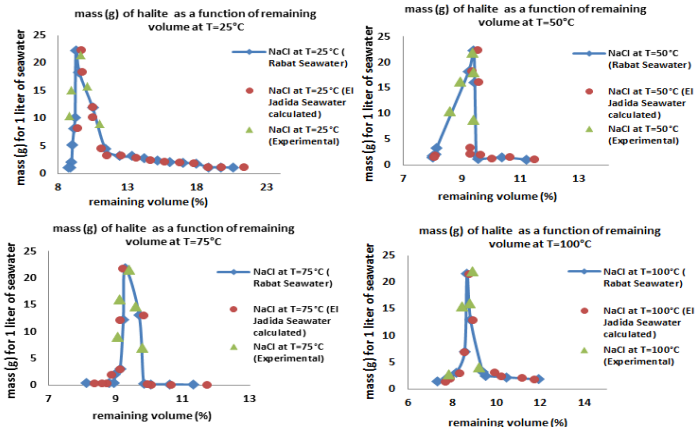

Figure 1: the impact of temperature on the quantity of the salts precipitate

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Theoretical and experimental studies of the adsorption of cationic surfactants on Na-Bentonite

Clays can be considered as adsorbents that respond to the environmental problem posed by the use of toxic chemicals products in many industries (textile, paint, agrochemical and food industry ...) and receive special attention thanks to their abundance and low cost compared to other adsorbent materials [1] [2] [3].

The modification of the clays (Bentonite) by surfactants (CPC) finds several applications in various fields such as cosmetics, drugs, paints, nanomaterials, etc [1], [3]. The samples of clay bentonite that we took from Nador region in North-Eastern Morocco have already undergone a series of chemical and physico-chemical analyzes [2]. The adsorption of the cationic surfactant CPC on a hydrophilic smectite (Bentonite) surface has been investigated. The adsorption of aqueous surfactant solutions on mineral substrates is mainly governed by electrostatic and hydrophobic interactions [4] [5] [6] [7]. For low coating rates, the surfactant cations physically adsorb in the form of individual ions at the negatively charged surface sites [4] [5] [6]. In this first stage of the adsorption process, the surfactant molecules exchange with exchangeable cations of the clay (sodium cations) [4] [5] [6] and may be other counter-ions present at the solid / water interface It was found that the rate of adsorption of surfactant CPC reached up to 1.7 CEC. The intercalation of surfactant in the interlamellar space was followed by IR and XRD measurements. The coefficients binding of the first stage of adsorption of the positively charged (CP^+) by cationic exchange on the negatively charged bentonite was determined.

Keywords: adsorption isotherm, bentonite, cationic surfactant, infrared, X-ray diffraction.

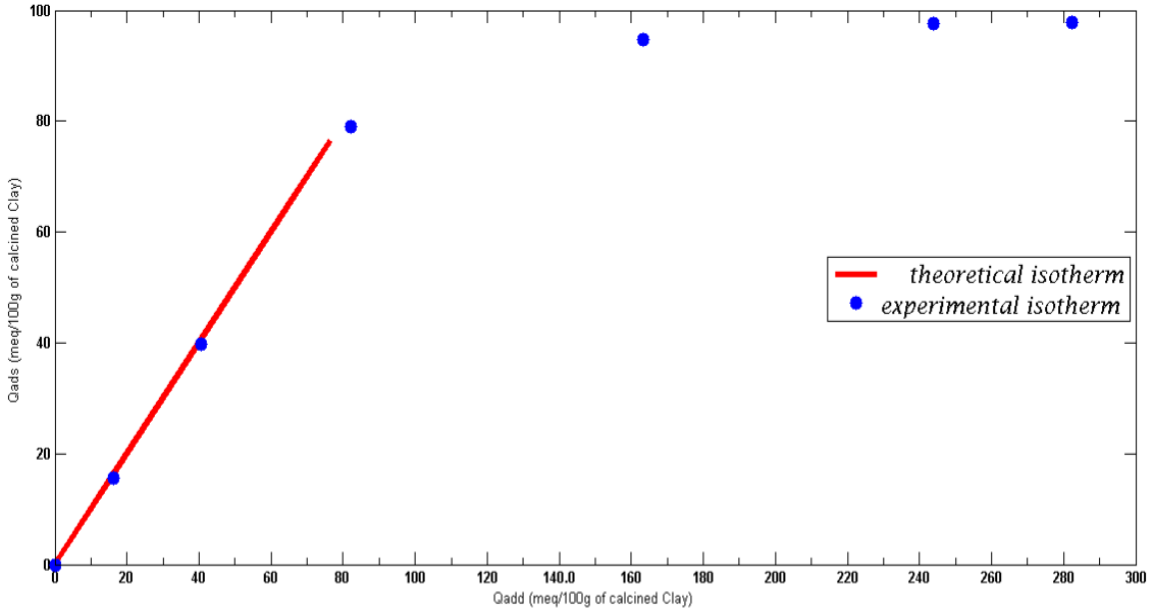

Figure: Adsorption isotherm of Methylene blue on Na-bentonite and its cationic-exchange modelization.

Acknowledgement: Work financed by the MESRSFC and the CNRST-Morocco -project PPR 15-17.

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The role of social and solidarity economy organizations in the design and implementation of a payment for environmental services mechanism for the protection of water resources in the Ourika catchment

Payments for Environmental Services (PES) have become essential in environmental and socio-economic development policies, as they constitute an innovative and promising mechanism for environmental conservation by integrating the dimensions ecological, economic and social aspects of natural ecosystems.

Indeed, PES are incentive instruments that consist in offering remuneration in return for the adoption of practices favourable to the preservation of the environment. They are based on contractual constructions that can involve private actors (landowners, companies, associations ...) and public actors (State, local authorities ...).

However, water is one of the main natural resources that the PES have to preserve. PES related to water put in contractual relation two actors to know:

- Land users as lovers, who are usually owners or occupying populations that have a right of use (potential suppliers of water-related services).
- Downstream water users, who also have the right to use water but whose enjoyment is conditioned by the practices of the populations upstream. (Potential beneficiaries of water services).

Thus, social and solidarity economy organizations, particularly associations and cooperatives operating in the field of environmental protection, can act as intermediaries to facilitate coordination and transactions between suppliers and users of services environmental.

In the high Atlas of the country, the Ourika watershed is emblematic of this movement in the sense that its inhabitants have developed, in the space of only ten years only, an impressive network of actors of social economy and solidarity who work for the sustainable development of the valley through, in particular, environmental preservation organizations.
Since the 2000s, this explosion of environmental initiatives, at the local level, aims at the sustainable territorial development of communities and the enhancement of their environment.

This article aims to highlight the specific role of these organizations in the design and implementation of PES for the protection of hydrological services in the Ourika catchment area. We propose an analysis that takes place in two stages. First, we present an inventory of the extent that payments for environmental services take in the Moroccan context. Then, we highlight the actions of social and solidarity economy organizations that can promote the design and development of implementation of PES at the Ourika catchment.

Keywords: Payment for environmental services, Protection of hydrological services, Social and solidarity economy, Ourika watershed.

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Study of antibacterial and antioxidant activity of essential oils extracted from Moroccan medicinal plants

In recent years, the use of essential oils as antimicrobial and antioxidant agents has increased significantly, this interest is due to an emergent microbial resistance towards conventional antibiotics and the increasing concern over the side effects associated with the use of synthetic antioxidants such as BHT, BHA and PG as food preservatives [1]. In this context, a wide range of essential oils derived from medicinal plants have been tested for their antibacterial and antioxidant potentials [2] [3].

This present work was undertaken with the main objective to evaluate the antibacterial effect of the essential oils isolated from the aerial parts of *Cistus ladaniferus* (*Cistaceae* family) and *Inula viscosa* (*Asteraceae* family) along with their antioxidant activity. The antibacterial activity was evaluated by the disc diffusion method using 4 bacterial strains (*Escherichia coli* CECT 471, *Enterococcus faecalis* 471, *Bacillus subtilis* CECT 4071 and *Staphylococcus aureus* CECT 476). The test was performed using an 18 h to 24h bacterial culture grown at 30°C in 10 mL peptone water. Each culture is adjusted using sterile distilled water with reference to the McFarland standard to achieve an inoculum of approximately 10^8 CFU/mL .The oils were adsorbed on sterile paper discs (20 µL) and placed on the surface of the solid media previously inoculated with the microbial suspension, then incubated at 30 °C for 24 h followed by the measurement of the zone diameter of the inhibition expressed in mm. Kanamicin is used as antibiotic reference and the experiment was done in triplicate.

The antioxidant activity was determined using the DPPH radical scavenging method. A dilution series of essential oils and BHT was prepared in ethanol. One mL of DPPH (1mM) solution was added to 3 mL of each concentration (2, 2.5, 3 and 3.5 mg/mL). After a 30 min incubation period at room

temperature, the absorbance was read against a blank at 517 nm and the inhibition percentage of the radical is determined by the following formula:

$$I\ \% = [A\ control - A\ test) / A\ control] \times 100$$

According to the results, the *Cistus ladaniferus* essential oil produced the strongest antibacterial effect with diameters of bacterial inhibition ranging from 18 to 24 mm. Its highest activity was against Gram-positive bacteria *Bacillus subtilis* CECT 4071. The *Inula viscosa* essential oil was also found to be effective against all strains except for *Staphylococcus aureus* CECT 476. Its spectrum of inhibition ranged from 11 to 21.5 mm.

The free radical scavenging activities of both essential oils followed a concentration dependent pattern. The antioxidant activity of *Cistus ladaniferus* essential oil was superior to *Inula viscosa* (46 - 63% for *C. ladaniferus* and 30 to 39 % for *I. viscosa*).

Keywords: Essential oils, antibacterial activity, antioxidant activity, medicinal plants

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Valorisation of the essential oils of two species of lavender as biofungicide in Morocco

In order to overcome the problems of fungal contamination, the requirements for food quality implicate the use of standards of food safety. For this purpose, the use of biological solution like the Aromatic and Medicinal Plants essential oils can be a good alternative to the chemical treatments against pathogenic fungi.

The aim of the present work is to evaluate the antifungal activity of the essential oils of two spontaneous species of lavender in Morocco, "*Lavandula dentata spp, dentata* and *Lavandula stoechas spp. stoechas*". In this study, the targets are three phytopathogenic fungi: *Rhizopus stolonifer, Aspergillus brasiliensis* and *Penicillium expansum.*

The results obtained showed that there was a difference in the mycelial growth of the three fungi. *Aspergillus brasiliensis* was very sensitive to *L. stoechas* essential oil in comparison with the other two fungi. At a dose of 0.5 µl/ml, the inhibition rate exceeded 80%.

The response was very strong for the *L. dentata* essential oil whatever the dose used. The high inhibition rate was obtained at 0.5 µl/ml and 0.25 µl/ml for *Rhizopus stolonifer* and *Penicillium expansum* respectively.

Keywords: Essential oil, *Lavandula stoechas, Lavandula dentate*, antifungal activity, biofungicide.

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Valorization as bioinsecticide of the essential oils of two lavender species: *Lavandula stoechas* L. and *Lavandula pedunculate* (Mill.) Cav.

Post-harvest losses during the storage of agricultural production caused by phytopathogenic agents are particularly worrying factors for farmers who resort to the massive use of pesticides to cope with the deterioration of foodstuffs. However, due to their potential danger to man and the environment, researchers are now looking for biological alternatives [1]. Since medicinal and aromatic plants essential oils were reported to have different virtues as toning, stimulating, calming, anti-inflammatory, antiseptic, antifungal and bactericidal effects [2] [3], research is extending to insecticidal properties in order to produce alternatives to synthetic insecticides [4] [5].

So, the objective of this study consisted in the valorization, as bioinsecticide, of the essential oils of two Moroccan species belonging to the Lamiaceae family (genus: Lavandula): *Lavandula stoechas* L. and *Lavandula pedunculata* (Mill.) Cav. Either, interspecific comparison between these lavender species was investigated on adults of *Tribolium castaneum* (Tenebrionidae).

The results obtained show that the essential oil of *Lavandula stoechas* L. exhibited important insecticidal and repulsive activities, which exceeded the effect of *Lavandula pedunculata* (Mill.) Cav. essential oil. The lethal times 50 and 99 (LT50 and LT99) recorded from tests with *L. stoechas* oil were lower to those obtained with *L. pedunculata* for the whole range of concentrations used, which confirms that the first essence is very active compared to the second.

Keywords: Essential oils, *Lavandula stoechas*, *Lavandula pedunculata*, bioinsecticide, *Tribolium castaneum*, lethal time.

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Study of the diet of anchovy *Engraulis encrasicolus* (Linnaeus, 1758) in Moroccan Atlantic coast

The fishery sector in Morocco is playing an increasingly important role in the country. The preservation of fish stock requires a description of biological aspects to develop sustainable management strategies of species. This work tends to obtain diet data of the anchovy *Engraulis encrasicolus* (Linnaeus, 1758) in Moroccan Atlantic coast.

The feeding of anchovy, *Engraulis encrasicolus* (Linnaeus, 1758) was investigated for the first time in Moroccan Atlantic coast during the period between January 2016 and December 2016. Samples were collected onboard the commercial purse-seine fleet. A total of 234 specimens were collected monthly, with total lengths and weight ranging from 6 to 16.5 cm and from 1.24 to 58 g. The diet of *E. encrasicolus* was studied through qualitative and quantitative analysis of stomach contents [1]. The vacuity index [2] depending on the seasons shows that the emptiest stomachs were encountered during summer (56%) followed by winter (46%), spring (24%) and autumn (15%). According to the frequency of occurrence, there was a clear dominance of crustaceans for all seasons and for the whole sizes. Copepod was the preferential prey group which is dominated by the Calanidae, Centropagidae and Oncaeidae families while other taxa (e.g. mollusks, fish (eggs and scales) and echinoderms) had less importance in the diet of anchovy. The use of the Hierarchical Ascendant Classification (HAC) based on %IRI values revealed that the anchovy is divided in two size groups (small and adults specimens) with different dietary preferences.

Keywords: *Engraulis encrasicolus;* diet; vacuity index; frequency of occurrence.

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Protective effect of essential oils against oxidative stress in *Tetrahymena thermophila*

Oxidative stress is associated with several human diseases and causes significant cellular damage which can compromise cell death by necrosis or apoptosis.

However, the prevention of chronic diseases through the use of antioxidant supplements remains controversial until now [1]. Natural products with regard to essential oils are very much in demand in biology research because of their antimicrobial and antioxidant properties [2].

In this work, we evaluated the protective effect of sage and oregano oils, known with their therapeutics properties, against oxidative stress in eukaryotic model *Tetrahymena thermophila*, widely used in physiological and toxicological studies [3].

Tetrahymena thermophila SB 1969 is cultured in PPYE medium (1% v/v) [4] with 10^{-3} of diluted *Salvia officinalis* or *Oreganum vulgare* oils (0.1%, v/v) in 0.2% agar solution. The stressors hydrogen peroxide (H_2O_2) and sodium nitroprusside (SNP) were added at 0.7mM and 1.8mM respectively after 24 hours of protozoa culture [5]. Morphology and cell density, by in counting the malassez slide, were monitored during 168 hours. Statistical significance was determined by Student's t-test. Essential oils were kindly supplied by M. Abdelmajid Houmane (Herbadis sarl. Morocco)

Results showed that the number of cells treated with essential oils had no significant difference with the number of untreated cells (Figure 1). However, the number of cells treated with H_2O_2 or SNP decreased significantly. In presence of sage or oregano, there was a significant increase in the number of *Tetrahymena thermophila* cells treated with H_2O_2. Nevertheless, cell number remained low in the presence of the SNP (Figure 1).

Figure 2 showed that cell morphology of protozoa was affected by stress agents. In presence of oils, the majority of cells treated with H_2O_2 or SNP have normal form (pear shape).

Sage and oregano oils showed a protection against H_2O_2 in the short-term and SNP in the long term. However, sage had a better protective activity against H_2O_2.

The use of these natural compounds may contribute to the prevention of chronic diseases related to oxidative stress in higher organisms.

Keywords: Oxydative stress; tetrahymena; essential oils; H_2O_2; SNP.

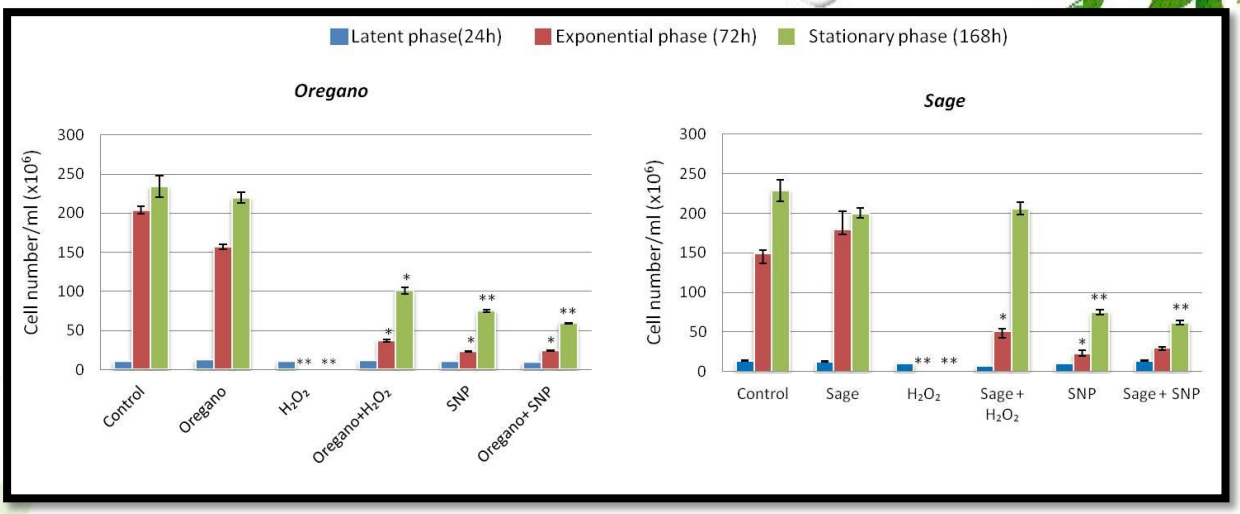

Figure 1: Enumeration of protozoa during the different phases of cell growth (*significant; **highly significant)

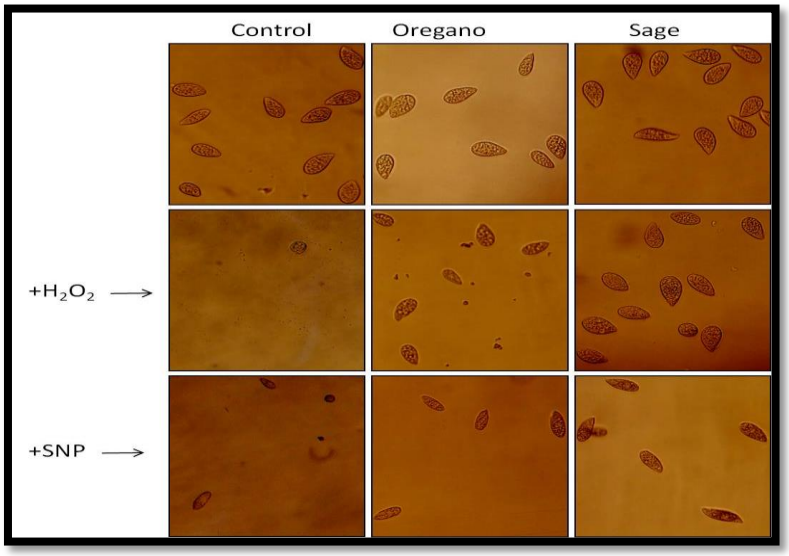

Figure 2: Microscopic images of protozoa showing the protective effect of oregano against H_2O_2 and SNP at 168 h.

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Morphometric analysis of the threatened freshwater crab *Potamon algeriense* (Bott, 1967)

The value of morphometric studies is well recognized in studies on the Crustacea, and relative growth data have been extensively utilized to evaluate developmental stages of the Crustacea [1].

Ontogenetic allometry changes in the relative growth of males and females of the freshwater crab *Potamon algeriense* were analyzed to describe some new sexual dimorphic features on the ontogenic trajectories of the cheliped. The field surveys were carried out between 2017 and 2018 in Zegzel River, Northeast of Morocco. Crabs were collected by hand or net. We surveyed carapace width (CW), carapace length (CL), major cheliped width (ChW) major cheliped length (ChL) of 406 crabs (190 females and 216 males) to the nearest 0.05 mm using a Vernier calliper.

