جامعة سيدي محمد بن عبد الله بفاس
UNIVERSITÉ SIDI MOHAMED BEN ABDELLAH DE FES

كلية العلوم والتقنيات فاس
FACULTÉ DES SCIENCES ET TECHNIQUES DE FÈS

PHEMAC
EU-MPC NEXUS

PRIMA

Phemac innovation week

Conference on Water, Agriculture, Environment & Energy

LSSC

Maroc Biotech

LBM2B

May 22 - 24, 2023

phemac.sciencesconf.org

Conferences Hall, Faculty of Sciences and Techniques
Imouzzer road, Fez

ORGANIZING COMMITTEE

- ABDI Farid, USMBA Fez, Morocco
- ALAMI HASSANI Aicha, USMBA Fez, Morocco
- BENAABIDATE Lahcen, USMBA Fez, Morocco
- BOUAMRI Khawla, USMBA Fez, Morocco
- DAFOUF Safae, USMBA Fez, Morocco
- ELABED Soumya, USMBA Fez, Morocco
- EL AMRANI EL IDRISSI Najiba, USMBA Fez, Morocco
- EL GHACHTOULI Naima, USMBA Fez, Morocco
- EL GHADRAOUI Lahsen, USMBA Fez, Morocco
- EL HAMMOUDANI Yahya, UAE Al Hoceima, Morocco
- GHENNIOUI Hicham, USMBA Fez, Morocco
- IBNSOUDA KORAICHI Saad, USMBA Fez, Morocco
- LAHMIDI Ikrame, USMBA Fez, Morocco
- MLIYEH, USMBA Fez, Morocco
- NAJAH Said, USMBA Fez, Morocco
- ZOUITANE Ilham, USMBA Fez, Morocco

SCIENTIFIC COMMITTEE

- ABDI Farid ; USMBA Fez, Morocco
- ALAMI HASSANI Aicha ; USMBA Fez, Morocco
- AL JAFARI Mohammed ; Royal Scientific Society, Jordan
- BENAABIDATE Lahcen ; USMBA Fez, Morocco
- BOUJAWDEH Ramy ; Berytech Foundation, Lebanon
- DIMANE Fouad ; UAE, Al Hoceima – Morocco
- ELABED Soumya ; USMBA Fez, Morocco
- EL AMRANI EL IDRISSI Najiba ; USMBA Fez, Morocco
- EL GHACHTOULI Naima ; USMBA Fez, Morocco
- EL GHADRAOUI Lahsen ; USMBA Fez, Morocco
- EL MODAFAR Cherkaoui; UCD Marrakech, Morocco
- ELMOUSADIK Abdelhamid ; UIZ, Morocco
- ELSADEQ Majid ; ASRT, Egypt
- FARAJALLA Nadim ; IFI, Lebanon
- FARES Issam ; IFI, Lebanon
- FILALI - MALTOUF Karim ; UM5 Rabat, Morocco
- GHENNIOUI Hicham; USMBA Fez, Morocco
- HABOUBI Khadija ; UAE Al Hoceima, Morocco
- HAIDA Souad ; University Ibn Tofail Kenitra – Morocco
- HOUARI Abdellah; University Ibnouzohr Agadir, Morocco
- IBNSOUDA KORAICHI Saad ; USMBA Fez, Morocco
- IRZI Zoulikha ; UM 1St, Oujda, Morocco
- KBAIER Zied ; Ecopark Borj-Cedria (TBC), Tunisia
- KHANFIR Mondher ; Arts & Métiers Accélération (AMA,) France
- LAHRACH Abderrahim ; USMBA Fez, Morocco
- MECHAQRAN Abdellah ; USMBA Fez, Morocco
- NAJAH Said ; USMBA Fez, Morocco
- RAIS Zakia ; USMBA Fez, Morocco
- RUBERTI Federico ; NET7 SRL (NET7), Italy

- SEFFEN Faten ; Chamber of the Commerce of the Center (CCIC), Tunisia
- TABYAOUI Hassan ; USMBA Fez, Morocco
- TUCCI Nicola ; INNOLABS SRL (INNOLABS), Italy
- VALENTE Manuel ; Universitat Autònoma de Barcelona (UAB), SPAIN
- ZOUHRI Lahcen ; Polytechnic Institute, UniLaSalle Beauvais, France

WELCOME TO WA2EN CONFERENCE

The ***W***ater, ***A***griculture, ***En***vironment and ***En***ergy nexus "WA2EN" conference brings together Scientists from all over the world to one meeting covering all disciplines related to Water, Agriculture, Environment and Energy sciences.

The meeting provide a forum where Scientists, especially early career researchers, will present their works and discuss their ideas with experts from different horizons.

The conference constitutes an opporrtunity for sharing institutional lessons from existing projects to develop successful projects addressing Water, Agriculture, Environment and Energy.

This Conference aims also to strengthen knowledge and research initiatives on emerging challenges to the water, agriculture, environment and energy to update the stakeholders, researchers and professionals on recent challenges in the water, agriculture, environment and energy sciences and finally to highlight research initiatives undertaken in the Morocco, and improve effective cooperation between Moroccan and Foreign researchers in the WA2EN fields.

The Water, Agriculture, Environment and Energy "WA2EN" Conference is organized by the Phemac Prima project in collaboration with the "Maroc Biotech Association".

SUMMARY

Water & Environment

VALORISATION DES LIXIVIATS DE LA DECHARGE CONTROLEE DE LA VILLE DE FES

A.TOUZANI [1*], F.DIMANE [2], M.TAHIRI [3], Y.EL HAMMOUDANI [4], Y.GAGA [5]

1, 2 et 4 Laboratoire des Sciences de l'Ingénieur et Applications (LSIA), ENSAH, Université Abdelmalek Essaâdi, Tétouan, Maroc

3 Laboratoire de Synthèse Organique, Extraction et Valorisation (LSOEV), FSAC, Université Hassan II, Casablanca, Maroc

5 Laboratoire des Biotechnologien Conservation et Valorisation des Ressources Naturelles (LBCVRN), Facultés des Sciences Dhar El Mahraz, USMBA, Fès, Maroc

**touzani110@gmail.com*

Résumé: Les lixiviats contiennent différents types de matières organiques et inorganiques qui peuvent polluer les milieux aquatiques s'ils ne sont pas correctement traités. Le choix et l'efficacité des techniques de traitement dépendent des caractéristiques des lixiviats, ces caractéristiques changent d'une région à l'autre et en fonction du temps et des saisons. L'objectif de cette étude est la valorisation des lixiviats de la décharge contrôlée de la ville de Fès, suite à la réalisation des tests de traitabilité de ce lixiviat en contrôlant les différents paramètres d'analyse. Pour pouvoir choisir la technique adaptée au type de lixiviat à valoriser. Dans notre cas pour le lixiviats de la décharge contrôlée de la ville de Fès, les caractéristiques physico-chimiques sont réalisées concernant la DCO, la DBO5, la MES, l'Azote total et le Phosphore, ces caractéristiques montre larichesse des lixiviats en éléments nutritifs qui peuvent la rendre valorisable. Aussi, une forte présence d'éléments métalliques est détectée ce qui montre que les ordures ménagères sont mélangées avec les rejets industriels ce qui peut nous mener sur une voie de valorisation industrielle. La caractérisation des lixiviats de la décharge contrôlée de la ville de Fès a montré le potentiel de ce produit d'être valoriser.

Mots-clés: Lixiviat de décharge, caractéristiques physico-chimiques, valorisation, éléments nutritifs.

Investigating the effects of soil heavy metal contamination from the abandoned Zeïda mine in the Upper Moulouya Basin, Morocco. An airborne dust pollution in semi-arid climate conditions.

ABDELMOUIZ ECH-CHAREF*[1], ABDELILAH DEKAYIR[1], GYOZO JORDAN[2], MOHAMED ROUAI[1], ANDFATIMA ZOHRA EL HOUFY[1]

[1]*Geo-explorations Geotechnics Lab., Faculty of Sciences, University Moulay Ismail, Meknes, Morocco –Morocco*