Our main result was the identification of morphological biometry showing a variability of the cheliped linked to growth allometry, with some difference between sex ontogenic trajectories. Specifically, we emphasized how the morphometric features of the cheliped change during body-size growth with different increasing rates. Particularly, the observed significant shape changes are mainly due to positive allometries in both sexes.

Remarkable ontogenetic changes were observed. In the allometric growth of the major cheliped, both sexes were heterochelous (89% of the collected crabs were right handed) usually being larger in males than in females.

Our study document for the first time confirms that a form of sexual dimorphism exists in the ontogenetic allometric trajectories of *P. algeriense* in both the large and small cheliped, these trajectories being related to mechanical aspects in predation, food manipulation, mate acquisition and between-sex differences in aggressiveness during antagonistic fights.

Keywords: freshwater crabs, *Potamon algeriense*, ontogenetic allometry, morphometry.

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Biomonitoring of ecological integrity and water quality using physicochemical, bacteriological and biological index in Martil basin (northwest Morocco)

Water resources in Morocco are facing quantity and quality problems. The deterioration of water quality in aquatic ecosystems is an increasingly important issue in northern Morocco where water resources are limited, fragile and endangered.

As other Mediterranean rivers located in the north of Morocco which are under increasing disturbance, the watershed of Martil also suffers multiple impacts under various natural and anthropic pressures which affect the quality of its waters. In an attempt to assess the deterioration of the waters of this basin, an evaluation of its ecological integrity has been carried out.

The Martil watershed is located in northwestern Morocco, covering an area of 1259 km^2. It arises from the confluence of Oueds Mhajrat, Khemis and Chekkoûr and crosses the plain of Martil through the city of Tetouan. Therefore, it is surrounded by a number of industrial, agricultural and tourist activities before flowing into the Mediterranean Sea [1]. The altitudes vary between 0 m on the coast and the plain to 1782 m in the extreme south [2].

In order to establish the state of pollution of the waters of this basin, our study focused on the determination of physicochemical and bacteriological quality parameters of the water as well as a biological characterization. To achieve this objective, water samples for physico-chemical and bacteriological characterization and benthic samples for biological diagnosis were obtained during a seasonal cycle (spring, summer, autumn 2017 and winter 2018) at 20 sampling stations, chosen from upstream to downstream of the watershed.

The physicochemical and microbiological quality was evaluated on the basis of twelve parameters (temperature, pH, electrical conductivity, dissolved oxygen, biological oxygen demand, chemical oxygen demand, suspended solids, sulphates, nitrates, nitrites, fecal coliforms, fecal streptococci). The

biotic monitoring was assessed using a biotic index, which is the biotic index Iberian Biological Monitoring Working Party (IBMWP) [3].

The values of the IBMWP Index as well as those of the weighted index used for the physicochemical and microbiological parameters have classified the waters of the upstream part of this watershed as good quality water while the waters of the downstream part have been classified as bad quality waters.
In the same way, the analyses of macroinvertebrate communities indicate that the further downstream shows a decrease or even a disappearance of polluted-sensitive taxa.

The results obtained following this study reveal an alarming situation of water quality in the Oued Martil watershed, particularly its downstream section.

Keywords: Biomonitoring, macroinvertebrates, water quality, pollution, Martil watershed, Morocco.

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Antimicrobial and antioxidant activities of *Lavandula stoechas* from the province of Taza Northern Morocco

The preservation of food products is a major issue for the agro-food industry. This implies, on one hand, mainly the control of the growth of microorganisms responsible for food-borne diseases, and on the other hand, the control of the organoleptic quality of these products.

The discovery of antimicrobial agents marked a milestone in the fight against infectious diseases. However, the onset of adverse effects of these drugs and the rapid progression of bacterial resistance has gradually rendered these agents ineffective and diseases believed to have been controlled re-emergent.

The search for natural plant substances with antimicrobial and antioxidant properties is therefore of great interest to the food industry.

In this context, the objective of our work is a contribution to the study of the antioxidant and antimicrobial activity of the essential oil of the plant *Lavandula stoechas.*

Antimicrobial activity was evaluated by the disc diffusion technique against five bacterial strains and against *Candida albicans*, the minimal inhibitory concentration was determined by the microplate technique (TTC assay). The antioxidant activity was performed by the free radical scavenging activity.

Our results showed a variable degree of antimicrobial and antioxidant activities of that *Lavandula stoechas* essential oil.

Keywords: *Lavandula stoechas*, essential oil, CMI, CMB, DPPH.

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Assessment of biomass production and membrane stability under salt stress in Mediterranean barley (*Hordeum vulgare*) accessions

Barley (*Hordeum vulgare*) is grown under a wide range of soil and climatic conditions. Among this, abiotic stress represents the main constraint in Mediterranean area. Salt stress significantly affects the growth and the productivity. Exploring responses of barley plants cultivated under salt stress is of crucial importance both for scientists and growers. In our study we assessed the biomass production and membrane stability under salt stress in some barley Mediterranean accessions. Indeed, an experimental trial was established according to a randomized complete block design with 3 replicates. Plant material consisted in 28 accessions originated from Morocco, Tunisia, Algeria and Egypt. Plants were submitted gradually to salt stress by adding NaCl (from 500 µs/cm to 8.1 ms/cm) during 3 months. Outcomes of the statistical analyses showed highly significant effect of salt treatment, accession and their interaction. Under salt constraint, significant reduction of biomass production and membrane stability were obtained. According to our results, accessions studied here can be ranked into five groups with respect to salt tolerance: the first group included highly tolerant accessions for which biomass reduction was lower than 10% when compared to control. The second one was marked by biomass reduction between 20 to 30%, the third showed a biomass reduction from 30 to 40%, the fourth group exhibited a reduction from 40 to 50%, and the most important reduction in biomass production was found in the fifth group (55 to 60%).

Keywords: Barley, salt stress, biomass reduction, membrane stability.

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Electrochemical study of corrosion of dental amalgam with green inhibitor in artificial saliva

Amalgam is a metal alloy that is easily formed, without heating, often using in the dental field. We distinguish the chemical corrosion which corresponds for amalgam essentially to the sulphidation of silver which translates into a surface dullness [1] [2] [3], the electrochemical corrosion responsible for the deep degradation of the restoration. Only this last deserves to be studied in order to limit as much as possible this phenomenon harmful to the durability of the restorations [3] [4] [5].

In this work, we studied the electrochemical of corrosion of dental amalgam was carried out artificial saliva with or without inhibitor, the electrochemical techniques of cyclic voltammetry, polarization curves and electrochemical impedance were employed as a function of concentration to determine. The inhibition efficiency increased with increasing the extract concentration but decreased with increasing the temperature and pH. The influence of temperature range of 10 to 40°C and the influence of pH was tested in solution of artificial saliva with or without acetic acid; the adsorption of the extract in dental amalgam surface follows a Langmuir adsorption isotherm.

Keywords: Dental amalgam corrosion, electrochemical study, Artificial saliva, salvadora persica.

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Antimicrobial peptides, bacteriocins, produced by lactic acid bacteria isolated from a traditional brine table olives against pathogenic bacteria

Because of the risk of security, many efforts have been made to limit or restrict the use of chemicals for food preservation. The biological approach using microbial antagonists, mainly bacteria and their metabolites, to control the deterioration of food has become a subject of a thorough investigation [1]. Numerous studies have demonstrated that the production of bacteriocins can be successfully applied in foods to inhibit *Listeria monocytogenes* and other food pathogens [2].

In this context, a purification of bacteriocins from two lactic *Enterococcus faecium* strains isolated from table olive brines was carried out by the YANG method, based on the influence of pH on adsorption and release.

The two bacteriocins which have been purified by the Yang method have shown important results whose zones have diameters of inhibition greater than 15 mm against *Listreria monocytogenes*. The results also showed that the bacteriocins were able to inhibit *Escherichia coli* O157: H7, a Gram-negative bacterium which is generally recognized as being insensitive to bacteriocinogenic activity.

Keywords: Lactic acid bacteria, purification, bacteriocins, antimicrobial activity, food preservation

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The nutritional value of *Cytisus villosus* in the rangelands of the Moroccan Rif

The *Cytisus villosus* is a legume shrub of 1 to 2 m, located mainly in the western part of the Rif. In this region, the shrub is characterized by its large palatability in the face of the livestock and by its importance on the phytosociological Plan [1]. In fact, it is inserted in the *Cytiso triflflori-Quercetum canariensis* association [2].

During the last ten years, the soil of the West-Center Moroccan Rif region was radically degraded because of the strong anthropogenic pressure, land clearing and frequent forest fires caused for the benefit of the cannabis culture [3]. The *Cytisus villosus* as a legume forage shrub has traditionally played a fundamental role in the maintenance and sustainability of the plant cover of the soils in the Rif. In addition, it's the preferred food of the goats in the region. The choice of *Cytisus villosus* for this study is mainly due to the strong degradation suffered by the stands of this shrub in the Western Rif as a result of the human pressure currently threatening its disappearance. This work is carried out to contribute to the valorization of this plant.

The chemical analyzes of this shrub fodder dry matter (41.18% DM), mineral matter (4.56% DM), organic matter (95.41% DM), total nitrogenous material (15.06% DM), neutral detergent fiber (51.94% DM), acid detergent fiber (34.02% DM), acid detergent lignin (7.25% DM) and minerals allowed us to evaluate the nutritional value of *Cytisus villosus*.

The results obtained described the aerial biomass of this shrub legume among good quality forages, while knowing that the nutritive value of the leaves is 1.22 UFL/Kg DM, while that of the soft stems is 0.64 UFL/Kg MS. The high energy content of leaf biomass resides in high MAT (20.15% DM) and low NDF fiber contents (36.64% DM); ADF (21.53% DM) and ADL (5.86% DM).

Keywords: *Cytisus villosus*; Rif, fodder, anthropogenic action, food value.

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Phenolic content and antiglycation ability of some aromatic and medicinal plants from Morocco

The objective of this study is to select extracts of Moroccan medicinal and aromatic plants that could prevent diabetic complications related to oxidative stress and glycation [1] [2]. Glycation is a non-enzymatic reaction of glucose or its metabolites (glyoxal or methylglyoxal ...) with proteins. This reaction leads to the formation of advanced glycation endproducts (AGEs), which are complex compounds that lead to tissue damage. We evaluated the antioxidant and antiglycation activities of the aqueous and methanolic extracts of 21 Moroccan aromatic and medicinal plants collected in Tangier. The antioxidant activity of the extracts was determined by their ability to scavenging the 2,2-diphenyl-2-picrylhydrazyl radical (DPPH), to chelate ferrous iron and to reduce ferric iron. The antiglycation activity was carried out using the BSA-glucose/fructose system by measuring the levels of fructosamine. The determination of total phenolic compounds and flavonoids was carried out by the method of Folin Ciocalteu and aluminum trichloride respectively. The methanolic extract revealed a strong scavenging effect of the DPPH radical, with an IC50 equal to 15.4 µg/mL observed with *Scolymus hispanicus*. The aqueous extract exhibited high metal ion chelation activity especially in *Thymus broussonetii* (IC50=37.9µg/ml). The majority of aqueous extracts showed an inhibitory activity of glycation. The plants with the highest glycation inhibitory activity are *Chenopodium ambrosioides, Artimisia herba-alba asso, Origanum majorana, Thymus broussonetii* and *Matricaria chamomilla.* The contents of phenolic compounds and flavonoids are generally higher in the methanolic extract. Finally, the antiglycation and antioxidant effects induced by the extracts show major advances in the search for natural products based on medicinal and aromatic plants. The active ingredients of these plants could delay and/or treat diabetic complications caused by the glycation of the body's proteins.

Keywords: Medicinal plant, antioxidant, antiglycation, diabetes

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Study of the effect of extract of plants on the corrosion of aluminum in 1M HCl

Aluminum and its alloys have been widely used in various industrial applications because of its inherent merits, such as low density, excellent electrical and thermal conductivity and relatively good corrosion resistance. Aluminum exhibits corrosion immunity in aqueous environments due to the formation of a thin passive oxide film on its surface. This oxide film is susceptible to dissolve in highly acidic environments because of its amphoteric characteristic [1].

The most effective method for protecting metals against corrosion is the use of inhibitors. Recently, use of low-cost and eco-friendly products such as extracted compounds from leaves or seeds as corrosion inhibitors for aluminum increased [2].

The aim of this work is to study the effect of water extracts of two plants on the corrosion of aluminum alloy in 1M HCl solution. The techniques employed for corrosion inhibition are gasometry, tafel polarization and electrochemical impedance spectroscopy (EIS). Chemical gasometry technique showed that addition of water extracts to 1M hydrochloric acid solution decreases the volume of the hydrogen gas evolved. The inhibition efficiency obtained from chemical and electrochemical tests were in good agreement, it increases with increasing concentration of water extracts. The potentiodynamic polarization experiment revealed that the water extracts are inhibitors of mixed-type and electrochemical impedance spectroscopy (EIS) confirmed that changes in the impedance parameters are due to surface adsorption. Scanning Electron Microscopy with Energy Dispersive Spectroscopy (SEM-EDS) study

confirmed that the inhibition of corrosion of aluminum is through adsorption of the extracts molecules on the surface of metal.

Keywords: Plants extracts, corrosion inhibition, green inhibitor, electrochemical, aluminum.

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Sharks from the Atlantic central Morocco: biodiversity, exploitation and marketing circuit

The present work is a contribution to the study of the diversity and exploitation of cartilaginous fish in the Moroccan central zone.

Sharks are a diverse group of cartilaginous fish (class Chondrichthyan) that has evolved over 400 million years. Historically, these fish were considered to have low economic value for industrial fisheries and as a result were neglected by fisheries management organizations. Today, many of these fish have become the target of commercial and recreational fisheries around the world, and they are also increasingly caught in fishing activities targeting other species [1].

Most of these species unfortunately have slow growth, late maturity, low fecundity and a long life span, resulting in low population growth rates, so many shark populations are now reduced, and some are threatened.

The objective of this work is to present the diversity of sharks and sharks landed in the central Atlantic Morocco to identify the main information available. We will also present the structure of the fleet, the fishing gear used, the fishing effort and the marketing circuit [2] [3].

Sharks are not only sought for the quality of their flesh, but also for the uses that can be made in such diverse fields (leather, chemistry, pharmacology, cosmetology and medicine).

The management of shark fisheries in the Moroccan central Atlantic has been hampered by the lack of biological and fishery data. Global warming also indirectly affects sharks by changing their distribution and behavior patterns.

Keywords: Fish cartilaginous, shark fisheries, Atlantic Moroccan center, diversity, structure of the fleet, fishing effort, marketing Circuit, Management and Global Warming.

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Contribution to the assessment of the concentration of three trace metals (Pb, Cd and Hg) in three sea products caught off the Moroccan Atlantic,

Our investigations in the framework of this study concern three marine species fished along the Moroccan coast: a fish, the sole (*Solea vulgaris*), a cephalopod, the cuttlefish (*Sepia officinalis*) and a crustacean, the pink shrimp (*Parapenaeus longirostis*).

The main objective of this study is to evaluate the level of concentration in these marine species, of three trace metals (Cadmium, Mercury and Lead) and to compare the results with the regulatory thresholds. The study also aims to reflect on the way Moroccan deep-sea fishing professionals can join a food safety management system to ensure the safety of their product and promote their competitiveness.

Sampling is carried out at the port of Agadir after unloading fishing vessels that operate beyond 10 nautical miles, dredging the seabed in the open sea of Agadir for pink shrimp, and in the open sea of Dakhla for sole and the cuttlefish. The analyzes were performed on the muscles of individuals belonging to the three species considered.

The results of our investigations show that the concentration of Pb varies between 0.0013 and 0.016 ppm for sole; between 0.001 and 0.207 ppm for the cuttlefish and between 0.045 and 0.065 ppm for the shrimp. For Cd, the concentrations vary between 0.007 and 0.050 ppm for sole; between 0.006 and 0.022 ppm for cuttlefish and between 0.005 and 0.04 ppm for shrimp. Concerning the Hg, the concentrations vary between 0.00014 and 0.024 ppm for sole; between 0.00012 and 0.06 ppm for the cuttlefish and between 0.001 and 0.085 ppm for the shrimp.

This study shows that metal levels detected in the three species of seafood products investigated are below the regulatory thresholds (Fish: 0.05 ppm for Cd, 0.3 ppm for Pb and 0.5 ppm for Hg - Cephalopods: 1 ppm for Cd, 0.3 ppm for Pb and 0.5 ppm for Hg - Shrimp: 0.5 ppm for Cd, 0.5 ppm for Pb and 0.5 ppm for Hg).

Keywords: Cephalopods, shrimp, trace metals, deep sea fishing, fish, food safety.

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Conservation and valorization of Oregano species

Morocco is characterized by a diversity of medicinal and aromatic plants that have socioeconomic interest. Owning to their economic, social, medicinal, ecological, cultural importance, the aromatic and medicinal plants field have started these last years to occupy an important place in different sectors, particularly in research, agriculture, industry, medicine and environment. There are an estimated 500 to 600 species of aromatic and medicinal plants and many are endemic. Among these species there is Origanum. Several species belonging to the genus Origanum are the most important among cauline weeds in world trade and in local markets as raw materials in the herbs, spices, pharmaceuticals and cosmetics industries. But production is still low in Morocco and in global level. Collection, conservation, improvement and domestication are the only way to preserve this plant for future generations.

In order to conserve and to protect this natural heritage, considerable efforts are required to characterize, list and value this plant. Therefore, biotechnology tools may provide some solutions to the protection and domestication of the species. Moreover, it will be the requirement for a high added value producing molecules for different bio-industrial sectors. Vegetative multiplication or *in vitro* culture is one of the important plant biotechnology axes that represent a powerful tool for the industrial and economic prospects. It provides the production of high quantity of cultivars that have a horticultural and agronomic interest and the selection of clones with a high yield and rich of active ingredient desired by users like pharmaceutical industries and cosmetic companies.

The context of our work, within the plant biotechnology laboratory, relies on the improvement, valorization and characterization of medicinal and aromatic plants that spread in north of Morocco. Our researches aimed at the development of an *in vitro* culture production technique of four species belong to the genus of Origanum (*Origanum majorana* L., *Origanum vulgare* L., *Origanum compactum* L.and *Origanum elongatum* L.) selected to meet the

needs of farmers in seeds and the introduction of an alternative culture of oregano with a high added value that can contribute to the economic and social progress of the region of introduction.

We established a protocol for vegetative multiplication *in vitro* of four oregano species by the axillary bud technique. Consequently, results from the tests of the mineral medium as well as cytokinins and auxins showed positive influence on the growth and the development of the explants. Indeed, the mineral solutions SD and N30K (Margara) gave the best results. In addition, the type of cytokinin present in the medium has an effect on budding, growth, hyperhydria and rooting. Also, the presence of auxins combined with cytokinins seems to be favorable for the generation of plantlets with an important roots ramification. Furthermore, the acclimatization of rooted vitro-plants of 12-16 weeks was successfully established.

Keywords: Oregano, micropropagation, conservation, valorization.

Acknowledgments: This research is undertaken in the framework of a Moroccan project PPR2 funded by MESRSFC and CNRST.

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Effect of aromatic and medicinal plants as diet supplements on zootecchnical parameters of growing rabbit

The objective of this study was to analyze and compare the effects of fennel, oregano and thyme dietary supplements on the feeding of rabbits. Ninety-six weaned rabbits, white New Zeland, were divided into four groups and submitted to the following dietary treatments: Control diet, F diet, O diet and T diet. The treatment of fennel, oregano and thyme had no beneficial effects on the growth performance of the rabbits, but did reduce the mortality rate. The phenylpropanoid and the phenolic monoterpenes were, respectively, the major components of the essential oils of *Foeniculum vulgaris, Origanum compactum* and *Thymus capitatus* aromatic plants and their active compounds can be used as additives in rabbit nutrition.

Keywords: Rabbit, oregano, fennel, thyme, growth performance, essential oil

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Removal of synthetic dyes from aqueous solution using a natural adsorbent material

This work aims to examine the extractive capacity of the sea weed with respect to two dyes called red-congo and methylene blue. These elements are dissected and analyzed chemically to see if they can absorb the dye. To this end, several parameters are examined including the mass of the adsorbent, contact time, initial concentration of the pollutant, pH and temperature of the solution. The samples before and after adsorption experiments are analyzed by a UV-visible spectrophotometer. The analysis of the results obtained shows that the kinetics of adsorption is of the pseudo-second order. The study of the adsorption isotherms shows that the model of Langmuir is the most suitable than other isotherm models. The pH and temperature have a very small influence on the performance of the extraction by fixing the sea weed on the red-congo and methylene blue. Finally, the sea weed can be considered as an alternative adsorbent material for wastewater treatment.