[2]*Eötvös Loránd University (ELTE), Budapest, Hungary – Hungary*

Abstract: The practice of Mining, which can be traced back to the dawn of civilization, yieldscritical minerals and metal ores that form the backbone of numerous industrial domains. However, it also engenders notable ecological harm and imposes dangers to adjacent populations. The Ze¨ıda mine in Morocco was a significant producer of lead for a period of 13 years, generating massive quantities of waste in the form of tailings that were exposed to natural weathering processes. To evaluate the impact of Mining activities on the surrounding soil ecosystems of the inactive mine, a comprehensive study was conducted utilizing physical and chemical examinations to determine soil contamination. Samples were procured from agricultural regions and assayed for Pb, Zn, Cu, Co, Cd, and As through ICP-MS (aqua regia extraction) analysis. The study results indicate that the soil in close proximity to the tailings had higher levels of metal when compared to reference soil with no contamination. The tests also revealed high levels of alkalinity, varying electrical conductivity and organic matter, and the presence of specific minerals like carbonates, quartz, orthoclase, and muscovite. Lead minerals (cerussite and wulfenite) were found in 3 soil samples, while illite and kaolinite dominated as clay minerals. Descriptive and multivariate statistics were applied to analyze metal distribution patterns. The results, when compared with international standards, exhibited high concentrations of heavy metals, especially Pb, Zn, Cu, As, and Cdof anthropogenic origin, with correlations observed between As, Cu, Cd and Pb, and Zn, indicating a common origin and similar transport behavior.

Keywords: ICP, MS, XRD, Potentially toxic elements, Environment, Ze¨ıda mine, Soils.

Analysis of the water quality used in the cooling of solar panels

Ali Ait Ali[1]& HICHAM Hihi[1]

1- Laboratoire d'Ingénierie, Systèmes et Applications, USMBA, ENSA Fès, Maroc
**Email : ali.aitali@usmba.ac.ma*
**Email : Corresponding author*

Abstract: The main objective of this work is to ensure the quality of water used to cool photovoltaic panels in dry areas; characterized by an arid and semi-arid climate (Morocco). It should be noted that the research that has been done in this context of cooling panels by using water does not take into consideration the quality of water, knowing that the latter can affect the performance of these panels. A water sample was collected, then it is analyzed in the laboratory before comparing the results tothe Moroccan standards of drinking water treatment. The results of the study proved that water isvery efficient and suitable for cooling solar panels, in particular, it does not cause any deposit of salts and limestone above them, that can plug the panels, especially since this region (Daraa Tafilalet), knows a very high heat above 25 °c on all in summer, this requires cooling to avoid anyloss of efficiency.

Keywords: Quality analysis, energy, photovoltaic panels, groundwater.

EFFET DE L'EPANDAGE DES MARGINES BRUTE SUR GERMINATION, CROISSANCE ET D´EVELOPPEMENT DE LA F`EVE (VICIA FABA)

El Hassane Kasmi*[†1], Abdessadek Essadek[1], Chaimaa Hakim[1], Kaoutar Aboukhalid[2], Abdesselam Maatougui[2], and Mounsef Neffa[‡1]

[1]: *Laboratoire de Bioresources, Biotechnologie, Ethnopharmacologie et Santé, Faculté des Sciences, Université Mohammed Premier, Oujda 60000, Maroc. – Morocco*

[2]: *Centre régional de recherche agronomique d'Oujda, Institut national de recherche agronomique Avenue Ennasr, BP 415 Rabat Principale, 10090 Rabat, Maroc – Morocco*

Abstract

L'oléiculture assure une activité agricole intense au Maroc et permet l'approvisionnement des unités de trituration. Les margines d'olives représentent la masse restante considérée comme résidu de la trituration des olives, leur élimination incontrôlée pose des problèmes sociaux, économiques et environnementaux majeurs.Ces problèmes sont attribués à la richesse de ces effluents en matière organique, salinité et en particulier en polyphénols. Dans ce contexte, l'idée de la valorisation des margines comme biofertilisant organique en agriculture a été proposée comme une alternative prometteuse pour la restauration de la fertilité des sols et l'amélioration de la production agricole C'est dans cette perspective qui nous nous sommes proposées de réaliser ce travail de recherche afin d'évaluer l'effet de différentes doses des Margines et des solution saline sur le comportement d'une variété locale de la fève (vicia faba) afin de déterminer l'implication de la salinité des margines dans la phytotoxicité. Les analyses ont porté sur les paramètres morphologiques, physiologiques, biochimiques et de déterminer l'effet des margines sur le stade de la germination des graines. Les résultats obtenus ont montré que l'épandage des margines à des taux élevés entraîne une réduction significative des paramètres étudiés. Nous avons constaté que le degré de la phytotoxicité dépend de la concentration des margines et du temps et du stade phénologique ; plus le dose augmente plus la phytotoxicité est importante et se manifeste par une séquence de change- ment morphologique et physiologique et biochimique par une progression et un retard de croissance, une inhibition de germination, une accumulation du proline et sucre soluble. En effet, l'alimentation des sols agricoles par les margines où le besoin en eau est ressenti reste une solution praticable vue de leur apport en éléments fertilisants et comme source hydrique mais `a condition que cette op´eration soit contrˆol´ee et maˆıtris´ee en respectant les doses `a appliquer.