Keywords: Adsorption, sea weed, red-congo, blue methylene

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Biological evaluation and study of cytotoxic properties of ethanolic extracts of *Opuntia dillenii*

Aromatic and medicinal plants represent to date a capital source of active ingredients which are experiencing a growing application as consumed products in various fields such as: the agri-food, pharmaceutical and cosmetic fields...

The Cactus is the common name of plants of the family "Cactaceac". It is native to Mexico and was introduced to North Africa in the 16th century. While opuntia dillenii is a cactus belonging to the opuntia family. It is a xerophytic plant that usually grows in semi-desert regions, as well as tropical and subtropical regions.

In the current study, we attempted to evaluate the antioxidant, antibacterial and antifungal activity, in addition to the cytotoxic properties of ethanolic extract prepared from the seeds of *Opuntia dillenii*.

The results obtained indicate that total phenol and total flavonoid content of the ethanol extract were 1760.51 ± 45.10 (equivalent of Gallic acid mg/g dry extract) and 20.27 ± 0.15 (equivalent of Rutin mg/g), IC50 value for DPPH and ABTS scavenging activity was 44.61±2.73 µg/mL and 88.50 ± 1.83 µg/mL, respectively. Antimicrobial activity observed for the extract ranging

between 0.31 and 0.62 mg/mL as MIC value against tested microorganism. MTT assay was employed for evaluation of cytotoxic activity, ethanol extract demonstrated growth inhibitory effect against MCF-7 breast cancer cells with IC50 value 0.17 mg/mL. The ethanolic extract of *Opuntia dillenii* showed significant antibacterial, antioxidant and cytotoxic effects. Our findings suggest a possible therapeutic potential of ethanolic *O. dillenii* extract, as well as its use as promising functional food ingredients.

Keywords: *Opuntia dillenii*, antioxidant, antimicrobial, cytotoxicity.

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Water management for citrus irrigation in the context of climate change – plain of Triffa - Morocco

The use of water for citrus irrigation is very intensive in the Plain of Triffa, where irrigation water is exclusively brought from Mohammed V dam. Analysis of climate data and hydrological programs recorded in service of the dams show a reduction in the importance of rainfall [1].

This study focuses on the appreciation of the hydric stress effect on the vegetative state and the production potentialities of clementine in the plain of Triffa in Eastern Morocco. The experimental plot covers a surface of a quarter of hectare of clementine variety “Fina Berkane” on rootstock Volkameriana and density of (3 m* 6m), installed in October 2012.

This work treats, also, a comparative study of deficit irrigation on the vegetative growth of the shoots, the yield and the fruit size, in order to reduce water use without affecting the physiological status and trees performances [2] [3].

Four irrigations schemes were defined according to the maximal evapotranspiration (ETM) calculated using reference evapotranspiration (ETo - calculated using weather station), and crop coefficient (Kc) [4], which varies according to physiological stage:

-120% d’ETM
-100% d’ETM
- 80% d’ETM
- 60% d’ETM

This study has shown that the application of 80% dose ETM meets trees needs without affecting yield and desired size; it also allowed a vegetative growth well timely distributed. This makes it possible to save 40% of ETM that equals about 400 mm/year (table1).

Table 1: water quantity to preserve during the practice of the deficit irrigation

Doses irrigation	120 % ETM	100 % ETM	80 % ETM
water requirements for citrus per year (mm) [5] [6]	1000 - 1100	850 - 900	680-700
Saved quantity of water per year (mm)	-	150 - 200	320 - 400

The analysis of the practice of 60% dose ETM shows a lower yield compared to the 80 and 120% dose ETM; a predominance of fruit size 5 and 4 (size that can be exported but with a low commercial value) was observed, added to deceleration of the vegetative growth.

Keywords: Water saving, climate change, plain Triffa, deficit irrigation, yield, vegetative growth, fruit size, clementine.

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Characterization of an unconventional vegetable oil extract from the almonds of the *Zizyphus lotus* L.

To valorize the local flora and testing new products, we have tried through this study to evaluate the chemical composition of fatty acids, sterols and tocopherols of an unconventional vegetable oil extracted from the almonds of the *Zizyphus lotus*. It is a tree that is a frutescent plant of 1.3 to 2.2 meters in height, very branched, present in several arid, semi-arid and even Saharan regions. The oil was obtained by mechanical pressure of the almonds. It is characterized by its indication of iodine, its ester's indication, and by its organoleptic characteristics that gives it a good quality. The analysis of CPG chromatograms shows that this oil is rich in unsaturated fatty acids in particular oleic acid (C18:1; 66.8%) and linoleic acid (C18:2; 13.6%).

The analysis of tocopherols by HPLC shows that this oil contains only γ-tocopherol with a 32.9 mg/kg. Finally, the interpretation of the chromatogram of sterols reveals a predominance of ß-sitosterol with a proportion of 71.7%.

Keywords: Linoleic acid, β-sitosterol, maceration, γ-tocopherol, *Zizyphus lotus*, sterols

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Study of the antibacterial activity of *Thymbra capitata* essential oil against pathogens in Brain Heart Broth and juices

The aim of this work was to study the antibacterial activity of *Thymbra capitata* essential oil, alone and combined with heat treatment, against *Escherichia coli* O157:H7 CECT 4267, *Staphylococcus aureus* CECT 976 and *Listeria monocytogenes* CECT 4032 in Brain Heart Broth (BHB), prickly pear and carrot juices.

The strains were added to BHB and the juices separately, then chosen concentrations of *Thymbra capitata* essential oil were added. For combination experiments, juices were treated thermally (50°C - 30s), then different concentrations of the essential oil were added. Control samples without the oil were prepared. BHB and the juices were conserved in 20 and 5°C for 30 days. Bacterial enumeration was carried out, at different time intervals, using the appropriate medium.

We have found that *Thymbra capitata* essential oil, alone or combined with heat treatment, significantly inhibited these pathogens in BHB and both studied juices during 30 days of storage at 20 and 5°C. We also noted that the effect was concentration-dependent. We also studied the effect of storage temperature and found different results depending on the studied strains.

Keywords: *Thymbra capitata* essential oil, antibacterial activity, Brain Heart Broth, prickly pear juice, carrot juice.

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Bioactive compounds in two aromatic and medicinal wild plants: *Matricaria chamomilla* L. (wild chamomile) and *Cladanthus mixtus* L. Oberpr. and Vogt. (Moroccan chamomile)

The extracts of medicinal plants are used directly or indirectly for the treatment of many diseases. Moreover, in most developing countries, the use of medicinal plants in traditional medicine has been observed for maintaining good health**.** *Matricaria chamomilla* L, (German Chamomile, *Matricaria recutita* L., *Matricaria suaveolens* L. chamomile) is a widely recognized medicinal plant from the Asteraceae family; it is native to southern and eastern Europe and cultivated also in countries of America and Asia. Also, it is one of the most popular medicinal plants commonly used in herbal tea, for food purposes and in folk medicine. The dried flowers of chamomile contain many terpenoids and flavonoids contributing to its medicinal properties. Wild chamomile, *Cladanthus mixtus*, also known commercially as Chamomile of Morocco, is a biennial chamenyphous Asteraceae with many upright stems. In Morocco, it is encountered in two different zones, the first between Tangier, Ouezzane, Souk Larbaa, Moulay Bousselham and Azilah, and the second between Kenitra, Sidi Slimane, Khemisset and Rabat. In the present study, we determined total polyphenols, flavonoids and flavanols contents in the flowers of two medicinal plants: *Matricaria chamomilla* and *Cladanthus mixtus*. The aerial parts of *Matricaria chamomillla* L. were collected from the region of Beni Hassan, Tetouan, and their identity was confirmed by Dr. Ahmed Lamarti (Abdelmalek Essaadi University, Tetouan, Morocco).

Flowers were dried in an oven at a temperature of 50°C in order to preserve as much as possible the integrity of its chemical composition, after they were crushed in a Microtron MB 550: KINEMATICA AG, with a speed of 8000 towers / min. The powder obtained is composed of particles whose size is 0.2 mm in diameter.

Five g of powder was macerated in 30 mL of hexane at room temperature for 1 h to remove chlorophyll and fats. Then, this mixture was centrifuged 15 min at 5000 rpm. The centrifugation was repeated 3 times, each time the supernatant was discarded and then the remainder of the hexane was removed by concentration under vacuum using a rotavapor. The fresh residue was extracted with 100 mL of different solvent systems (80% acetone, 80% methanol, 50% methanol). Extraction was carried out using a magnetic stirrer at room temperature for 1 h, and then centrifuged 15 min at 5000 rpm. This extraction was repeated two times. The three supernatants were pooled and incubated at 4˚C until analysis.

Briefly, the total polyphenols content was measured using the Folin-Ciocalteu method, with gallic acid as standard described previously [1]. Flavonoids content was determined by the method described by Bahorunetal et al. [2]. Then the Total flavonols content was determined using the method of Kumaran and Karunakaran.

In conclusion, methanol 80% was the most effective solvent to extract polyphenols from *Matricaria camomilla*, while acetone 80% was the most effective one for *Cladanthus mixtus*. In addition, *Matricaria camomilla* contains more polyphenols than *Cladanthus mixtus*.

Keywords: *Matricaria camomilla*, *Cladanthus mixtus*, polyphenols, flavonoids, flavonols.

Acknowledgments
This research is undertaken within the framework of a Moroccan project PPR2 funded by MESRSFC and CNRST.

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Use of lignocellulosic waste as catalyst for the synthesis of carbonates from CO_2

The use of carbon dioxide as a carbon source in chemistry can be both a solution to reuse CO_2 emitted into the atmosphere (the main greenhouse gas related to human activity) and to limit use of other less abundant sources. Thus, the interest of scientists for the reactivity of carbon dioxide has increased considerably since the oil crisis of 1973 [1].

Among the most interesting applications of CO_2 is the reaction with epoxides for the synthesis of carbonates [2]. In this reaction, polycarbonates can be obtained by alternating insertion of CO_2 and epoxide, and cyclic carbonate by intramolecular cyclization (Figure). Several types of catalysts have been used in this reaction such as ionic liquids and alkali metal salts, especially for the formation of cyclic carbonates, and coordination compounds with different types of metals.

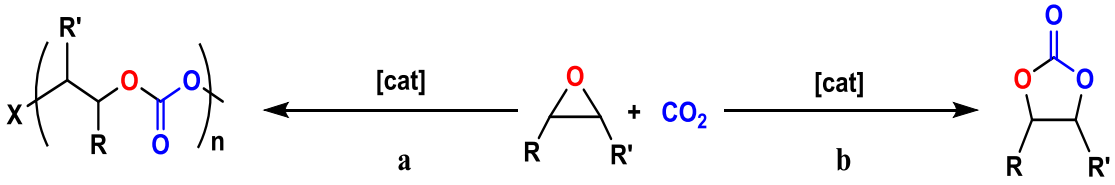

Figure: polycarbonates can be obtained by **a)** alternating insertion of CO_2 and epoxide **b)** and cyclic carbonate by intramolecular cyclization.

Here we will present the study of carbonate formation from CO_2 using lignocellulosic biomass as inexpensive, renewable and benign catalyst for the environment [3].

Keywords: Lignocellulosic waste, carbon dioxide, carbonates.

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First record of *Oreochromis niloticus* in merja zerga lagoon: a ramsar site of the Northern Morocco

The Merja Zarga lagoon is a major transitional zone of the northern Morocco, which was designated as a RAMSAR site in 1980 due to its importance for migratory birds [1]. This lagoon is also important in the local economy, generating incomes for the local population from tourism, agriculture and fisheries. The Merja Zarga was investigated mainly for benthic invertebrate communities biodiversity and population dynamics [2], hydrological characteristics [3] and no information is found in the literature on fish biodiversity. During the year 2017, we conducted a year-round quarterly survey using a beach seine (10*2.5m; 5mm square mesh) in order to study the recruitment dynamics of marine fish. Each survey consisted in 3 stations of 3 fishing hauls positioned in a way to cover the major components of lagoon: the fishway and the two main channels. During the October survey, a single individual of *Oreochromis niloticus* (208 mm, 363g) was caught at temperature 19.4°C and salinity 31.6‰. The interviews of local fishermen led to the conclusion that the emergence of this species in the lagoon dated-back to 2015. Furthermore, and presumed that the species is more abundant at low salinity, a sample of 50 individuals brought by fishermen showed that most individuals were juveniles with estimated ages of 2 to 3 years. This species, which was introduced in 2008 for aquaculture purposes in a dam hundreds of kilometers far upstream, found her way to the Merja Zerga lagoon. Even-though no mouthbrooding females were found to date, the presence of young juveniles suggests that this species may fulfill its lifecycle in the lagoon, which may affect the fish community structure and diversity and impact this particular ecosystem and its potential role of essential habitat for fishes (EHF) [4].

Keywords: Tilapia, alien species, transitional ecosystems, Ramsar site, Morocco.

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Evaluation of the effect of sludge from surface water treatment on the growth and development of pea cultivation

This work aims to evaluate the effect of agricultural spreading of physicochemical sludge, generated during surface water treatment by coagulation-flocculation, on the growth and development of a pea culture in a sandy soil from the region of Sidi Bennour. The effect of several doses of sludge ranging from 5% to 30% was investigated and the results were compared to that of the control tests (0%). Different parameters were analyzed such as chlorophyllous forms “a” and “b”, total soluble sugars, stem length, etc.

The results obtained revealed a moderate influence of the applied doses on the development of the chosen culture. It was found a slight increase in soluble sugar especially for the high doses 20% and 30%. However, the chlorophyllous forms were inhibited with the application of these mass percentages. It has also been found that the studied sludge positively influences the length of the plant stems. In terms of dry biomass, the application of sludge revealed a positive effect especially for the dose of 5%. Other tests and analyzes are in progress to complete this work.

Keywords: Sludge, coagulation-flocculation, agricultural spreading, culture pea.

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Particle size distribution and statistical analysis of the grain size Messinian bentonite from the Kert bassin (Northern Morocco)

This work focuses on the granulometric characterization the Messinian bentonites of Kert Neogene basin located in the Moroccan Northeast region in the Rif chain [1]. It was carried out by analyzing the evolution of the granulometric behavior of the bentonites along the profiles of the deposit. To do this, a sampling campaign was carried out in the form of a tight mesh [2]. The particle size analysis of the Messinian samples was sandy loams and loamy sands, however the clay fraction ranged from 1.665 to 9.094% while the silt fraction from 20.817 to 92.794% and the sand fraction from 1.272 to 77.518%.

The results for grain size indices and their distributions as a function of morphological units have shown that they are generally very fine sands and very coarse silt, moderately misclassified [3], very poorly ranked and almost symmetrical.

Keywords: Granulometric distribution, bentonites, Trebia, Kert Neogene basin, Morocco.

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Natural populations of *Arbutus unedo* L.: Range and settlement conditions in Morocco

Plant genetic resources are an essential part of biodiversity and are responsible for the sustainable development of agriculture and agro-industry. They constitute precious resources for a majority of rural populations in developing countries, particularly in Africa where more than 80% of this population uses them to ensure their well-being. Indeed, several thousand little known wild species have an undeniable food potential.

Currently, it is scientifically proven that the Mediterranean diet promotes good health although some local foods are still little studied. The Arbutus (*Arbutus unedo* L., family Ericaceae), also called strawberry tree, is in fact an essentially wild species and typical of the Mediterranean region. It is also used as a source of food and therapeutic agents in medicine because of the properties (astringent, antiseptic, anti-inflammatory, antispasmodic, diuretic, etc...) attributed to the different biological parts (leaves, fruit, bark and root) of the plant. In recent years, these applications have aroused growing interest among scientists and even the general public.

In Morocco, the Arbutus remains little studied and known from the point of view of nutritional and therapeutic uses in medicine and the only farms of this species are restricted to its seasonal consumption if we refer to the work that has been devoted to it. However, scientific studies show its high nutritional value thanks to its composition in certain nutrients (carbohydrates, vitamins and minerals) and phytonutrients (polyphenols).

In view of the above, the present study aims to provide original data on the biogeographic range, the bioclimatic stage than that of the vegetation of

Arbutus unedo L. We also thought it would be interesting to determine the main climatic conditions to have an idea of their installation, in order to contribute to the design of management programs and sustainable conservation strategies of *Arbutus unedo* L., and on the other hand, to allow the multiplication and enhancement of populations of a greater interest of this species.

Keywords: *Arbutus unedo* L., biogeographical distribution, bioclimatic stage, vegetation; Morocco.

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Geological and geotechnical study of surface formations and its impact on the sustainable development plan of the city of Sefrou

The town of Sefrou occupies a surface of about 80 km^2 including most spans quite hilly morphology courses. The objective of this work is the study of lithostratigraphic and geotechnical engineering of the profiles and superficial training in the city. Thus, the first results of this work have revealed that the substratum of Sefrou region is constituted by very consolidated or rocky formations, they are calcareous or dolomitic. These rock formations outcrop largely on the outskirts of the urban community of the city, with the exception of the northern part of the city where they are covered by little consolidated sedimentary lands. At the center of the city, the superficial formations are composed of clay or clay-sandy sediments with some rare stony elements that can meet by place. Conglomerates training fool all visible both at the level of the eastern part of the city. Finally, a geotechnical modeling of the whole of the urban area of the city will be the conclusion of this work. It will serve as a basis for possible future developments of this settlement.

Keywords: Sefrou; geology, geotechnical, modeling, development city.

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Biological activity and phytochemistry of the healthy and infected leaves with galls of *Pistacia atlantica* desf. in Meknes-Morocco

The Pistachio of Atlas, *Pistacia atlantica* Desf., from the family of Anacardiaceae and known under the vernacular names "lebtem, Kwawas", is a widespread species in Morocco and widely present in traditional pharmacopoeia [1]. Also, this species is frequently infected by "*Forda riccobonii, Geoica swirskii*" that are foliar galls-inducing aphids. A sampling, among various recovery method was used for different trials of *P. atlantica*, to compare the healthy leaves with others with galls, both in terms of chemical composition and biological activity.

The results obtained during the phytochemical study revealed the presence of some biologically active chemical compounds such as tannins, flavonoids, sterols and triterpenes, with the infected leaves were richer in tannins than healthy ones, especially in gallic tannins. Considering biological activity, it appeared that the tested strains of *Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa* and and *Staphylococcus aureus* were especially susceptible to the infected leaves essential oil. Indeed, all the bacterial strains presented an inhibition zone of large diameter (16-22 mm), whereas, healthy leaves had a significant effect only on *S. aureus* with inhibition diameter about 16 mm. Hence, under biotic stress, Pistacio tree react by producing more metabolits; so, leaves with galls, could be an added value through using their essential oil in combatting deleterious bacteria, enabling a modern soft pharmacopoeia and reducing the use of chemical drugs and their possible side effects.

Keywords: *Pistacia atlantica* Desf., leaves, galls, phytochemistry, essential oils, antibacterial activity.

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Sea turtles in the waters of the Yemeni Red Sea

Sea turtles are considered as endangered species, due to the decrease in their population in Yemen seas, because they are subjected to threats over nesting beaches, feeding grounds and so on. No more data is available on those threats or it's status in Red sea shores. The status of marine turtles is described for some areas in Red Sea coast of Yemen. The common species in the Western Indian Ocean are found nesting or feeding in Yemen sea water [1]. Marine turtles are widely distributed along Red sea and Gulf of Aden (Figure 1). Green turtle, Hawksbill turtle, Olive ridley, Loggerhead turtle and Leatherbacks turtle had been recorded from the Yemeni water. Their nesting and breeding ground extends along sandy shores of Yemen. Nesting beaches along the southern coast of Yemen are suggested to be some of the best remaining nesting ground in the world for green turtle [2] [3]. Yemen is known to be one of the important places of fishing activities in the red sea and Gulf of Aden, and uses many techniques like gills nets, per sine, line net and trawling etc., which is considered one of the causes of mortalities for marine turtles as well as pollution.