Keywords: Margines, Biofertilisant, Phytotoxicité, Paramètres Morphologiques, Physiologiques, Biochimiques, Vicia faba

LA SECHERESSE CLIMATIQUE : ETUDE DE L'EVOLUTION DES PHENOMENES DES SECHERESSES AU NIVEAU DU BASSIN VERSANT DE SOUSS-MASSA (SUD DU MAROC)

MARYAME El-YAZIDI[1]* ET MOHAMMED BENABDELHADI[2]

1,2- Laboratoire Ecologie Fonctionnelle et Génie de l'Environnement, FST, Fès, USMBA
Maryame.el yazidi@usmba.ac.ma

Résumé: Le bassin versant de Souss-Massa est situé au centre-ouest du Maroc avec une superficie de 27 800 km². Il est limité par les montagnes de l'Anti-Atlas au sud et du Haut Atlas au nord, l'océan Atlantique à l'ouest et le massif de Siroua à l'est. La région de Souss-Massa a un climat semi-aride à aride typique. La variation des précipitations est très importante dans le temps et dans l'espace, montrant une nette décroissance des précipitations depuis les montagnes vers les plaines. La température moyenne annuelle varie entre 14 et 18 ◦C dans le Haut Atlas et l'Anti-Atlas, avec 20 ◦C sur la plaine. La température maximale journalière atteint 49°C, et la température minimale journalière descend atteint -3°C. Dans cette étude nous nous sommes appuyés sur une méthode statistique pour déterminer et analyser l'évolution des phénomènes des sécheresses dans le bassin versant de Souss-Massa au niveau de deux stations à partir d'une analyse quantitative de l'indice pluviométrique standardisé SPI d'une série pluviométrique de 51 ans, au cours de la période 1966-2017. L'analyse des résultats de l'indice pluviométrique standardisé de deux stations montre une alternance entre les années humides et des années sèches avec une dominance des années sèches bien remarquable. Nous ne pouvons pas lier cette sécheresse uniquement à l'aspect naturel puisque l'homme joue également un rôle important dans l'impact de ce bassin par ses exploitations agricoles, industrielles et domestiques.

Mots clés : Bassin versant, Souss-Massa ; Température moyenne annuelle ; Température journalière ; sécheresse et indice pluviométrique standardisé

INONDATIONS MEDITERRANEENNES EN MILIEU URBAIN: CAS DU GRAND BERKANE

Hafssa Afif*†[1], Mostafa Oujidi[1], Mimoun Chourak[2], Imane Amar[1], and SmahaneRamdani[1]

[1]*Applied Geosciences Laboratory (LGA), Department of Geology, Faculty of Sciences Oujda - FSO,Mohammed First University – Morocco*

[2]*Department of Mechanics and Applied Mathematics, National School of Applied Sciences Oujda - ENSAO, Mohamed Premier University. – Morocco*

Abstract: Le Maroc fait partie des pays méditerranéens fréquemment touchés par les inondations. Elles ont causé des dégâts humains et matériels dans de nombreuses régions du pays : les inondations catastrophiques de la vallée de l'Ourika en 1995, de la plaine de Martil en 2000, de la région de Mohammadia, Berrechid et Settat en 2002, et de la région de Berkane en 2004, 2010, et 2012, 2022 entre autres. Le développement durable et la gestion intégrée des catastrophes naturelles présentent au- jourd'hui la part prédominante dans les discours politiques publics. Dans ce contexte, la cartographie et la modélisation des zones susceptibles aux inondations sont cruciales pour le développement durable. Notre étude est lancée en vue d'améliorer les connaissances sur le risque d'inondation au niveau de la ville de Berkane pour une meilleure gestion du territoire et pour contribuer au développement durable de la ville. Le matériel et les méthodes utilisées pour l'élaboration de cette étude consistent en une etude bibliographique des caractéristiques géologiques, climatiques et hydrologiques. L'analyse et l'interprétation des données géologique, hydrologique, de la télédétection et l'occupation du sol ont permis de déterminer les mécanismes de la circulation des eaux superficielles, présentés à l'aide d'une simulation faite par le logiciel Iber afin d'établir la cartographie de l'aléa en fonction de la vitesse et de la hauteur de la tranche d'eau. Les résultats de la modélisation sur Iber, ont permis de définir l'intensité de l'aléa qui est un paramètre important du risque d'inondation de la ville de Berkane, qui menace la population ainsi que les infrastructures qui relient les deux bords de la rivière.