Survey, including an interview with the fishermen, was carried out during February to Marsh 2015, in Hudaydah and adjacent areas. We had asked a series of questions that gave us a knowledge about the turtles in regions, such as its distribution, threats, uses of products of marine turtles and occurrence in the fisherman nets. We as well took some photos of turtles to make the identification easier to fishermen. Those interviews were conducted with fishermen, as well as with those who have a knowledge about marine turtle. Contact was established with fishermen and coast guard to inform us on the presence of stranding marine turtles.

The interviews with the fishermen showed existence and nesting of marine turtles along Red Sea coast of Yemen particularly in the islands. Their existence and nesting happen during October, November and December in many area and other areas happen during January, February and March. *Eretmochelys imbricata* (Hawksbill turtle) and *Chelonia mydas* (Green turtle) were the most common species found in Yemeni Red Sea waters. Hawksbill turtle represent most strandings and five strandings were observed. The artisanal fishing gears that interact with marine turtles are shrimp trawls, gillnet, longlines, per Seine net and Stake net, where there were nearly 50

turtles caught accidentally by those gears during fishing seasons yearly. Some part of marine turtle is used for treatment and as food like meat. Capture of turtles for human consumption and as bycatch in fisherman nets near the feeding and nesting sites are an important threat to marine turtles (mainly hawksbill).

Keywords: Yemen, fishermen, turtles, threats.

Figure 1: The Red Sea coast of Yemen

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Performance study on solar collector

The presented work concerns modeling of the heat transfer of a solar air heating system and performance of a collector concerning the data meteorological local of the site (Tetouan: the North of Morocco). Via FORTRAN software, and by using the method of Gauss Seidel, a system of equations has been solved [1] [2].

The profiles temperatures of glass covers, absorber plate, insulation and the outlet temperature of air has been determined according to certain parameters variable: mass flow rate, conduit thickness, wind velocity, …

The results consider the daily evolution of fluid temperature at the output of collector concerning the climate of Tetouan by taking into account the wind velocity (v).

Keywords: Modeling, performance, solar air collector.

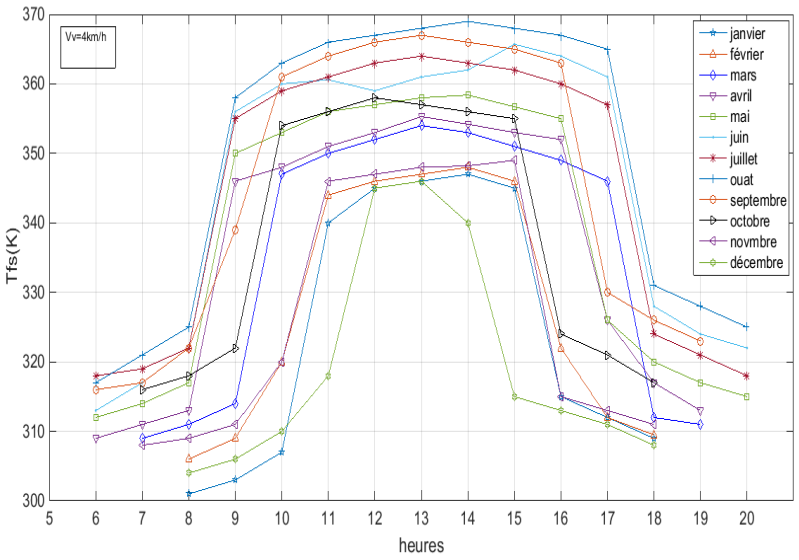

Figure 1: daily evolution temperature output collector for versus typical clear days, v=4km/h

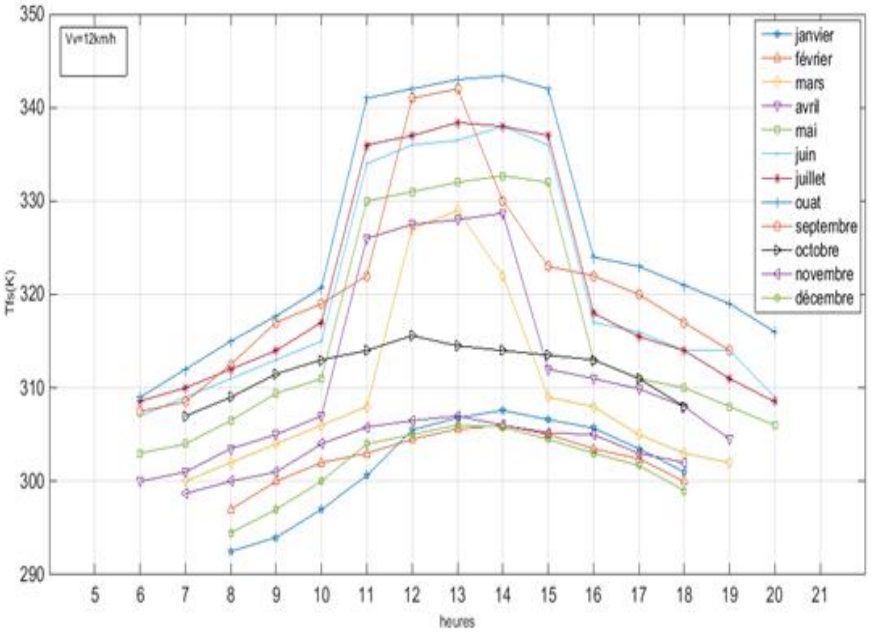

Figure 2: daily evolution temperature output collector for versus typical clear days, v=12km/h

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The role of *in vitro* culture on the preservation of aromatic and medicinal plants resources: case of *Thymus* spp.

In recent years, there has been renewed interest in natural medicines that are averaging active ingredients obtained from plant parts or plant extracts. Medicinal and Aromatic Plants (MAPs) are increasing worldwide and attract growing interest for farmers, traders, economists, teachers, professionals, health officials and various industries. The MAPs are natural biological resources that have a great potential to synthesize a huge variety of important secondary metabolites, also referred to as natural products, far more than animals and even microorganisms [1] [2].

With its varied climatic zones, Morocco has a rich diversity of medicinal herbs. The Rif region harbors the Reserve of the Mediterranean Intercontinental Biosphere. It contains important ecological potential, reserves and parks with an important heritage of MAPs possessing a certain economic interest, plants currently operated by local people and those potentially exploitable and recoverable. Nevertheless, in the Rif region, operation of MAPs is often carried out in an individual way, archaic and traditional, mainly based on the collection of natural plants and their sale in the rough to collectors who are often strangers to the area, which may easily result in the exhaustion of plant genetic resources, biotope destruction and the loss of wild populations and thus also threatening valuable incomes for rural households. Consequently, the sustainable use of natural resources has become an unavoidable necessity from both environment protection and socio-economic points of view [3].

Plant tissue culture is an alternative method of commercial propagation and is being used widely for the commercial propagation of a large number of plant species, including many MAPs. Its techniques can be divided into three broad categories. The most common approach is to isolate organized meristems like shoot tips or axillary buds and induce them to grow into complete plants. This system of propagation is commonly referred to as micropropagation. In the second approach, adventitious shoots are initiated on leaf, root and stem

segments or on callus derived from those organs. The third system of propagation involves induction of somatic embryogenesis in cell and callus cultures [2].

The research topic is about the promotion and enhancement of four species of MAPs from *Thymus* genus, they are used worldwide as condiments, ornamentals and sources of many important compounds as flavones, rosmarinic acid, triterpenes, carbohydrates and especially essential oil that possesses numerous biological activities including insecticidal, antibacterial, antimycotic, antioxidative and food preservative properties [4]. However, the continuous human pressure, mainly due to local uses, is reducing and destroying populations, making this very rare species extremely threatened. Extinction risk of this species has led us to contribute to the *ex situ* conservation. The multiplication by *in vitro* culture, means micropropagation, is a very important methodology to obtain a great number of high-quality plants in a short period of time. Therefore, we try to establish a suitable *in vitro* propagation protocol for conservation, genotype selection and consistent clonal production of these species.

Keywords: Aromatic and medicinal plants, *Thymus* spp., *in vitro* culture, clonal production, micropropagation.

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Phosphogypsum treatment for use in the cement and ceramic industry

As the world population is constantly increasing, it has become increasingly necessary to increase planting areas and significantly improve the yield of agricultural production. To achieve these ends, in a globalized and highly competitive economy, it has become essential to resort more and more to fertilizers. The development of the fertilizer industry leads to the production of more and more phosphoric acid by treating natural phosphates with sulfuric acid [1].

The most used route for the production of phosphoric acid is that of the wet process using sulfuric acid, because the latter is the most economically viable and allows the valuation of different grades of phosphate. Nevertheless, this path generates enormous amounts of phosphogypsum of which only a very small part (5% at the international scale) finds an application in a valuation matrix.

The use of phosphogypsum is still interesting because the construction industry consumes quantities of natural gypsum in much the same range as the production of phosphoric acid residual gypsum. A decisive point from the point of view of the use of phosphogypsum is the knowledge of the types of impurities and their chemical composition, the study of their influence on the final products as well as the possibilities of their elimination.

The present work aims to identify suitable solutions to treat and improve the quality of phosphogypsum. To do this, we must eliminate all traces of organic matter and P2O5, in order to reuse it in different areas such as the

manufacture of ceramics (or the presence of organic matter gives rise to the problem of breaking the tiles) as well as in the cement industry (where the presence of P2O5 causes the problem of retardation).

We carried out tests at the laboratory scale, during which we tested a new technique of phosphogypsum treatment, it is the solid liquid extraction using an organic solvent. Thus, we compared this news with leaching by mineral solution. The results obtained show that this new technique has made it possible to improve the extraction efficiency of P2O5 and to eliminate the organic matter without changing the structure of the PG.

Keywords: Phosphogypsum, P2O5, organic matter, cement industry, ceramics.

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Valorization of industrial wastes, phosphogypsum and fly ash from a thermal power station, in building materials

The ceramics industry in particular traditional building materials is undergoing a major expansion in Morocco. An increasing demand results in the creation or expansion of several production units (cement, brick ...) throughout the country.

These materials, produced in large tonnages, are likely to contain some industrial waste capable of causing environmental problems. This confinement should have no negative impact on the performance of the material nor on users' health. Our goal is the proper use of this waste (produced several million tons annually) which is being disposed by discharging it into the sea, or by its burial nearby the place of production. The purpose of this work is the recycling of two different industrial wastes: the phosphogypsum (rejection of the production of phosphoric acid) and fly ash (residue thermal from power stations) by integrating them into the formulation of clay brick products. The advantage behind this process is that the microstructure of these products has a glassy phase that may confine some dangerous heavy metals radioactive sources. The products are characterized (XRD, porosimetry, mechanical strength ...) according to their content of additives, firing temperature...

The overall results are encouraging and allow us to offer the optimal settings for a beneficial substitution of clays by phosphogypsum and fly ash for the development of clay brick.

Keywords: Phosphogypsum, fly ash, waste management, valorization.

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Byproducts evaluation: phytochemical investigation and antioxidant activity of pomegranate peel extracts

The aim of the present study was to valorize pomegranate peel extracts. Different extracts of pomegranate peel were obtained by successive extraction with solvents of increasing polarity (Hexane, Chloroform, Acetone, Methanol, Water) using the Soxhlet apparatus, and were evaluated for their radical scavenging activity by DPPH method [1]. Qualitative and Quantitative phytochemical screenings were used to determine the phytochemical constituents in *Punica granatum* peel extract [2].

In our work, we found that methanol extracts possessed significant stronger radical scavenging activity compared to other extracts, the results indicated clearly that methanol extracts show high antioxidant activities. Preliminary phytochemical constituents of *Punica granatum* peels polar extract showed the presence of polyphenols [3].

Keywords: Peel, phytochemical screening, antioxidant activity, extracts, flavonoid, polyphenol, DDPH.

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SAR Radar Interferometry at Detection long ground movements in northern Morocco case of Chefchaouen

Ground movements or landslides are one of the most present and frequent natural hazards, affecting all regions of the world, causing enormous damage each year in terms of both human lives and material damage, hence the importance of the study of ground movements for the monitoring of the territory, the prediction and prevention of landslides, etc. This is a complex and dynamic process that requires continuous technological adjustments in order to obtain the most accurate and up-to-date information on natural events and their evolution.

This thesis focuses on remote sensing Radar SAR (Synthetic Aperture Radar), its potential as an additional monitoring technique and as an alternative method, at least in preliminary assessments of phenomena, to traditional ground-based monitoring systems. Among the different types of remote sensing techniques, one that meets the requirements of dynamic processes very well is SAR interferometry (InSAR). This branch of remote sensing uses active monitoring sensors that measure the backscattered radiation produced by the pulse from the sensor and directed towards the Earth's surface.

These systems use radar antennas capable of producing and receiving electromagnetic signals, in detail, modern satellites are equipped with synthetic aperture radar (SAR) sensors that provide good ground resolution.

SAR images are composed by the amplitude that depends on the reflectivity of the scene and the phase, among other things, is proportional to the bidirectional distance between the satellite and the ground.

InSAR is the method used to process SAR-generated images and is based on a combination of one or more satellite image pairs whose orbital parameters are all known [1]. The combination of two SAR images of the same scene acquired in different orbits, i.e. angles of incidence, produces an interferogram

that reflects the phase difference between the two acquisitions, which can be exploited in combination with the orbital information for each acquisition.

The objective of this work is to evaluate the applicability of satellite interferometry monitoring in northern Morocco precisely in the city of Chefchaouen which is an area characterized by structurally complex geological formations and slopes conducive to instability (landslides, mudslides, boulder falls, etc.) that give rise to slow to extremely slow deforming phenomena, hence the need for an interferometric study.

Keywords: landslides, SAR radar, remote sensing, interferometry, InSAR, SAR, interferogram.

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Study of water quality of some springs in the region of Tangier-Tetouan-Al Hoceima (Morocco)

In Morocco, groundwater constitutes an important part of the country's hydraulic heritage [1]. In rural areas of developing countries, the majority of inhabitants do not yet have access to drinking water or sanitation. They often use groundwater (wells, springs, boreholes) for various needs (drinking water supply, livestock, irrigation, etc.). The rural and urban world in Morocco still feeds mainly on groundwater (sources, wells, boreholes, ...) [2].

The spring waters of the groundwater in the Tangier-Tetouan region are known for their low piezometry and, consequently, for their easy uncontrolled exploitation. Indeed, the absence of drinking water supplies, in some rural areas or in some fragile categories of the population, pushes them to utilize spring water in all usages, including drinking, because these waters are for free. Besides, and with the dominance of traditions and customs related to the culture of the users, they are using spring waters even when treated drinking water is available. [3]

The consumption of water containing toxic chemicals leads to damages in the human body. The metals can accumulate in the human body and poses serious health risks to the people consuming. [4]

Our research aims at reviewing the presence of heavy metals in spring water and their possible health effects.

To achieve the goal of detecting heavy metals in different sources in northwestern Morocco, *Inductively coupled plasma* atomic *emission spectroscopy* (ICP-AES) will be used.

At the end of this study, the results obtained will be compared and modeled by the Principal Component Analysis method (PCA).

Keywords: Heavy metals, spring water, health, ICP-AES, PCA.

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Effect of geographical conditions (soil and climate) on the quality of olive oil in Morocco

Olive oil is a very important agricultural product of the Mediterranean region, especially Spain, Italy, Greece, Tunisia, Syria, Turkey and Morocco [1]. Virgin olive oil (VOO) plays an important role in the Moroccan agronomy and economy. With an area approximating 1.000.000 ha, the olive sector contributes about 5% in the composition of the Gross Domestic Product (GDP) [2].

Olive oil is a key component of the traditional Mediterranean diet, which is believed to be associated with a relatively long life in good health [1]. It is much appreciated for its nutritional value which is strongly related to the quality [3]. According to the International Olive Council's standard, the quality of olive oils is a set of physicochemical and organoleptic characteristics for the classification of oils in different categories [4]. This quality is influenced by several factors [5] related to the variety, climatic and cultural conditions as well as crushing conditions [6], which require a thorough study and mastery in order to achieve a good quality oil.

The chemical composition of VOO’s depends on pedo-climatic conditions, agronomic and cultural techniques, postharvest storage, oil extraction systems and VOO storage conditions [2].

In Morocco, over 90 percent of olive oil is produced from the “Picholine marocaine” cultivar. However, a great difference is shown among the composition of VOO’s produced in different regions [2].

For these reasons and in order to improve the olive sector in Morocco, we aim to study the quality of olive oils according to pedoclimatic variations.

The aim is to study the effect of pedoclimatic factors on the nutritional quality of olive oils. Soil samples from the study areas will be taken to conduct a soil

characterization study (Particle size fractionation, pH determination, conductivity, moisture, determination of organic matter, total limestone measurement, total nitrogen). To determine the quality of the olive oils, samples will be collected from the traditional oil mills. Physicochemical analyzes concerning free acidity, peroxide index, specific extinction coefficients K232, K270, specific extinction variation ΔK, chlorophyll content, phenol content and fatty acid composition will be realized. At the end of this study, soil analysis results as well as those of olive oils will be compared and modeled by the PCA (Principal Component Analysis).

Keywords: olive oil, nutritional quality, pedo-climate, PCA.

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Analysis and evaluation of the purification performances of a natural lagooning station

(Case of the sewage treatment system of the M'rirt city)

Over the past decade, the National Office of Electricity and Drinking Water (ONEE) has made liquid sanitation one of his strategic missions. Thus, a rigorous follow-up of the purification performances of this various station is necessary in order to identify their failures and dysfunctions. Indeed, the M'Rirt station located 3.5 km from downtown, has been operational since June 2003 thanks to the ONEE with a capacity of 31 000 people. The M'Rirt station was designed to treat 1800 m^3/d of wastewater and a BOD5 pollutant load of around 1200 kg/d (2010 horizon) in order to preserve the Tighza wadi and improve the health conditions of the population of the center [1]. This natural lagoon station consists of four anaerobic basins, four optional basins and six drying beds.

All the methods used for the analysis of the monitoring and control parameters are standardized according to Moroccan or international standards in force. The Suspended solids (SS) were determined by the gravimetric method (NM-03-7-052-1996). Biochemical oxygen demand (BOD5) was measured by OXITOP (NM 03-7-056-1997). The chemical oxygen demand (COD) was measured by the colorimetric method (MA 315-COD 1.0 CEAEQ Québec Standards Method, 5220D, 22nd Edition 2012) [2]. Nitrogen and total phosphorus were determined by the continuous flow colorimetric method (Skalar Methods Catmr 475-424).

Based on the results of the purification performance of the M'Rirt station during the 2013-2016 period for raw and untreated sewage, it can be concluded that: The M'Rirt station operated in hydraulic overload of up to 150% and in organic overload of 92%. The wastewater at the entrance of the M'Rirt station is charged (exceeding the prescribed value 1200 kg/d) and the effluent at the exit of the station is not compliant with Moroccan standards of domestic discharge for the three Physico-chemical parameters MES, DBO5 and COD. For physico-chemical parameters, the abatement results are very low (27% of BOD5). This is due to the hydraulic and organic overload and the algal proliferation knowing that the cleaning of the anaerobic basins was carried out in 2010. In view of this situation, the ONEE is currently carrying out a project to extend the station with a change of method from natural lagooning to aerated lagooning (completely aerated).

Keywords: Raw sewage, M'Rirt station, natural lagooning, aerated lagooning, purification performances.