Keywords: Berkane, aléa, Inondation, Modélisation, Iber software.

Benthic foraminifera: a promising monitoring tool for the marine ecological status in the T´etouan coast, north west Morocco

Haitam Afilal*†[1]

[1]*Faculty of Science and Technology of Tangier, Department of Earth Sciences / Geosciences research team on natural risks (Georisk), Abdelmalek Essaâdi University, Morocco (Georisk) – Ancienne Route de l'Aéroport, Km 10, Ziaten. BP : 416. Tanger - Maroc, Morocco*

Abstract: This study investigates the potential use of benthic foraminifera as an assessment toolfor the marine ecological status in the Tétouan Coast of North West Morocco. Sediment samples were collected from various depths along the Martil coast, and analyzed for their faunistic composition, as long as their corresponding abiotic parameters (pH, total organic carbon, % carbonates, and granulometry). Biocenotic indices were calculated and compared in the different samples, followed by the principal Component Analysis (PCA) and Cluster Analysis, allowing the identification of the main factors controlling the distribution patterns of the benthic assemblages. The study found that the foraminiferal density and species assemblages were primarily in- fluenced by the organic charge and sediment grain size variations caused by the continental contribution of Oued Martil. These findings provide valuable insights into the potential use of benthic foraminifera as a tool for assessing the ecological status of marine ecosystems in the Moroccan Mediterranean coasts.

Keywords: Benthic foraminifera, Ecological status, Moroccan Mediterranean coasts

IMPACT DU CHANGEMENT CLIMATIQUE ET ANTHROPIQUE SUR LES RESSOURCES EN EAUX DU CAUSSE EL MENZEL, MOYEN-ATLAS, MAROC

I. NAOUADIR[1]*, A. DRIDRI[1], A. ELAARAJ[2], H. EL ASMI[1] & E. H. CHELLAI[3]

1- Laboratoire de Géosciences, Environnement et Ressources Associées, Faculté des Sciences Dhar El Mahraz, Université Sidi Mohamed Ben Abdellah, B. P : 1796, Atlas, Fès 30000, Maroc
2-Laboratoire des Ressources Naturelles et de l'Environnement, Département de Géologie, Faculté Polydisciplinaire de Taza, Université Sidi Mohamed Ben Abdellah, Fès 1223, Maroc
3- Département de Géologie, Faculté des sciences Semlalia, B. P : 2390, Université Cadi Ayyad, Marrakech, 40000. Maroc
**Email :liass.naouadir@usmba.ac.ma*

Résumé : Les paysages karstiques du Moyen-Atlas comptent parmi les environnements les plus riches en terme hydrologique, écologique et géologique. Ils fournissent une variété de ressources naturelles de grande valeur économique, dont les plus importantes sont l'eau, le sol et les ressources forestières. L'un des exemples les plus spectaculaires qui offre une telle variété de richesses naturelles est le Causse El Menzel. Ce plateau karstique carbonaté révèle à la fois une importante superficie forestière comme le cas de la Réserve Royale de Ghomra et des ressources karstiques en eaux dont les plus importants sont les grandes sources de Aïn Sebou (2500 l /s comme débit moyen). Aïn Timedrine qui alimente le principal cours d'eau du Maroc Oued Sebou a une couverture pédologique qui couvre les grandes dépressions karstiques du Causse et servent la végétation naturelle et la production agricole (culture du blé, d'oliviers, grenadiers, pommiers, pruniers…). Toutefois, les 20 dernières années l'impact du changement climatique avait prévu que les températures augmenteraient de 2 à 4 ◦C et que les précipitations diminueront de 53%. Combiné aux activités anthropiques liées à la sur exploitation des eaux sans mesures appropriées et la pollution ont perturbé le système hydrologique du Causse en provoquant une véritable pénurie d'eau avec une baisse spectaculaire du niveau des eaux souterraines et un épuisement des eaux de surface dans plusieurs secteurs tels que : Quaçbat Ben Yazgha, El Menzel…. Cette situation mettra en péril la sécurité de l'eau dans la zone. Nous pensons qu'une politique urgente de mobilisation et de protection des ressources en eau par une gestion participative peut permettre d'économiser l'eau pour les générations futures et de soutenir la production agricole.