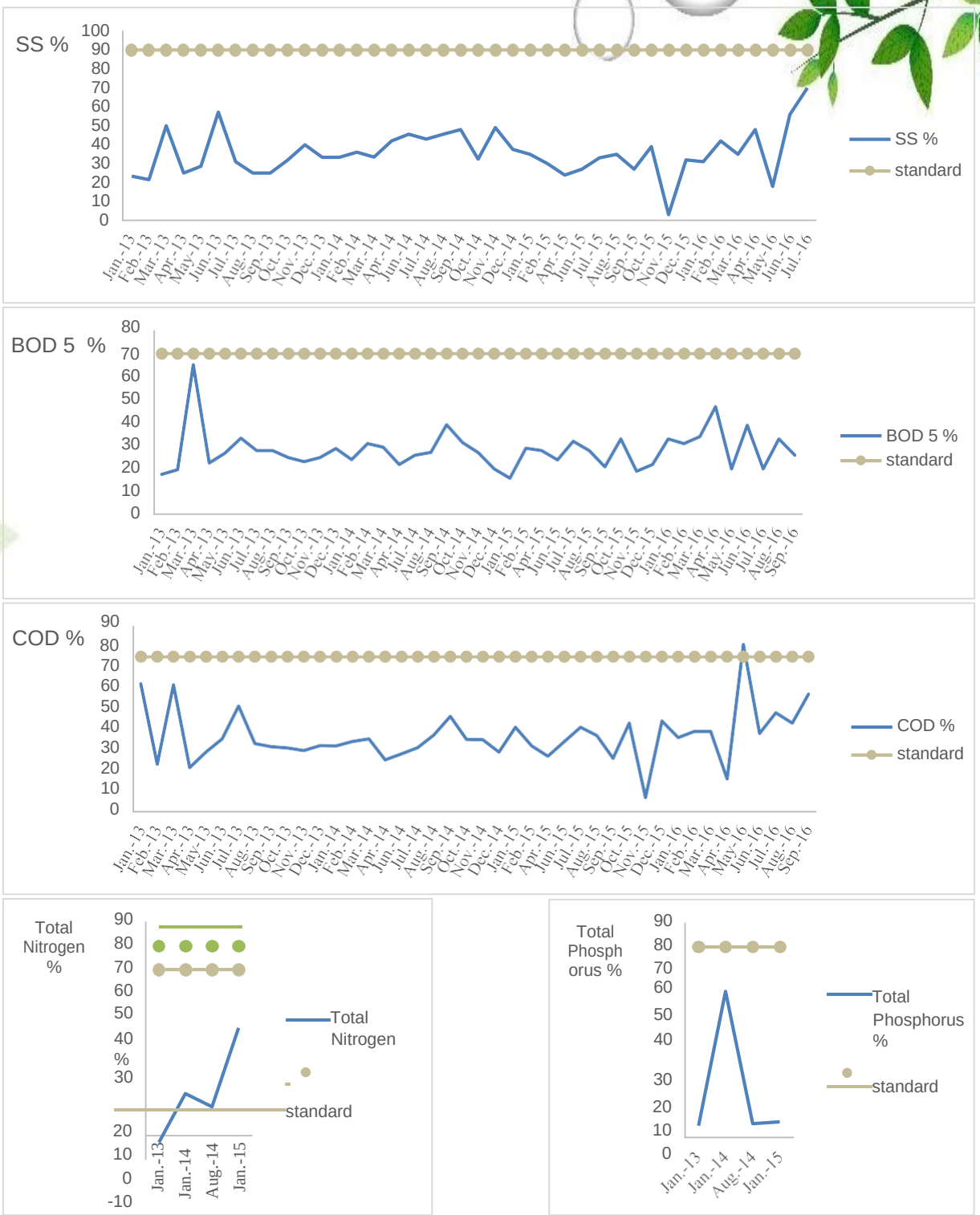

Figure 1. Abatements of the SS, BOD5, COD, total nitrogen and total phosphorus at the M'Rirt station

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Medicinal plants in front of the environmental stress

Medicinal plants have formed the basis of sophisticated systems of traditional medicines, according to their bioactive compounds which are at the origin of the secondary metabolites, in particular polyphenols. They have an important potential in the treatment of various diseases due to their different activities such as antimicrobial, anticancer, antiviral and antioxidant activities [1].

Nowadays, governmental climate changes, water availability and susceptibility to diseases may also impact the content and the composition of plants, thus the bioactivity, and the stability of bioactive compounds. Furthermore, the abiotic stress caused by drought and salinity can alter the metabolism, cellular functioning and the reduction of plants growth [2].

To contest these environmental constraints, we emphasize on a vital relationship between plants and microscopic fungi: mycorrhiza is called a green revolution characterized by the establishment of complex relationships between the roots of plants and fungi.

Currently, the demand for herbal medicines and several natural products from various plant species has been steadily increasing. To overcome the limitation of the largescale production and avoid the overexploitation of natural populations, it's necessary to promote an efficient *in vitro* propagation technique under controlled environmental conditions. This method seems to have many advantages, including the absence of seasonal constraints, the reliability and predictability of production, the efficient isolation of target compound and mostly to allow the application of biotechnology-based approaches for plant improvement and the production of valuable secondary metabolites [3]. Besides, the propagation of tissue culture was discovered more than 20 years ago, prior to the development of *in vitro* culture techniques with a greater emphasis on micropropagation [4].
Therefore, the main objective of this study is to search and identify a new bioactive molecule from a natural resource, which may serve as raw material for a pharmaceutical, food, agriculture and cosmetically industry.

Several studies have shown that certain aromatic and / or medicinal plants are more concentrated in active principle when they are mycorrhizal than when their roots do not mingle with fungi. This leads to the increasing use of mycorrhizal fungi for the cultivation of many medicinal plants. This would enable farmers to avoid pesticides, the residues of which are forbidden for this type of plant, and would favor their cultivation without inputs (products phytosanitary, fertilizer ...), thus avoiding a significant source of pollution [5].

In this study, we aim to highlight the ability of medicinal plant cells, tissues and organs to produce secondary metabolites and accumulate many other chemical compounds, *in vitro* culture, then the establishment of Mycorrhizal association with a medicinal plant cultivated *in vitro* under normal conditions and conditions of salt stress. Thereafter, looking for the impact of the symbiosis between plant and AMF on the resistance and the metabolism of the plant, we hope also to study the effect of salt stress on the production of secondary metabolites, of cells and tissue growing *in vitro* to detect the change attributed to production of secondary metabolites.

Keywords: Culture *in vitro*, medicinal plant, fungal mycorrhizal arbuscular, secondary metabolite, abiotic stress.

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Qualitative study by GIS and modelling of the Temara water table

Water is a key strategic issue and a key factor in sustainable development. In a context of climate change and water scarcity, it is important to know the water potential in terms of quantity and quality for the urban and rural domestic supply of a large megalopolis of tomorrow. This knowledge conditions future development, and is part of the research strategy, aimed at optimizing and mitigating environmental problems. To contribute to the sustainable water resources management policy that Morocco is following, we will proceed with the study of the Temara groundwater table. In this work, we study the characterization of the study area by climatological, topographical, geological, hydrogeological and pedological aspects, the monitoring of the evolution of groundwater recharge for the various existing water points and the elaboration of a vulnerability map. In this regard, we have called upon Geographic Information Systems (GIS) to establish the various thematic maps, statistical methods and Multicriteria Analysis (MCA) through the DRASTIC method.

Keywords: Climate change, environmental problems, Temara groundwater, GIS, Multicriteria Analysis, DRASTIC method.

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Effect of some medicinal plants on the corrosion behaviour of NiTi based orthodontic wires

Wires of nickel and titanium are the most used in orthodontics because of their mechanical properties. There are a lot of studies in the literature about corrosion behaviour of NiTi based orthodontic wires. Although, they have a corrosion resistance, it has been proven that in acidulated and fluoridated mediums these wires lose their passive layer [1].

The aim of our study is to assess the effect of some medicinal plants on the corrosion behaviour of NiTi based orthodontic wires in comparison with sodium fluoride.

In this study, we used a 17*25 inch NiTi and CuNiTi orthodontic wires. For electrochemical measurements, the following electrolytes were prepared: Ringer lactate artificial saliva with addition of 0.1%, 0.5% or 1% of sodium fluoride (NaF) and 20ul of Artemisia, Syzygium *aromaticum* and Celtis *australis* essential oils, hydrosols of *Syzygium aromaticum* and Artemisia, and extract of *Celtis australis*. The electrochemical experiments were performed with a potentiostat.

In solution containing 0.1% NaF, the material remains passive. From 0.5% and above, the current densities are higher. Impedance measurements confirm these results. For medicinal plants, negative values were related to solutions containing essential oils. Positive values have been observed in solutions containing hydrosols and the extract.

Our results have confirmed those founded by several previous studies. Fluoride decreases the corrosion resistance of NiTi based orthodontic wires. Essential oils decrease it too, but the most interesting solutions are those

containing hydrosols. It has been described that the composition of the essential oil and the hydrosol of the same plant are different and this could explain our results [2].

Keywords: Corrosion, electrochemical analysis, NiTi, CuNiTi, aromatic plants.

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Groundwater quality: a review of the evaluation methods

Water is, assuredly, one of the vital natural resources for all known forms of life especially groundwater as it represents the most important storage of freshwater that exists on the earth. Moreover, groundwater plays a crucial role in sustainable development which is manifested by providing water for domestic, agricultural and industrial uses and contributes to maintain ecological diversity [1]. However, the impact of some harmful activities whether natural or human may affect the quality of this resource [2]. Groundwater quality evaluation is necessary especially for regions which are groundwater dependent since this evaluation allows us to know which water is suitable for use and which one is requiring treatment [3, 4]. To do so, many methods have been developed to evaluate groundwater quality [5]. Thus, the core objective of this work is to give an overview of different methods that exist in the literature and to highlight their disadvantages and advantages in order to help decision makers and researchers to choose easily the adequate method for a given use case [6].

Keywords: Groundwater quality, sustainable development, evaluation methods.

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Study on the spread of Louisiana Red Crayfish (*Procambarus clarkii*) at the level of the GHARB area (northern Morocco) and its impact on agricultural products case of rice

Louisiana red crayfish (*Procambarus clarkia*) is from the North-east of Mexico and the Central South of the United States (Louisiana) [1]. It was introduced to several countries, generally for gastronomic reasons or repopulation of destroyed areas by a disease. Due to its fast proliferation and its incredible capacity of adaptation [2], the crawfish has become well spread in the world. However, this species has particularly got negative results on the local biodiversity [3].

This study was designed to study the spread of Louisiana red crayfish in the Gharb area and its impact on the rice fields. The introduction of Louisiana red crayfish in the area of Gharb, Morocco, is a few years old. The first observations date back in 2008 in the Sidi Allal Tazi town in irrigation canals, fields of culture and the Oued Sebou. Since then, Louisiana red crayfish took advantage of the presence of water to propagate to two ways. Oued Sebou streams have allowed a rapid propagation to South areas, on the one hand. On the other hand, Louisiana red crayfish followed irrigation channels to reach the rice fields. This propagation has continued in the area of the Gharb where many cases were seen during the year 2015-2016.

The presence of this species in the rice paddies has not passed unnoticed and the first consequences arrived early. The burrowing activities of Louisiana red crayfish are one of the main sources of the damage caused by this species. Indeed, the galleries excavated by the crayfish make lose irrigation water. In addition, the loss of cultivable area that continues to increase over time constitutes direct damages. Rice production has decreased since the appearance of this species in the rice fields. Rice farmers are forced to use pesticides to try to limit the impact of this species during the whole rice cultivation period and continue to maintain standards of rice production.

The water losses (65,215 m3 / ha) of irrigation that we evaluated during our study amount to 23,480 MAD / ha, corresponding to 2.16 € / ha because of one MAD = 0, 0919219 € (estimate of 31/08/16).
Rice losses, reported by rice growers, would be between 4224,000 and 4752,000 MAD / ha, i.e. between 388.28 and 436.52 € / ha.

Non-exploitation losses for recovery of the crayfish product, that is to say, the amount of crayfish present in the fields and that could be exploited but which is not, vary between 1505.00 and 3010. MAD 1,000 / ha is 138.34 and 276.68 € / ha.

In all, the losses (water losses + losses in rice production + non-exploitation losses for recovery of the crayfish product) caused by the Louisiana red crayfish in the Gharb zone would be between 528.78 and 715.36 € / ha.

These losses are consistent, and reflect the impact of the Louisiana crayfish in rice cultivation in the Gharb area. It should also be noted that this loss assessment does not take into account additional costs related to the purchase of pesticides. Compared to losses in other countries, these show that Louisiana Red Crayfish is destroying the rice crop in the study area.

Keywords: *Procambarus clarkii*, Gharb, rice growing, Sebou, damages, water, Morocco

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Contribution to the study of the agronomic and physiological behavior of Nour Clementine subjected to the partial root drying (PRD) irrigation

The irrigated perimeters of Lower Moulouya are among the most fertile plains of Morocco with an important value of agricultural production. Lower Moulouya is composed by 4 plains (Triffa, Zebra, Garet and Bouareg) having the irrigated perimeters with coming waters from the Mechraâ Homadi and Mohamed V dams, the latter its storage capacity is today only about 250 hm^3 (initial capacity 700 hm^3). These contributions do not fully cover their agricultural needs, additional pumping from the aquifers are also conducted. On 1122 Mm^3 / year of mobilized water in low Moulouya, 95% are consumed by agriculture. For example, about 4000 wells are recorded in the Triffa's plain water table (550 km^2 wide) [1]. As a result of drought and overexploitation, its level has dropped from 0.2 to 0.7 meters per year during recent years [2]. To remedy this situation of water scarcity, Moroccan government has implemented a policy of modernization of irrigated agriculture by the development of localized irrigation on a large scale through the National Irrigation Water Saving Program (NPEEI). This program consists of a massive conversion of surface and sprinkler irrigation to localized irrigation over an area of nearly 550,000 ha, thus for a period of 10 years; with an average equipment rate of nearly 55,000 ha / year [3]. This method of irrigation has a high degree of efficiency of water distribution and a water saving of 50 to 70% compared to the gravity irrigation and 30% compared to the sprinkling [4] and offers a possibility of use of the fertigation. This ultimately leads to an efficient use of water and fertilizers and a reduction in the vertical transfer of chemical inputs (nitrogen and pesticides) likely to induce groundwater pollution.

The purpose of this work is to contribute to the study of the improvement of water productivity by the partial root drying (PRD) irrigation strategy to Nour clementine of a pilot exploitation at the level of the Triffa's plain (Slimania). The deficit irrigation rate applied is 75% compared to normal irrigation, spread

over the entire irrigation period of the plot. The comparison focused on the variation of the soil water stock by means of Time Domain Reflectometer (TDR) probes which are installed at different horizons of the ground, drainage or capillary rise measured by tensiometers, transpiration by Sap Flow probes and meteorological parameters by a microclimatic station. In addition, the study includes the monitoring of physiological and agronomic parameters (rooting, juice acidity, maturity coefficient, fruit shape, fruit bark thickness, average yield (kg / tree), size, juice content, sugar content, average fruit weight (g), fruit color, Metal Trace Elements (Cd) and pesticides of two clementine lines in PRD and other trees on the farm in normal micro-irrigation.

Keywords: Deficit irrigation, partial root drying irrigation (PRD), water productivity, Triffa plain.

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Effect of Extraction method on composition and organoleptic properties of Bitter orange essential oil

Bitter Orange, Sour orange, Bigarade orange, refers to a Citrus tree (*Citrus aurantium*) and its fruit, belonging to Rutaceae family; It has been used for its essential oil, and is found in perfume, used as a flavoring or as a solvent.

Bitter orange essential oils were extracted from fresh fruits peel by two extraction methods; Hydrodistillation (HD) and Microwave-Assisted Hydrodistillation (MAHD). Qualitative and quantitative analyses were then carried out with Gas chromatography-Mass spectrometry to evaluate the peel essential oils composition. The major compound was D-limonene (42.60%) obtained by HD vs 85.77% obtained by MAHD; It appears that limonene is the chemotype of both *Citrus aurantium* oils.

Time and yield of extraction, organoleptic properties and refractive indexes of bitter orange oils were also evaluated during this comparative study.

Keywords: Bitter orange, *Citrus aurantium*, hydrodistillation, microwave-assisted hydrodistillation, Rutaceae family, essential oil extraction, gas chromatography-Mass Spectrometry

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Geomorphological mapping using sentinel-1 Radar SAR Imagery: A case of sidi Ifni inlier, Anti-Atlas Morocco

Today geomorphological mapping phenomena play an essential role in the prevention of natural hazards. It is a very powerful tool to identify and understand the role of tectonic and climatic control factors on the past, recent and future evolution of the topographic surface.

Satellite imagery is recognized as a powerful aid to geomorphological mapping.

It is in this perspective that the present work presents a contribution of the geographic information system (GIS) and sentinel-1 radar imagery to the geomorphological study of Ifni inlier.

This study aims to extract primary geomorphological indices such as: maximum slope, aspect and curvature as well as other indices as descriptors of the Morphology of the terrain.

Keywords: GIS, Synthetic Aperture Radar SAR, Geomorphology, Sentinel-1, Sidi Ifni.

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Effect of 3-indole butyric acid on the rooting of three strawberry plants cultivars (*Fortuna*, *Fragaria* and *San Andreas*)

Strawberries are currently among the most profitable fruit crops and are in great demand by the markets, especially European and American. Few countries have mastered their culture, especially for off-season productions that start in November and end in May, just before seasonal products come in from cold mountainous regions. To overcome this problem, plants production remains an effective solution. This production goes through several stages at the laboratory before arriving in the field.

The *in vitro* culture of strawberry plants allows obtaining from a small fragment of plant placed on a synthetic nutrient medium an infinity of identical healthy plants. In this context, the present work aims to study, *in vitro*, the effect of plant growth regulators on the rooting of three strawberry plants.

In vitro germination of Strawberry achenes is an obligatory step for the production of plants necessary for micropropagation [1]. The achenes of three cultivars "*Fortuna*", "*Fragaria*" and "*San Andreas*", scarified and sterilized by sulfuric acid H_2SO_4 (36N) for 5 min, showed a maximum germination capacity after a short passage on the agar medium based on mineral salts of Murashig and Skoog (MS, 1962).

For the apex multiplication phase, we used the Murashig and Skoog medium supplemented with different concentrations of plant growth regulators (1 mg/L of IBA, 0.5 mg/L of BA and 0.1 mg/L of AG_3) for mass production of Strawberry plants.

For the rooting phase, the best results were obtained on MS medium supplemented with different concentrations of IBA (0.5, 1, 2 or 3 mg/L). The necessary concentrations of IBA are different depending on the cultivar and after 5 weeks, the plants are developed at varying frequencies. The regenerated plants are easily acclimated to a previously sterilized peat-vermiculite substrate.

Keywords: *in vitro* culture, strawberry plant, germination, apex, propagation, *Fortuna*, *Fragaria*, *San Andreas*, growth regulators.

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Mineral analysis of the different components of the clove of mature carob tree (*ceratonia siliqua* L., Fabaceae, Caesalpiniaceae) and contribution to the study of its micropropagation

The carob (*ceratonia siliqua* L.) is a Caesalpiniaceae Fabaceae presenting a significant variability of biological form and floral type. In Morocco, except the most arid zones, it is present up to 1150 m of altitude.

The mineral content of the pod is very variable. Potassium is the majority, of 17 300 ppm for the embryo and 10 600 ppm for the pericarp. Calcium is well represented in the integument (6 958), the embryo (4 920 ppm) and the pericarp (3 060 ppm). The chlorine content is high in the pericarp (2 197 ppm) and the endosperm (1 267 ppm). Magnesium is concentrated in the embryo (3 997 ppm) and undetectable in the endosperm. Two micronutrients are in concentration not negligible in the fruit, the aluminum (91.5 ppm in the integument, 77.9 ppm in the pericarp and 61.3 ppm in the endosperm) and iron, localized primarily in the embryo (126 ppm) and the integument (118 ppm).

Several types of explants were used: apical buds or apex, cotyledonary buds, axillary buds, embryonic cotyledons immature, etc. The WPM macronutrients, followed by those of MS, are the most favorable to the initiation (induction) of the explants and have been added of the micronutrients and vitamins MS and of the BA to 2.22 µM. The auxins, including the AIB and the AIA in low concentration (0.5 µM), associated with the BA (2.22 µM), significantly improve the neoformation of stems during this initial phase. The phase of multiplication is optimal with the BA (to 2.22 and 4.44 µM). However, the combination of the BA (2.22 µM) to the AG3 (0.87 to 1.44 µM) gives shoots chlorophyllose more. The BA (0.44 µM) associated with the AIB (0.5 µM) allows an elongation of shoots satisfactory. The rooting of these last few (89%) was observed on the mid MS/2, supplemented with 10 µM of AIB. The acclimation on the peat at 100% relative humidity is 80 per cent of success.

The apex also gives directly 68% of shoots rooted on the middle of base (WPM macronutrients, micronutrients and vitamins MS) without phytohormones in the presence of an auxin (AIA, AIB, ANA or 2,4-D) at low dose (0.5 µM). These seedlings acclimatize easily (95%).

Among the cytokinins, the BA to 4.44 µM S is shown more favorable to the bud. Unlike the gibberellins, the addition of an auxin (AIA, AIB, ANA or 2,4-D) to 0.5 µM and the presence of the BA to 2.22 µM improve the organogenesis of the explants. The multiplication of shoots is permitted by the BA to 2.22 µM. A rooting of 90% is obtained with 10 µM of AIB. We are able to acclimate 65% of the seedlings in the same conditions as previously.

Keywords: Carob tree, *Ceratonia siliqua*, Fabaceae, pod, mineral composition, micropropagation, callus formation.

Acknowledgments: This research is undertaken in the framework of a Moroccan project PPR2 funded by MESRSFC and CNRST.

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Preservation of forest resources by somatic embryogenesis: case of Moroccan *Quercus suber* tree

Cork oak (*Quercus suber* L.) is a forest species belonging to the Fagaceae family. It is a tree that characterizes the Mediterranean ecosystem. *Quercus suber* L. plays important ecological, economic and social roles. It is extremely polymorphous, distributed in the western Mediterranean region, in the various European and African countries and territories.

In Morocco, cork oak occupies a total area of 377.000 ha. Moroccan cork oak forest represents 14% of the total global area. It is an ecosystem of great ecological importance allowing conservation of genetic resources and the protection of the environment (climate stabilization) nationally and globally.

Nevertheless, cork oak is declining in many parts of the Mediterranean basin and the species is considered endangered because of the absence of natural regeneration. In addition, vegetative propagation of this species by classical methods is not effective because it has several limitations.

Faced with these problems, new vegetative propagation techniques have been used to preserve this ecological heritage. *In vitro* culture techniques (organogenesis and somatic embryogenesis) are very effective tools that can help in the conservation of genetic resources and the improvement of species.

Somatic embryogenesis is considered as the best method of micropropagation that can solve problems of yield and intraclonal variability. It had several successes in forest species allowing the production of trees from somatic embryos.

Firstly, our study consists in inducing primary somatic embryogenesis from leaves obtained from epicormic shoots from branches collecting from *Quercus suber* L. trees.

Secondary, we tested the technique of secondary somatic embryogenesis. We have conducted experiments that aim to specifically test the influence of

different plant growth regulators on the induction of secondary somatic embryogenesis.

Finally, we were interested in studying the effect of growth regulators, embryos size and the period of cold storage on the germination of cork oak somatic embryos.

We noticed that the frequency of germination depends on the genotype and the plant growth regulator used. Germination of large somatic embryos (>12 mm and with large cotyledons) was successful. Stratification at 4°C for 2 months was the most efficient for stimulating somatic embryos germination of *Quercus suber* L.

Keywords: Cork oak, *Quercus suber* L., *Fagaceae*, secondary somatic embryogenesis, germination.

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The preservation by *in vitro* culture of two sylvan camomiles, *Cladanthus mixtus* (L.) Oberpr. and Vogt *Vogtia annua* (L.) Oberpr. and Sonboli

In the context of natural resource conservation and valorization of medicinal and aromatic plants in Morocco, we undertook the study of micropropagation of wild chamomile (*Cladanthus mixtus* L.) and blue chamomile (*Vogtia annua* L.). These two species were selected for their socio-economic and pharmaceutical interest.

We conducted an experimental study on the morphological characters of achenes of both species by weight measurements of fresh and dry matter and a biometric study. The achenes of both species proved to be very poor in water: *Cladanthus mixtus* L. (6.12 %) and *Vogtia annua* L. (10.52 %).

Similarly, we determined and compared the effect of medium mineral composition of achenes germination of both species. The distilled water with agar was adopted for *C. mixtus* for better and faster germination, and seed imbibitions of *Vogtia annua* for 15 hours in sterile distilled water containing 1% of gibberellic acid (GA3) and placement in the Gautheret medium [1] with agar had a positive effect on the duration and rate of germination.

We tried to improve the composition of mineral solution for the development of apex of both species. Cloning by *in vitro* culture of apex taken from 15-day seedlings after *in vitro* germination, allowed us to select three clones (A, B and C) of *C. mixtus*. The multiplication medium has been improved for the clones A and C. The macroelements, microelements and MS vitamins [2], 3% sucrose and 0.7% agar, were selected, as well as for explants *of Vogtia annua* Growth and rooting of axillary buds were higher in the presence of SD medium macronutrients [3] supplemented with MS microelements and vitamins [2], and Fe-EDTA without growth regulators. The composition of the mineral solution therefore has a significant influence on the growth of both species.

To study the influence of cytokinins on growth and development of *Vogtia annua* buds and two clones of *C. mixtus*, different cytokinins were tested at several concentrations. Kinetin (Kin) at 0.1 mg/L appeared to be the most favorable cytokinin for the development and organogenesis of explants of the two clones of *C. mixtus* in terms of number of buds as average shoot length. Regarding to buds of *Vogtia annua*, the SD medium (1980) control without cytokinin remained the most appropriate, since it generated a good multiplication of buds and 100% rooted plantlets of maximum size. The different tested cytokinins showed a negative effect on the development of buds of *Vogtia annua*.

We also studied the effect of auxins on axillary buds of both species. For both clones A and C of *Cladanthus mixtus*, NAA (0.1 mg/L) associated with Kin (0.1 mg/L) usually promoted explants multiplication, elongation and rooting development, especially during the phase of multiplication and rooting stage. Media control without auxin SD and SD + 0.1 mg/L IAA favored micropropagation of *Vogtia annua*, with a maximum number of leaves, an average number of shoots and higher average size of shoots, with a large percentage of rooting. IAA had an inhibitory effect at high concentrations on organogenesis and an exhibiting callus effect on shoots.

Finally, we tested the effect of three polyamines (putrescine, spermidine and spermine) on growth, sprouting, rooting and the hyperhydry of buds callus for clones A and C of *Cladanthus mixtus* and those of *Vogtia annua*. In the presence of these three polyamines with zero percent callus hyperhydrie, putrescine (0.1 mg/L) stimulated growth, budding and rooting explants of both clones of *Cladanthus mixtus*. For *Vogtia annua* buds, SD medium with low indicator of polyamines significantly promoted the growth and rooting of shoots followed by that supplemented with 0.1 mg/L of putrescine.

Keywords: *Cladanthus mixtus* (L.) Oberpr. & Vogt, *Vogtia annua* (L.) Oberpr. & Sonboli, tissu culture, cloning, plant growth regulatory.

Acknowledgments

This research is undertaken within the framework of a Moroccan project PPR2 funded by MESRSFC and CNRST.

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Study of the antibacterial and antioxidant activities of essential oils from North Morocco

Essential oils are investigated for their activities such as antibacterial, antifungal, antiviral and antioxidant activities. In this work, we investigated the antibacterial and antioxidant activities of essential oils of *Thymbra capitata, Mentha pulegium, Salvia officinalis, Eucalyptus globulus* and *Rosmarinus officinalis* from North Morocco. The antibacterial activity was studied by well diffusion technique and microtitration assay.

The effect of different medium pH and incubation temperature was investigated by the microtitration assay. The antioxidant activity was studied by DPPH technique.

The results of this study showed that essential oils have antibacterial and antioxidant activities. The antibacterial activity varied depending on medium pH and incubation temperature. *Thymbra capitata* essential oil had the highest antibacterial and antioxidant activity. In conclusion, essential oils exhibit different activities that vary depending on several parameters.

Keywords: Essential oils, antibacterial activity, antifungal activity.

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Study of essential oils antioxidant and antibacterial activities

Essential oils, extracted from aromatic and medicinal plants, have several activities allowing them to be used in medicine, perfumes and food preservation. The aim of this work was to study the antioxidant and antibacterial activities of *Origanum elongatum, Thymus wildnowii, Artemisia herba alba, Verbena triphylla l'Her* and *Lavandula angustifolia* essential oils.

DPPH technique was used to assess the antioxidant activity while well diffusion technique and microtitration assay were used to study essential oils antibacterial activity. Microtitration assay was used to evaluate the effect of different medium pH and incubation temperature on the antibacterial activity of the studied essential oils.

The results of this study showed that essential oils have antioxidant and antibacterial activities. The antibacterial activity varied depending on medium pH and incubation temperature.

In conclusion, essential oils have different antioxidant and antibacterial activities. These activities depend on the essential oil chemical composition and the studied strain.

Keywords: Essential oils, antifungal activity, antibacterial activity.

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Study of the fruit essential oil of fennel (*Foeniculum vulgare* Mill.) commercialized in Morocco

The fennel is an aromatic *Apiaceae* (= *Umbelliferae*) cultivated as a vegetable (bulbous fennel), a condiment (soft fennel) and for the production of its essential oil rich in (E)-anethole (bitter fennel), principle of anised beverages.

We carried out an experimental study on the morphological characteristics of 14 samples of fruits of cultivated fennels (bitter, sweet and bulbous) marketed in Morocco and of 3 samples of wild fennels collected in 3 areas (Errachidia, Ksar-el-Kebir and Ouezzane). The size and the weight of fruits facilitate certain distinction between bitter, sweet and bulbous fennels. Sweet fennel presents the longest and heaviest fruits (7.53 mm and 191 achenes per g of dry matter, sample A) followed by bulbous fennel (5.57 mm and 263 achenes per g of dry matter, sample K). Bitter fennel (cultivated, batch M and wild, sample L) presents smaller (respectively 3.51 and 3.41 mm length) and lighter fruits (respectively 456 and 524 achenes per g of dry matter).

In the same way, we determined and compared the essential oil composition of each batch. All compounds were detected by gas chromatography / mass spectrometry coupling. Thus, essential oil of the various batches contains 25 components (16 monoterpenes and 9 arylpropenes). We report the unusual presence of sabinene hydrate, p-butylanisole, elemicine and 2 isomers, methyleugenol and methyl-isoeugenol.

The 17 analysed batches were classified in 3 series.

The first one corresponds to the *vulgare* variety and contains five chemotypes:

-Chemotype (E)-anethole,
-Chemotype estragole,
-Chemotype estragole + (E)-anethole,
-Chemotype methyleugenol + elemicine,
-Chemotype methyleugenol + methyl-isoeugenol + elemicine.

The second series corresponds to the *dulce* variety and contains two chemotypes:

-Chemotype (E)-anethole,
-Chemotype estragole.

The third series corresponds to bulbous fennel (Chemotype (E)-anethole). Certain condiment fennels of the trade often contain little (E)-anethole and much estragole, which led us to propose a standardisation.

Keywords: Fennel, *Foeniculum vulgare*, *Apiaceae*, Essential Oil, Chemotype, Chemotaxonomy.

Smart City and Objects Conn

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Data security of smart cities

The smart city is a new concept of urban development. It is about improving the quality of life of city dwellers by making the city more adaptive and efficient, using new technologies that rely on an ecosystem of objects and services. The scope covering this new mode of city management includes: public infrastructures (buildings, street furniture, home automation, etc.), networks (water, electricity, gas, telecoms), transport (public transport, roads and smart cars, carpooling, so-called soft mobility - by bike, on foot, etc.), e-services and e-administrations. In recent years the concept of the smart city has become democratized, especially with the creation of several study groups and the establishment of more and more intelligent city in the world (New York, Paris, London ...). However, the emergence of the Internet of Things (IOT) continues to boost the development of smart cities, it also increases the need to address security issues. The purpose of this article is the description of the data exchange flows between each component of the smart city and the users, to identify the types of protocol of these exchanges and the associated IOT applications.

The safety of smart cities is partly based on IOT technology, and the other part on the protocols we present, and which can be grouped into two families:

- Common protocol: Bluetooth, Wi-Fi,
- Specialized protocol: X10 [1], Insteon [2], Zigbee [2], Z-Wave [2], BACnet [3], 6LoWPAN [4], WirelessHART [5], ISA100 [5].

In order to prevent intrusions, it will be necessary to understand their origin. The best way to do this is to ensure that every device connected to the Smart City's infrastructure, be it a car, a street lamp, or an earthquake detector, has a validated identity and is properly connected to the network.

Because, if a device is identifiable, it is much easier to confirm that the data it generates are authentic and that it is possible to trust them. In addition, this means that if the device tries to perform an action without permission, it can be identified, and its action can be prevented.

Each network necessarily has these security flaws and it does not fully protect against malicious actions. Even if the best security measures are taken, someone or something will eventually get introduced to it given the large number of vectors of attacks and threats that exist.

As such, effective risk management is key to assessing and responding to threats in any smart city. Controls and, more importantly, restoration plans must also be put in place not only to reduce the extent of the risk, but also to respond actively once a problem has been identified.

From all that precedes we can conclude that there are several possibilities for in place the security of data exchanges in a smart city. First option is the creation of a kind of general framework that can encompass all the electronic devices that the smart city can have, not to mention the option (which will be at the same time) to propose the establishment of a protocol general information technology between the different actors of the smart city.

Keywords: Smart City, IOT, security, cybersecurity.

Table 1: Different security technologies in the smart city with a comparison and scope in each component

Smart city component	Communication protocol
Smart Home	X10
Smart Building	Insteon
	Zigbee
	Z-Wave
	BACnet
	6LoWPAN
	WirelessHART
	ISA100
Smart Retail	NFC [6]: RFID standards including ISO/IEC 14443 ISO/IEC 18092
Smart Healthcare	WBAN or simply BAN [7]

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Optimization method using Big Data: State of art and perspectives

Nowadays, Social Media Data is becoming a major role in the feasibility of smart city, it gives valuable insight about the citizen behaviors that helps to take better and smart decisions to avoid any bad incidents. In fact, the real value of Big Data resides in the well analysis and exploitation of this huge amount of information [1]. To well analyze Data, there is two big fields of machine learning methods: the supervised and unsupervised methods.

The supervised methods are the area of study that focuses on computer systems that can learn data. This often-called model system that can learn to perform a specific task by analyzing many examples for a problem. There are different categories of supervised machine learning techniques for different types of problems. I quote classification and regression. The main difference between these two categories is that classification means to group the output into a class, and regression means to predict the output value [2]. Among the algorithms used in the supervised methods I mention:

- Decision Tree: a method of classification and regression whose popularity rests in its simplicity [3]. There are different algorithms for building trees from decision such as: Cart, ID3, C4.5 and C5.
- Support vector machine: is a classification method based on a space vector where the goal is to find a decision limit between two classes that are maximally away from any point in the training data [4]. There are two models of the svm: linear and nonlinear
- The neuron networks: is a method of classification inspired by the functioning of biological neurons, we distinguish between: monolayer neurons and multilayer neural networks [5].

The Unsupervised method is also a method of machine learning that aims to divide a heterogeneous group of data into subgroups in such a way that the data considered to be the most similar are associated within a homogeneous group and that, on the contrary, the data considered as different are found in another distinct groups [3]. One of the most important algorithm used in the unsupervised method is: Kmeans algorithm.

To find the most optimal result, it is essential to use an optimization algorithm. The optimization has two components: mathematical programming and combinatorial optimization [6].

- Mathematical programming: mathematical optimization is the selection of a better element from a set of available alternatives. In the simplest case, an optimization problem consists in maximizing or minimizing a real function by systematically choosing input values in an allowed set and calculating the value of the function [7].
- Combinatorial optimization: combinatorial optimization is a matter of finding an optimal object from a finite set of objects [8].

Given the importance of finding the most optimal results to create more effective smart cities, our study will focus on improving the optimization methods using social media data. Our prospects are to collect Data using Twitter Api to create models using the supervised machine learning methods and compare results to improve precession using a better optimization method.

Keywords: Big Data, Smart city, classification, regression, machine learning

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Fifth generation roads:

Smart and electricity generating roads.

The crossroads of different engineering fields, road infrastructures, crystallize many innovations in the fields of materials and structures, energy and information. The first four generations of roads (the mule track, the Roman road, the Mc Adam pavement, and the highway) have each greatly improved the service rendered to their users [1].

It is time to invent the next generation of road, which will be scalable, positive energy, cooperative and acceptable. For this purpose, we will introduce the road R5G (fifth generation road). Thanks to prefabricated concrete slabs, the road surface can support the heavy weight of traffic [2]. This road could even be energy producing, the road surface is composed of photovoltaic tiles with a thickness of 7 mm. This type of tiles has been studied to withstand the effects of weather and the passage of heavy vehicles, and thanks to the technology Wattway one kilometer of this type of road would allow to supply in street lighting a small city of 5 000 inhabitants [3]. In addition, the introduction of the new information and communication technologies in this road enables the diagnosis of the running surface using sensors installed in the surface of the road and the dynamic management of road traffic [4].

Keywords: The Mc Adam pavement, R5G, the technology Wattway.

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IoT system for detecting input/output of patients and staff via RFID technology

Since ancient time, we have been constantly trying to invent tools and techniques to facilitate life and to make every day practices easier. Among the technologies that have evolved the connectivity of the world, we can mention the Internet of Things (IoT) that uses all the things that can transmit or receive information by combining several technologies if needed. However, the diversity of technology causes the notion of Interoperability which is the ability to communicate different components of IoT. Among the technologies adopted by IoT, one finds the RFID identification [1] which can be used for identifying and monitoring of objects or persons, etc. It is composed of Tag, which is equipped with a chip connected to an antenna allowing it to transmit and receive information that can be read by a reader, and of a RFID reader which is equipped with an integrated or external antenna able to convert radio waves into data.

The internet of objects can be applicable in various domains to improve the quality of the offered services. Among the fertile domains requiring integration of the Internet of objects, there are Agriculture, Logistics and transportation, Industry and Health. In this regard, Venot et al. [2] identified and described a multiplicity of solutions dedicated to the field of health.

This work proposes a solution to two problems that impede the management of hospitals in Morocco. The first problem concerns the escape of patients from hospitals (or babies kidnapping, etc) without regularizing administrative situations or without the agreement of corresponding doctors, etc. While the second problem is related to management of staff, resolution of problems with a direct impact on the quality of staff's work and on administration of hospital. The proposed solution is a system called 'IoT-SDES2P' aimed at detecting the input / output of staff and patients using RFID technology while providing mechanisms for the validation of presence and management of information of staff and patients. This technology identify patients and employees in a fast and secure way with own identity and without human intervention. The patient or the employee wears the tag in form of a bracelet (for example).

When the tag passes in front of the reader, the identifier stored in the tag will be read and will transfer to an application in order to make others treatments. The system's operation is subdivided into two scenarios. The first scenario is related to staff. Upon the recruitment, a new employee takes a card with an identifier that will be entered with his personal and professional information; and the identifier will serve as his own reference. When putting a card to validate presence and entry's time by an employee, the reader detects the identifier and it will transfer it to a Java application for processing. The second scenario is related to patients. On the first arrival of a patient, the responsible reception officer enters the patient's personal information and assigns him a code associated with the delivered bracelet. The bracelet, with a unique tag, will be worn by the patient during his entire stay in the hospital. For any definitive departure or any temporary exit, the readers installed at the different exits of the hospital carry out the detection of the tags. Thereafter, the system verifies the patient's possession of the appropriate authorization for departure and the receptionist will finalize the administrative process so that the patient can go out in an official way. In opposite case, the system will trigger an alarm to signal the detection of an unauthorized exit of the concerned patient.

It's obvious that the world is becoming more and more connected, and a technology able to keep and evolve this concept corresponds to Internet of Things since it allows interconnecting the everyday objects to accelerate the process of accessing to information. It should be adopted and used in critical areas such as health to evolve working conditions and staff performance to save lives. The proposed system is a practical solution to solving some health field problems that still requires ideas to improve this critical area.

Keywords: Internet of Things, RFID, Ubiquitous Computing, Health.

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Air baggage traceability system based on RFID, mobile technology and NoSQL Database.

Radio Frequency Identification (RFID) is a form of Automatic Identification and Data Capture (AIDC) [1] that uses radio waves to automatically identify people or other objects [2]. This technology has recently seen growing interest from a wide range of industries such as retail, pharmaceutical and logistics [3]. RFID technology can be used to track objects in a manner similar to using barcode based systems and Optical Character Recognition (OCR) systems [1], but RFID also brings additional benefits. RFID technology does not require line of sight readings, can read multiple tags simultaneously, and store large amounts of data in addition to the ID of the object tracked [4].

The RFID systems basically consist of two or three elements: a tag/transponder and a reader for a Simplified RFID system, or a tag/transponder, a reader and a middleware deployed at a host computer. The RFID tag is a data carrier part of the RFID system which is placed on the objects to be uniquely identified. The RFID reader is a device that transmits and receives data through radio waves using the connected antennas. Its functions include powering the tag, and reading/writing data to the tag. As shown in Fig. 1, the signals sent by the reader‘s antennas form an interrogation zone made up of an electromagnetic field. When a tag enters this zone, it gets activated to exchange data with the reader [4]. Later, the identification data read by the RFID reader is processed by the software system, known as the RFID middleware. The RFID middleware manages readers, as well as filters and formats the RFID raw tag data so that they can be accessed by the various interested enterprise applications [5].