Mots clés : Karst, Eau, surexploitation, Causse El Menzel, Moyen-Atlas, Maroc.

Cartographie de l'aléa d'inondation dans la commune d'Ain Beni Mathar, cas du bassin versant d'Oued El-Hai

IMANE AMAR[1,*], SAID BENGAMRA [1] ,HANAE BOUISS[1], AFIF HAFSSA[1], RAMDANI SMAHANE[1]

1 :Université Mohammed Premier, Faculté des Sciences Oujda, Département de la Géologie, Laboratoire des Géosciences Appliquées, Maroc.
Amar.imane@ump.ac.ma

Résumé: Dans cette dernière décennie la relation du changement climatique avec les risques d'inondation est désormais un sujet familier et très tendance. Les changements climatiques augmentent la concentration dans le temps des précipitations, causant des inondations intenses longues et fréquentes dans le pays. Dans cette perspective vient l'objectif de notre étude qui repose sur l'évaluation et la cartographie du risque d'inondation dans la commune d'Ain Beni Mathar. Ain Beni Mathar fait partie des Hauts plateaux septentrionaux du Maroc ,elle est caractérisée d'un climat aride, elle est limités au nord par les Monts de Jerada et Jbel Bni-Bouyala, à l'Est par la frontière algero-marocaine, au sud par le Haut Atlas oriental et à l'Ouest par les plateaux de Rekkam et la crête majeure des hauts plateaux. Elle est drainée par un réseau hydrographique important dont le cours d'eau principal est celui de Oued El-Hai. Lors des pluies intense, la ville de Ain Beni-Mathar est exposée aux risques d'inondations causées par d'Oued El-Hai. Cela cause la mise hors services de la route provinciale R606 traversant Ain Béni-Mathar ainsi que la détérioration des biens de la population avoisinante. Devant cette situation alarmante nous avons entamé une étude des inondations dans cette zone afin de cartographier l'aléa, la vulnérabilité et le risque hydrologique Afin de protéger la population d'Ain Beni-Mathar et ses biens contre les inondations, nous avons commencé par une étude hydrologique du bassin versant générateur des crues, en calculant ces caractéristiques morpho-métriques à l'aide du SIG ainsi que le calcul des débits de crues d'Oued El-Hai par la méthode SCS et la cartographie de l'occupation du sol. Par la suite nous avons recours à la simulation 2D des crues de différentes périodes de retour via le logiciel Iber 2.5. L'occupation de sol nous a permet de voir l'influence du sol sur la réponse hydrologique ainsi que la simulation des crues,nous a permis de cartographier l'aléa inondation en fonction de la vitesse d'écoulement et de la hauteur du niveau d'eau de l'Oued selon trois classes d'aléa, faible, moyenne et forte. Cette étude nous a données aperçu sur le fonctionnement hydrologique du bassin versant de l'Oued El-Hai, caractérisé d'une surface qui dépasse les 4000 km², par la suite la simulation 2D des crue selon les différents périodes de retours et il s est avéré que l'inondation prend plusieurs valeurs selon les zones.