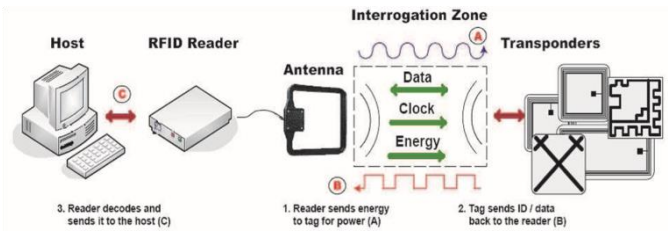

Fig. 1. RFID System Components [1]

In this work we present the realization of an application named BagTrac allowing travelers to follow their baggage from their smartphone, the interest

is obvious for those who are worried, rightly, the risk of loss, but it is also a tool for airlines to find lost luggage more easily.

The purpose of this embedded application is to collect information transmitted by an RFID reader, and send them to a database in real time to process and transmit them to an application installed in a mobile terminal, working with the Android operating system, to allow a tracking of the position of luggage at airports.

The architecture of the project is as follows: on the bag or suitcase is affixed an RFID tag; by using a wireless communication, the reader disposed on the path of the bag follows its position throughout their journey by sending the id of the tag retrieved to the Arduino board, the latter establishes a connection with the database via its USB port through a Java application, to store the location of the bag.

The mobile application communicates with the database to display to the user the location of his suitcase. The position is then collected, centralized in real time and transmitted to the corresponding user. [Fig.2].

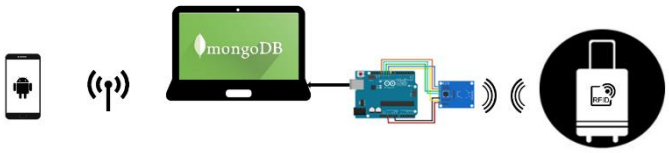

Fig. 2. Project architecture

Keywords: RFID, tag, middleware, reader, BagTrac.

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Parallel spatio-temporal Voronoï diagram based on a distributed architecture
- Application to hazardous materials transport risk –

The problems of calculating the short time-dependent path in smart cities are manifold and extremely delicate. Indeed, traffic conditions change dynamically from time to time. And to have a dynamic management of transport systems, it is necessary to find the shortest paths on a large map (for example, a road network) where the weights (delays, consumption, congestion ...) associated with the borders change. Highlighted, the transport delay of hazardous materials increases the risk margin of road accidents and incidents in the space network, which causes multiple damages in human, material, economic, environment, etc. Indeed, road accidents caused by these transports of hazardous materials in complicated urban spaces and overloaded by a large traffic can create disruptions and consequently disasters and incalculable and invaluable damages.

Our contribution is to compute Voronoï spatio-temporal parallel diagrams based on a distributed architecture with the algorithm A* which makes it possible to find the optimal shortest time path and to implement it via ALT, in order to optimize the travel time from one node to another. On the other hand, the DSTV calculation allows vehicles carrying dangerous goods to travel safe and short paths in an urban environment while keeping a minimal Euclidean distance from vulnerable sites. Indeed, a shorter path depending on the time can be defined as follows:

Let s and d be two distinct privileged vertices of a graph, called source and destination respectively. The problem of the shortest time-dependent path $(TDSP)$ is then to find a minimal cost path between the source and the destination satisfying certain resource constraints in terms of time [1]. According to the definition of Okabe et al., [2] a Voronoi network diagram (DVR) is defined by the division of the Voronoi network, that is to say a set of trees of the shortest paths (classic). Each one of them contains the points the closest to each Voronoi generator by traversing the shortest path between these components. Mabrouk and Boulmakoul [3] find that if the network analyzed is a real spatial network (road network, transport network, etc ...), this diagram is called the Voronoï Spatial Network Diagram $(DVRspatial)$.

$$Vor(i) = \{ \forall\, p \in P \,/\, Pp_{cc}(gi,p) \leq Pp_{cc}(gj,p),\, 1 \leq \forall j \leq n, i \neq j \}$$

In fact, the spatio-temporal Voronoi diagram is used to calculate the spatial accessibility of Voronoi to a set of places of interest as a function of time. It determines the Voronoi generators (emergency services, hospitals, ...) closest

to each set of nodes in the space network, giving the distance (or access time to the destination) and the path most short between these spatial components as a function of time. Indeed, solving the problem of the shortest path depends on the TDSP [4, 5], we discuss a type of algorithm considered capable, reliable and effective to answer these challenges; it is the algorithm A* [6] which allows to estimate the distance that separates the node departure (the Voronoi generator) from the arrival node passing through arcs whose cost of the arcs can be in terms of distance, time, fuel consumption ...

Then, the spatial network is partitioned using a method based on the distributed calculation of the Euclidean distance to facilitate parallel processing where "distributed" spatial network data is represented as a set of resilient distributed spatial data (spatial RDD). The next step is to generate trees of the shortest paths depending on the time since partitioning in order to perform the distributed calculation of $APCC$ depending on time. Spatial data is divided into ng parts. That said, they will be under the treatment of n_g executors. In parallel, at the level of each partition j, the calculation process follows the algorithm A* to search for the nodes closest to the root g_j of the tree Sub_Netj as a function of the weights of the paths traveled. Later, we update the vertex and vertex assignments of the generators. However, the shortest time-dependent $ACCDT\,(g_i)$ trees rooted at $g\,(i,i) = 1 \ldots, n_g$are computed in parallel and independently in which each $ACCDT\,(g_i)$ comprises all the reference points, constituting a graph where each vertex includes the information on the weight of the shortest path to reach the root g_i.

The proposed calculation process is based on a distributed architecture. It calculates Voronoi spatio-temporal diagrams by processing partial and parallel spatial data to minimize the risks associated with transporting hazardous materials. In such a way that the longer the transport of dangerous goods increases, the greater the risk of disasters, something that generates the importance of searching for the shortest time-dependent paths and calculating spatio-temporal diagrams.

Keywords: Smart cities, Voronoï diagram, Spatio-temporal Voronoï graph, risk of transport of hazardous materials, algorithm A*.

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Active Vibration Control of plate with Piezocomposite materials

Aerodynamic properties and aeroelastic responses of plate can be improved via active shape control using piezoelectric actuators. In this work, a type of piezocomposite material called macro-fiber composite is used for actuation to achieve shape control of the plate [1]. This study focuses on the vibration suppression of the plate during dynamic motion in open-loop architecture. The aeroelastic model is established using the optimal control LQG accompanied by the Kalman filter [2] [3].

Keywords: Shape control, piezocomposite actuators, MFC, vibration suppression, LQG, Kalman filter.

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Technological innovation at the service of the Environment

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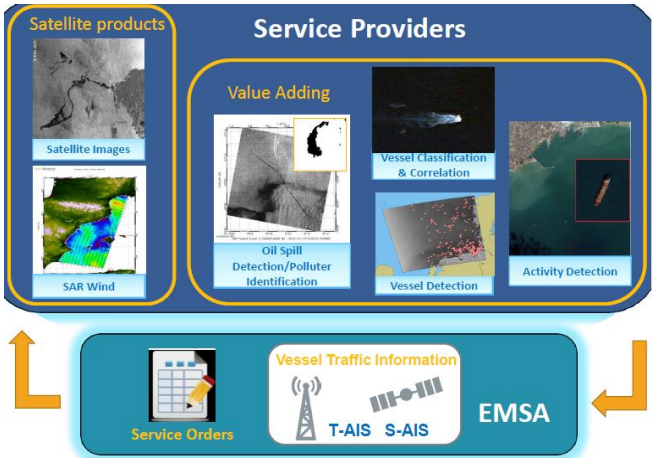
CleanSeaNet, satellite monitoring service of the marine environment against pollution

The CleanSeaNet service (CSN) is one of the services provided by the European Maritime Safety Agency (EMSA). Its purpose is the protection of the marine environment by monitoring and detecting oil spills. It is set up to support the actions of the member States of the European Union and partner countries bordering the Mediterranean Sea, the Black Sea and the Caspian Sea, within the agenda of the European Neighborhood Policy.

In fact, this service is a regular picture taking by powerful satellite radars, day and night, by cloudy or clear sky and with global coverage. The data from these satellites are managed into images and analyzed to find oil spills on the sea surface and to monitor accidental pollution in emergencies, and also to help to identify potential polluters.

CleanSeaNet service consists of three main components [1] [2]:

1. Polar-orbiting satellites
2. Service Providers
3. EMSA: Procurement, contract management, ordering, database management, quality control, operational monitoring



In near real time, the analyzed satellite images are made available in SafeSeaNet Ecosystem Graphical User Interface (SEG) and also sent by email as a CleanSeaNet Alert report to the national contact points in each country including or will be affected by the polluted maritime area. In order to be able to product these Alert Reports for users of the CSN service, the satellite image data are compared and correlated with:

- The additional data on maritime traffic available in EMSA (SafeSeaNet /AIS, SAT- AIS, LRIT);

- The data regarding the elements of the area affected by the oil spill (winds, algae, sandbank, etc.).

The time between the acquisition of the satellite images and the issue of the final CSN Alert Report to users is 30 minutes for radar data and 60 minutes for optical data (in the case of optical images). This period has been reduced to a minimum in order to acquire an effective and rapid response from the competent authorities of the States whose coasts are alarmed.

This will lead to an immediate deployment of the necessary resources of investigation (sending an airplane, a ship ...). So, if a potential spill is detected, it is extremely important that coastal state administrations are immediately alerted, which increases the likelihood of catching a polluter pollutant. As a result, the near-real-time service capabilities of CleanSeaNet are very important for a fast response by the coastal states. This speed of reaction is in fact a decisive factor in succeeding the objectives of the CSN service.

The Kingdom of Morocco is one of several users of the CSN service as well as many services provided by EMSA. Currently, this service is done without any specific legal reference. The only law project text still in process of adoption.
This legal reference (after adoption) must clearly define the sentences imposed on polluters and the penalties to be paid according to the global principle of polluters-pays. Also, according to this text, the Moroccan authorities, especially the Moroccan Royal Navy, will intercede in the different maritime domains to seize the polluting ships and heading them to a national port so the departments responsible for the marine environment and the sea resources will start litigation in court to order penalties and fines. It must also define which Moroccan courts will be competent regarding the areas where the infractions (pollutions) are done.

Keywords: Protection, marine, Safety, satellite, spill, pollution, polluters, fines…

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SERS investigation of polythiophene/electrode interface

Surface enhanced Raman scattering (SERS) has been proved to be a powerful technique to provide high quality spectra even at very low surface coverage [1] [2]. Indeed, it has been shown that some metals, like silver, copper and gold, under appropriate roughening treatments, can produce a huge enhancement of the Raman intensity for molecules adsorbed onto their surface [3] [4].

The two mechanisms commonly considered to account for SERS are connected either to a molecular enhancement of the molecule polarizability due to its adsorption onto the metal surface or to an intensification of the electromagnetic field induced by the resonance of the surface plasmons.

In the case of polythiophene, the use of suitably roughened electrode plates like silver, copper or gold as working electrodes for the electrosynthesis of thin polymeric films, allows to obtain not only selective structural insights into the inner polymer layers, but also a fine analysis of the polymer/electrode interface. Indeed, the defect bands exhibit a significant SERS effect when the doping yield is increased, indicating that the structural defects are close to the SERS-active surface or even act as anchorage points of the polymer to the metallic support. Moreover, according to the SERS selection rules, the strong enhancement of the C-C ring stretching mode suggests that the polymer rings make a significant angle with the electrode surface.

Keywords: Surface enhanced raman scattering, polythiophene, electrosynthesis, silver, copper, gold.

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Remote Sensing and Geospatial tools for land cover /land use in the Saiss plain, Morocco

The Saiss plain is one of the very important zones for the agricultural practice in Morocco, with a significant amount of water. Obviously, these resources have experienced degradation in the last years, with population growth, the development of the industrial activity in and the overexploitation in the agriculture. The main objective of this work was to study Land use changes in the Saiss plain by the use of geospatial tools and remote sensing technique. For this we used four Landsat TM (Tematic Mapper) images and one Landsat OLI (Operational Land Imager) Image acquired between 1884 and 2017 respectively. The results showed a decline in the vegetation cover by 83.97%, the bare soil surface decreased by 81.5%, and water surface has increased by 86.16% in the same period. On the other hand, the region experienced an enormous expansion of urban areas; the surface of the two big cities (Fez-Meknes) was increased almost three times, with the urban population growth and the immigration towards these two cities. We suggest that our results may provide valuable information, which could be useful for management and planning guide for urban areas and agriculture in Saiss plain.

Keywords: Saiss plain, remote sensing, geospatial tools, urbain areas.

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Evaluation of the pesticides use in Meknes Region, Morocco

The inappropriate use of pesticides affects the entire functioning of the ecosystem, Indeed, the absence of data on the use of pesticides in the province of Meknes led us to conduct surveys of farmers. The objective of our study is to present an overview on the use of pesticides in the province of Meknes (Morocco). The Investigations in the province show that the majority of farmers practice arboriculture, cereals and legumes, the remainder is partitioned between market gardening and olive growing. Most of these crops are grown in the field. Herbicides are the most frequently used pesticides, with 57.74% of the products used, followed by fungicide with 27.03%, and insecticides with 13.91% of the total pesticides used. Organophosphorus pesticides have a percentage of 17%, followed by the bipyridia family with 15%, and 12% represented by the pyrethroids. Glyphosate is the most widely used herbicide, ranking first with 15.22%, followed successively by paraquat (14.96%) and copper metal-copper sulphate (13.65%). The investigations revealed mismanagement of pesticides, the ninety farmers questioned treated unprotected, applied overdoses and lived adjacent to the treated plots.

Keywords: Pesticides, glyphosate, paraquat, investigation, Meknes region.

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Environmental risk assessment and spatiotemporal variability of atmospheric Volatile Organic Compounds and Nitrogen Dioxide using passive sampler in Meknes City (Morocco)

Epidemiological evidence links nitrogen dioxide and volatile organic compounds (VOC) trends to a wide range of health effects. In this context, a key issue is the ability of the monitoring to serve as an indicator of personal exposure to these atmospheric pollutants. In Morocco, only few regions have air quality monitoring stations. In Meknes, where no air quality monitoring station exists, the use of diffusive sampling tubes for monitoring and mapping of air quality is relevant.

The purpose of this study was to evaluate the air quality in Meknes by measuring levels of VOC and NO_2 in relation with road traffic during summer 2014 and winter 2015. Thus, passive diffusion tubes were deployed in 16 near-road and residential sites for 14 to 30 days to measure BTX and NO_2. In parallel to the winter campaign, road traffic counting sessions were conducted at the main roads of the city. Collected samples were analyzed and pollutants concentrations were determined using spectrophotometry and gas chromatography techniques. Our study results show that the average concentrations of BTX and NO_2 are highest in the city center, from where we noticed a decreasing gradient of pollutant levels. No season impact was noticed. The average concentration of benzene in Meknes during the two measurement campaigns is equal to 2.065 µg/m^3 which exceeds the quality objective set by the European Union (2 µg/m^3) but still lower than the annual limit value set in Morocco (10 µg/m^3). Concerning the average of NO_2 concentration in all sites and measurement campaigns, it is approximately 30.652 µg/m^3, which is lower than the admissible limit value set by the European Union (40 µg/m^3) . Sites with high levels of benzene have also shown high levels of nitrogen dioxide (R^2= 0.8714). VOC and NO_2 present in the atmosphere of our study area are mainly generated by

road traffic. This study shows that population is exposed to atmospheric pollutants which may lead to emerging health effects. Our results also invite to examine the various lines of setted limit values in different countries and to assess the collective evidence.

Keywords: Passive sampler, air quality, BTX, NO_2, Meknes.

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Technological innovation and environmental responsibility of automotive subcontracting companies based in Morocco

Technological innovation and environmental responsibility (concept associated with CSR: corporate social responsibility) make an essential and indissociable set by companies producing high technology products: like the automobile and its components. Automotive subcontractors are companies that design, produce and deliver component modules and systems to vehicle manufacturers as original equipment manufacturers (intelligent subcontractors). New technologies, called "environmental technologies" are also adapted for these companies. There is some work on the integration of an eco-technological innovation analysis model within a company [1]. Environmental technology covers both integrated techniques that avoid the formation of pollutants during production processes, and end-of-pipe technologies that reduce the release into the environment of any polluting substance generated. It can also include new materials, energy and resource efficient manufacturing processes, ecological know-how and new working methods [2]. Automotive suppliers located in Morocco occupy a key position regarding the possibilities of building an environmentally responsible automobile industry through technological innovation. Their economic weight (workforce, turnover, number and location of their production sites, upstream management of the sector) and their technological skills (mastering key technologies for progress in environmental and road safety) have a major place in the industry [3] [4].

In this observational study, we try to find answers to the following question: How can technological innovation serving the environment bring a competitive advantage to automotive subcontracting companies based in Morocco?

Keywords: technological innovation, environmental responsibility, automotive subcontractors, competitive advantage, Morocco.

Table 1. Release and transfer amounts of PRTR-listed chemicals (kg) (Source: CSR Report 2017-YAZAKI Group)

Substance	Amount handed	Amount released					Amount transfered			Total
		Aire	Water Zone	Soil	Landfill	Release Total	Sewer	Waste	Transfer total	
1,2,4-trimethylbenzene	4,318	2,560	0	0	0	2,560	0	1,710	1,710	4,270
Antimony and antimony compound	15,451	0	0	0	0	0	0	0	0	0
Xylene	3,820	2,800	0	0	0	2,800	0	130	130	2,930
Toluene	4,967	3,090	0	0	0	3,090	0	790	790	3,880
Nickel	3,060	0	0	0	0	0	0	0	0	0
Nickel compounds	3,428	0	0	0	0	0	0	440	440	440
Bis (1-methyl-1-phenylethyl) peroxide	2,297	0	0	0	0	0	0	0	0	0
Bis (2-ethylhexyl) phthalate	5, 117,742	0	0	0	0	0	0	0	0	0
Lead	7,525	0	0	0	0	0	0	0	0	0
Total	5,162,608	8,450	0	0	0	8,450	0	3,070	3,070	11,520

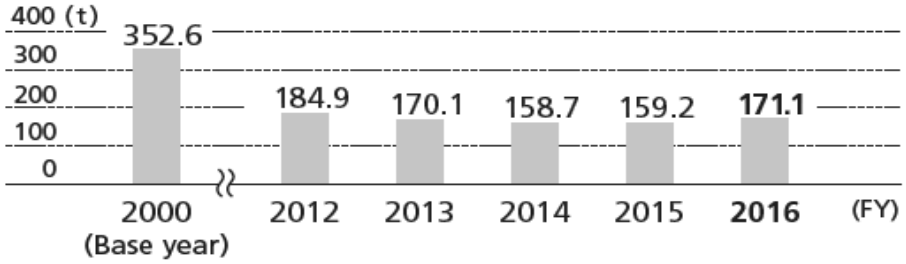

Figure 1: Reducing Volatile Organic Compounds (VOC) emission (Source: CSR Report 2017-YAZAKI Group)

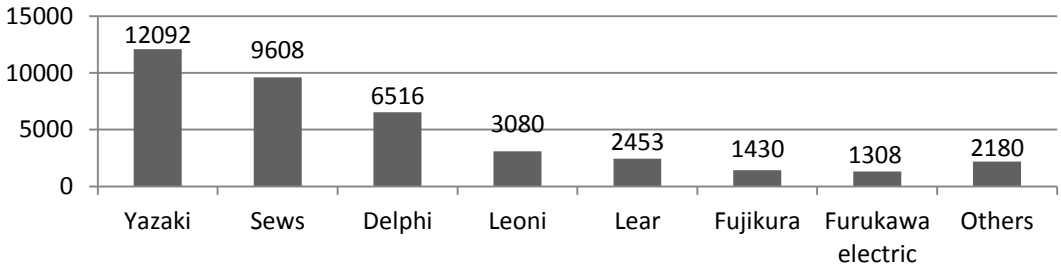

Figure 2: Sales performance of Yazaki Morocco (2014)-Millions $ (Source: Yazaki Morocco)

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The adoption of an information system "ERP" eco-responsible "green IS"

In the middle of these new economic and managerial ways of thinking, the adoption of environmental innovations, usually indicated by evocable of Eco-innovations, seems to be the way privileged toward a more in this new field of investigation, the information system seems to be able to play a particular part.

The policy Green IS that aims, in a vision by the risk, to reduce the ecological, economic and social print of computer equipment throughout their cycle life cycle and in a vision by opportunity, to contribute to the strategy of sustainable development of a company, is one of the pillars of this new governance.

Information systems (IF) must answer to new challenges caused by the requirement of eco-responsibility consequently, the problems to which we consider to answer in this article relates to the evaluation of SO “in particular the ERP” from the point of view of sustainable development. More precisely, we want to know, which add an impact of the adoption of an optimal information system ‘ERP’ on the sustainable development. In addition, up to what point the organizations, public or private, integrate the principle and criteria of sustainable development into their process of adoption of SO, and consequently, to analyze if their information system is in conformity with the new challenges included by the emergence of sustainable development.

Confronted with the challenges of sustainable development, public and private organizations must imply itself in eco-responsible approach. There is the need for setting up a performing IS at the social and environmental economic plan. But the contribution of IS to sustainable public management can do a several regards, in particular the ERP make it possible to improve the productivity, the effectiveness and to transform the process trade. In addition, it can contribute to the dematerialization of the company, in particular, the development of administration electronic (E-administration) and participative

democracy (E-democracy) take part in the improvement and modernization of the public services (e.g. dematerialization of tenders) and contributes to the bringing together between local citizens instances. The expected benefit of the introduction of E-administration is in particular “user satisfaction”, “the acceleration and improvement of the decisional process concerning the public policies”, “simplification of the administrative formalities”, ”reduce the problems of physical displacement as well as time of request” or ”more personalization of the public’s services offered of the citizens” [1].

In the public or private organizations, it acts to integrate, with the total performance, the invoice and the energy implications of the DSI i.e. their equipment, of their software and their key process. Concerning equipment (hardware), it seems certainly relevant to privilege equipment and equipment “low consumption” and “which can be recycled” but also to reconsider overall the device while benefitting from offer (software as service) and by pooling the data, the applications and the accesses within “data center” green and secure (such of old nucle are sites reconverted in Germany or Google container dated center turn). Obviously concerning, the software it acts by way of optimizing the couple performance/consumption (via solutions type carbon management software) and to minimize the external costs (zero-paper/dematerialization, zero-displacement/videoconference…) by targeting in priority the energy wasters activities like the function sourcing-purchase-sale, logistics, the production, but also the management of the buildings and the workflows. Concerning the practices, the transformations, progress relate to the division of the data and the applications least energy consumption and we saw it the rise to power of the sourced solutions (SaaS, cloud computing…). In the fact, the directions of the information systems (DSI) appear in the center of the piloting of the concerns and their own reception of “Green technologies” quickly evolved besides? The DSI also appear in the same investigation as an effective lever of action of Green IT provided they are implied [2].

This work brings an overall picture on sustainable development in relation to the information system “ERP”.

Keywords: Green IS, green ERP, environment, sustainable development.

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Ligandless Cloud Point Extraction and determination of lead (Pb^{2+}) in plant *Atriplex nummularia* growing in and around mining area in south eastern of Morocco

Ligandless Cloud point extraction (CPE) procedure is useful technique for determination of trace amounts of metals ions [1]. It has been developed and applied to miscellaneous materials such as water, pharmaceutical samples… [2] In this study, we propose the determination of lead (Pb^{2+}) in plant *Atriplex nummularia* growing in and around mining area in southeastern of Morocco. The technique involves use of Tween 80 as surfactant, and flame atomic absorption spectroscopy FAAS [3]. Sample preparation modes prior CPE were also investigated and calcination procedure was found to be the most efficient.

Keywords: Ligandless Cloud Point Extraction, Pb^{2+}, Tween 80, *Atriplex nummularia*, FAAS.

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Preparation, modeling and study of the adsorption of lead ion from aqueous solutions by Moroccan stevensite

The aim of this study was to the preparation of the clay fraction <2um of a stevensite from the Kssabi region and removal of lead ion from aqueous solution by adsorption in order to protect the environment and preserve the water quality. The Experiments were carried out to optimize various experimental parameters such as: initial lead concentration, pH, temperature, contact time and mass of the adsorbent. The influence of pH on lead adsorption has been studied in the pH range of 2 to 7. The optimal pH is about 4 and the high temperature was the best fit. The experimental data are well represented by the Langmuir model while the Kinetic analyses showed that the adsorption rates were more accurately represented by a pseudo second-order model. All adsorption processes reached equilibrium in 10min. In addition, various thermodynamic parameters, such as Gibbs free energy (ΔG), enthalpy (ΔH) and entropy (ΔS) were calculated. The adsorption process was found to be a spontaneous and endothermic process.

Keywords: Stevensite, Adsorption, Isotherm, Kinetic, Lead, Water Quality, Thermodynamic study, Modeling

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Effect of the use of purified water on the durability of ordinary and self-compacting concretes

The aim of this work is, first of all, to upgrade the treated wastewater of the Er-Rachidia station in order to reduce the overexploitation of groundwater and the cost of using drinking water in concrete. Secondly, is to improve the technical quality and the durability of concretes exposed to external sulfate attack. For this purpose and in order to evaluate the effect of purified water on the durability of concrete, a comparative study was made between ordinary and self-compacting concrete manufactured in one hand with drinking water and in the other hand with purified water. Each concrete has undergone three different protocols of external sulfate attack namely total immersion, immersion-drying at 60°C and immersion-drying at 105°C. These samples were stored, for three months, in three different environments (tap water, seawater, and 5% solution of pure sulfuric acid (H_2SO_4)). Finally, the concrete specimens were subjected to strength tests, splitting tension and dimensional variation.

Keywords: Treated wastewater, concrete, durability, external sulfate attack, strength tests.

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Reaction between α-Amino compounds and trans-β-Pheynylglycidic Esters. DFT Investigation

Reaction between trans-β-phenylglycidic esters and α-amino compounds are important process on the route to β-amino-α-hydroxy esters, which in turn serves as an intermediate in the synthesis of Paclitaxel (Figure). The latter is considered a chemotherapy drug that is commonly used to treat ovarian, breast and non-small cell lung cancer [1] [2] [3].

In the present work, our attention was devoted to a discussion of reaction between trans-β-phenylglycidic esters and α-amino compounds by using the density functional theory on the B3LYP /6-311G (d, p) level applying the Gaussian 09 program. Indeed, we have calculated in each case the following chemical global quantities: the molecular energies, the HOMO and LUMO energies, the electronic chemical potential, the hardness and softness as well as the electrophilic and the nucleophilic character. By the same method we determined the electrophilic and nucleophilic Parr functions and the local electrophilicity and nucleophilicity index. This calculation could be an important basis for an experimenter who can expand the range of reactive entities leading to the formation of taxol.

Keywords: DFT, Taxol, chemotherapy, molecular energies, electrophilicity index, nucleophilicity index, Parr functions.

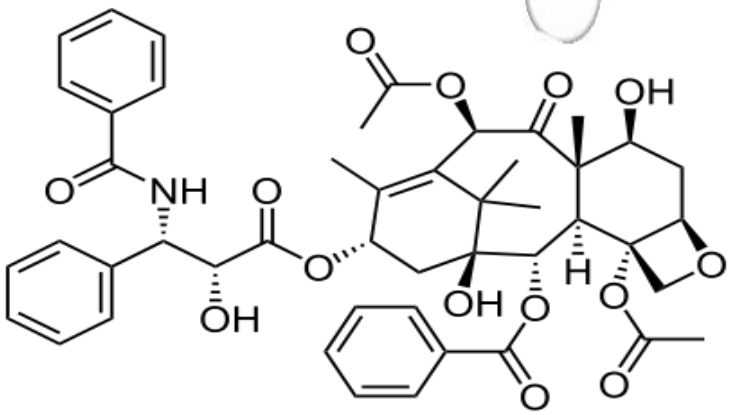

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Figure: Taxol structure

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Experimental and theoretical analysis of the reactivity and regioselectivity in esterification reactions of diterpenes (totaradiol, totaratriol, hinikione and totarolone)

Six esters have been synthesized in the acetylation, benzoylation and B.V oxydation of starting materials totaradiol 1, totaratriol 2, hinikione 7 and totarolone 8. A complete theoretical study of the reaction has been carried out including highly regioselectivity induction experiments and using density functional methods (B3LYP/6-31G*). The analysis of the nucleophilic Parr functions $\mathbf{P_k^-}$ [1] and the electrostatic potential in diterpenes 1 and 2 offered an explanation of the regioselectivity found in these reactions and in Baeyer-Villiger reaction [2]. We used transition state theory and the electrostatic potential to understand the high regioselectevity observed, we found that the regioselectivity is kinetically and thermodynamically favorable, and the electronic density is located in the multi-substituted carbon.

Keywords: Regioselectivity, esterification, diterpene, Parr function, DFT B3LYP/6-31G*.

Table 1: DFT/B3LYP/6-31G(d) Electronic chemical potential (μ), chemical hardness (η), electrophilicity (ω) and nucleophilicity (N) values, in eV.

	η	μ	w	N
Diol	5.68	-2.67	0.62	4.02
Triol	5.68	-2.63	0.60	4,06
Ac_2O	6.80	-4.28	1.34	1.85
Benzoyl chloride	5.39	-4.79	2.13	2.04

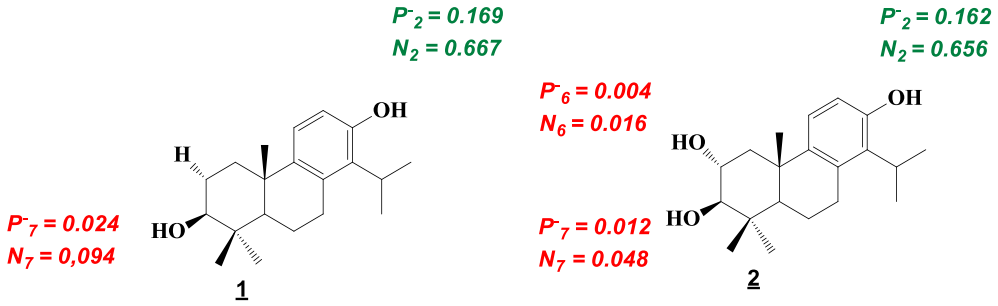

Figure 1: The ASD of the radical cations and nucleophilic Parr functions P_k^- of diterpenes**.**

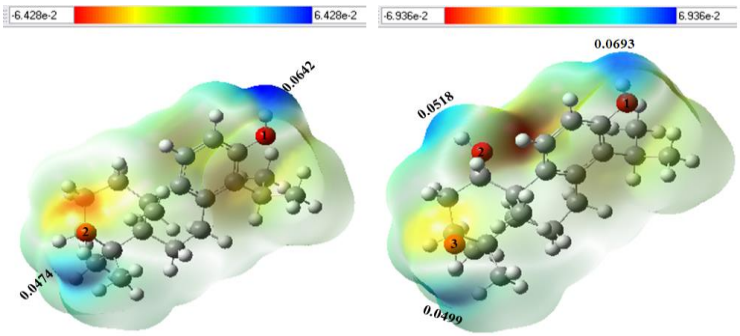

Figure 2: Calculated electrostatic potential on the 0.001 au surface of totradiol and totaratiol

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Corrosion behavior of a super-ferritic stainless steel in industrial and synthetic phosphoric acid solutions at different temperatures

Corrosion has always been a major industrial and environmental problem. Corrosion is the destructive attack of materials by reaction with its environment. The severe consequences of the corrosion process have become a problem of global importance. In addition to our daily encounters with this form of degradation, corrosion is wasting precious resources, product loss or contamination, yield reduction, costly maintenance and expensive over-sizing. It can also compromise safety and inhibit technological progress. Moreover, structures such as storage tanks, pipelines, ships, wagons, tank trucks and nuclear waste processing facilities that store and/or transport potentially hazardous materials may be highly exposed to harmful effects of corrosion. When the structural integrity of these facilities is weakened by corrosion, the environment and public safety are threatened.

Due to the aggressiveness of this phenomenon, many scientific and technological advances have been accumulated in recent decades on the subject of corrosion. The present work represents a contribution to the study of the corrosion phenomenon, and more precisely, the corrosion of stainless steels in the phosphoric acid manufacturing industry. In fact, stainless steels represent the best compromise between mechanical strength, corrosion resistance and reasonable cost, for use in processes involving aggressive media such as the phosphoric acid manufacturing industries [1]. The resistance of these materials to corrosion comes from the fact that in contact with air or water, there is formation on the surface of a thin and stable oxide layer which prevents metals from reacting with corrosive environments [2]. Although phosphoric acid is a moderately corrosive medium against stainless steel compared to other acids such as chloric acid, nitric acid or sulfuric acid, the technology of its production by wet process make it an extremely aggressive medium because of the presence of a number of impurities such

as fluoride, chlorides and sulphates [3] [4]. Moreover, operating temperatures aggravate the situation. In several previous studies, industrial phosphoric acid is commonly replaced by a synthetic acid which contains chlorides and sulphates [5, 6], without taking into account the effect of other impurities (fluorinated compounds, sulfur compounds, metal compounds, gypsum particles ...). In the present work, corrosion behavior of a superferritic stainless steel, in industrial phosphoric acid and a synthetic solution of phosphoric acid containing sulphates and chlorides, is studied for 24 hours between 293 and 343 K. The electrochemical and semiconducting properties of passive films formed on the alloy surface in both media were investigated by potentiodynamic polarization curves, electrochemical impedance spectroscopy (EIS) measurements, potentiostatic tests and Mott-Schottky analysis. The resistance and stability of the passive film formed on the alloy were found to decrease as the temperature increased for both media. Passive film is less stable in industrial acid than in synthetic acid. In fact, the results have shown that the passive film formed in simulated phosphoric acid medium is compact with a thickness of the order of 1.2 nm and a resistance which decreases with an increase in temperature, but remains at high values in the studied range of temperature. On the other hand, the passive film formed in industrial phosphoric acid is characterized by the presence of two layers, an inner compact layer under another porous layer. The resistance of these two layers is severely influenced by the increase in temperature. The Mott-Schottky analyzes have confirmed the previous results. The passive films formed on the alloy surface in both media exhibit n-type semiconductor behavior, with higher donor densities in the case of films formed in industrial phosphoric acid. The passive films formed in industrial environment are more defective, ie less corrosion resistant and more sensitive to the increase of temperature compared to the films formed in simulated phosphoric acid.

Keywords: Stainless steel, corrosion, phosphoric acid, EIS, Mott-Schottky.

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Impact of household waste organic matter on the quality and quantity of leachate produced at the technical landfill center of Oujda city (Oriental Region of Morocco)

Since its inauguration in 2005, the technical landfill center of Oujda city (TLC) has been receiving an annual flow of 140,000 tons of household waste, with a total cumulation estimated at 1.6 million tons.

The seasonal characterization of this waste allowed us to establish an inventory of the average composition of household waste and measure their evolution over time which is of paramount importance for the quantitative and qualitative monitoring of leachate produced. Indeed, this typological characterization showed a dominance of the fermentable fraction into household waste with a rate of 74% and a moisture of 75%.

To concretize the impact of organic matter on the quantity and quality of leachates, a seasonal pilot test of leaching (without water supply) was conducted on two columns sheltered from precipitation. Each of two of columns were filled with 65 kg of fermentable fractions of household waste, randomly sampled from different collection areas at Oujda city.

Weekly samples (14 weeks) of leachate from each column were used to evaluate the leachate fluxes during four seasons of the year. Thus, measurements of produced leachate volumes and a physicochemical characterization (BOD5, COD, BOD5/COD, NH4+, NO3-, pH, Conductivity, Chlorides, Sulfates, MES, etc.) were carried out and allowed better follow of the degradation kinetics of this organic fraction, then, the estimation of its contribution to the global water balance of the landfill.

These data will be used to simulate and model the leachate quality and quantity at the Oujda's landfill, thus, a better management of its flows, withdrawal biogas optimization and the implementation of appropriate processes for their treatment.

Keywords: household waste, landfill, fermentable fraction, organic matter, leachate, characterization, Oujda, Oriental of Morocco.

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Antibacterial effect of a layered double hydroxides Zn-Al on *Escherichia coli* and *Staphylococcus aureus*

The objective of this study consists in highlighting the increase efficiency and the power disinfecting of a material layered double hydroxides" HDLs " Zn-Al also known as hydrotalcite " synthesized in the Laboratory Chemistry-Biology applied to the environment on water consumption. We studied the effect of this product developed with a ratio of Zn^{2+} / Al^{3+} = 3, the antibacterial activities of the «HDLs» Zn-Al were tested against *Staphylococcus aureus* (Gram-positive) and *Escherichia coli* (Gram-negative) bacteria.

The synthesized material has been characterized by powder X-ray diffraction (XRD) (Fig1), Fourier transform infrared (FTIR) spectroscopy (Fig2). The diffractogram of RX presents all the lines (00l) characteristic of the structure lamellar. These lines are thin and intense showing good crystallinity and purity of the synthesized sample. The infrared specter shows a band in 3445 cm^{-1}, wide and intense correspondent in the vibration of valence of the groupings hydroxyls accompanied with the band in 1631 cm^{-1} corresponding to the vibration of deformation of water molecules. We find also the band in 1365 cm^{-1} corresponding to carbonates and vibrations of network in the domain 1000-500 cm^{-1} there.

The Minimum Inhibitory Concentration (MIC) was determined according to the technique of the microtiter on microplate described by Eloff and Andrews [1, 2]. 40 µL of TTC (2,3,5-triphenyltetrazohum chloride) was used as an indicator of bacterial viability [1]. 50 µL of Muller-Hinton broth were added to each well of a microtitre plate containing 96 wells, and 50 µL of the stock aqueous suspension of nanoparticles (10 mg/mL) were added to the first well of each row from which a series of geometric dilution common ratio of 2 were made.
The obtained results showed that both bacteria have the same MCI (0.031 mg/mL). *E. coli* presents a Minimum Bactericidal Concentration (MBC) of

0.125mg/mL. When the report CMB/CMI is superior or equal to 4 [3], the tested material is considered as a bacteriostatic agent.

In conclusion, these preliminary tests realized on both bacteria Gram+ and Gram$^-$ show an important antibacterial efficiency of the matrix HDLs Zn-Al, which allows to suggest a possible use for the decontamination of waters and environment.

Keywords: Layered double hydroxides "HDLs"Zn-Al, bacteria, antibacterial activity.

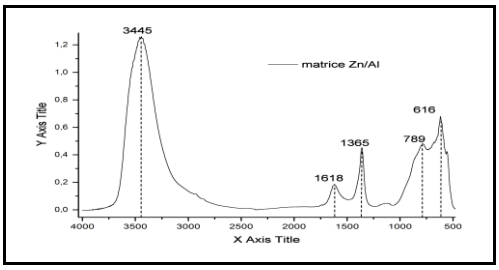

Figure 1: X-ray spectra of spectra of matrix HDLs Zn - Al

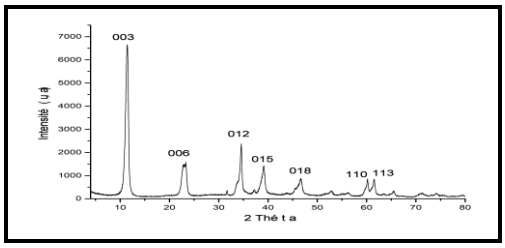

Figure 2: The FT-IR matrix HDLs Zn – Al

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Acknowledgements

This work is realized within the framework of the project (PPR2), supported by the MENFPESRS and the CNRST, Rabat Morocco.

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Inhibitory effect of corrosion of ordinary steel by a new vitreous compound in 1M HCl medium

Corrosion is the degradation of the material by chemical or electrochemical reaction with the environment; it undergoes a progressive loss of material at the points of contact with the surrounding environment. This definition recognizes that corrosion is a deleterious phenomenon, destroying the material and reducing its properties, rendering it unusable for an intended application [1]. The use of inhibitors is the most practical method for protecting metals against corrosion.

Our work is focused on the study of the effect of a borate glass-based glass phase on the inhibition of steel corrosion in a 1M HCl solution at room temperature and at different concentrations; the electrochemical study was carried out by stationary polarization and electrochemical impedance [2]. The tests confirm that the rate of corrosion decreases as the concentration of the compound reaches the value of 200 ppm; According to this result, this compound is proven effective in limiting corrosion damage with an acceptably fine.

Keywords: Corrosion, polarization, impedance, glassy phase, steel, HCl

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