Mots clés : Aléa ; Inondation ; Oued Mesakhsa ; Iber2.5

AMELIORATION DES PERFORMANCES DE LA STATION DE DESSALEMENT DE L'EAU DE MER D'AL HOCEIMA PAR LA METHODE AMDEC

I. AOUERYAGEL [1,2*], I.ES-SMIRI[1], F. CHAOUKET[1], I.RAISSOUNI[1], D. BOUCHTA[1]

[1] *Laboratoire des matériaux et système inter faciaux, faculté des sciences Tétouan, MAROC*
[2]*Laboratoires de l'ONEE-BRANCHE Eau Al Hoceima, MAROC*

*iman.aoueryagel@etu.uae.ac.ma**

Abstrat: L'insuffisance des ressources hydriques et le besoin en eau potable constitue le souci majeur par nombreux pays, notamment pour la Maroc qui a connu une augmentation importante en besoin hydrique sous la pression de la croissance démographique, le développement économique ainsi que les conditions climatiques. Pour y remédier, le Maroc a lancé un programme ambitieux d'installation des stations dedessalement de l'eau de mer avec la technique d'osmose inverse dans des zones semi arides. Ainsi,la station de dessalement de l'eau de mer d'AL HOCEIMA a démarré en Juin 2020. Dans le but de maintenir le bon fonctionnement de la station et d'améliorer la fiabilité des processus, on a mené une étude pour la détection d'éventuels dysfonctionnement des procédés dela station susceptibles d'altérer la qualité d'eau dessalée. Pour ce faire, on a opté pour une analysequalitative et quantitative par la méthode AMDEC-processus. Cette dernière permet de recenser les défaillances qui peuvent affecter la fiabilité d'un procédé. A la lumière des résultats obtenus on a élaboré un plan d'amélioration qui s'appuie sur des actionscorrectives à court termes et préventives à moyenne et à long terme afin de maintenir le bon fonctionnement de la station et d'améliorer la fiabilité des processus.

Keywords: Dessalement; Amélioration; Performances; AMDEC; L'eau.

E´valuation de la fiabilit´e des produits de pr´ecipitation satellitaires pour les ´etudes climatiques et hydrologiques dans le bassin Haut Drˆaa, sud du Maroc.

Khalid En-Nagre*[1], Jamal Eddine Stitou El Messari[1], and Mourad Aqnouy[2]

[1]*Laboratoire de Géosciences Appliquées et Marines, Géotechnique et Géorisques (LR3G) – Faculté des Sciences, Université Abdelmalek Essaâdi, BP : 2121 93003, Tétouan, Morocco*

[2]*Laboratoire de recherche en géologie appliquée. Équipe de recherche en géologie appliquée et télédétection – Université Moulay Ismaïl de Meknès, Faculté des Sciences et Techniques B.P :509, Boutalamine 52000, Errachidia - Maroc, Morocco*

Abstract: Les régions arides et semi-arides, comme le sud du Maroc, sont confrontées à une disponi- bilité limitée de données de précipitation, ce qui représente un obstacle important pour les études climatiques et hydrologiques. Les produits de précipitation satellitaires (PPS) peuvent être utilisés pour pallier cette lacune de données. Dans cette étude, nous avons évalué directement la fiabilité des données des PPS (TRMM 3B42-V7, GPM 3IMERGDFV6 et CHIRPS) en les comparant aux mesures au sol dans le bassin Haut Drâa, afin d'estimer les caractéristiques des précipitations. Les PPS ont également été évaluées de manière in- directe pour leur capacité à simuler l'écoulement à l'aide de deux modèles hydrologiques (HEC-HMS et GR4J). L'analyse a été effectuée en utilisant la méthode point à pixel, et nous avons utilisé plusieurs critères de performance pour comparer les résultats (NSE, R2, PBIAS, RSR, POD et FAR). Nos résultats montrent que les trois produits ont des diffi- cultés à reproduire avec précision la quantité de précipitations journalières, avec des valeurs de ($R2 < 0.5$) et des valeurs de PBIAS > 25% qui témoignent d'une surestimation des précipitations. Cependant, l'évaluation de l'efficacité hydrologique des différents PPS a montré que les simulations réalisées avec le modèle HEC-HMS en utilisant les données de précipitations TRMM et GPM ont montré des performances satisfaisantes lors de la cali- bration et de la validation. En revanche, les simulations effectuées avec le modèle GR4J ont donné des résultats non acceptables. De plus, les simulations forcées avec CHIRPS ont présenté des performances médiocres, avec des valeurs plus faibles de NSE et de R2, ainsi que des erreurs PBIAS élevées. Par conséquent, les PPS peuvent être utilisés comme alter- native utile pour combler le manque de données de précipitation dans le bassin Haut Drâa. Toutefois, il est essentiel d'effectuer une évaluation rigoureuse de leur précision avant de les utiliser pour des applications hydrologiques et climatiques.

Keywords: Précipitation, GPM 3IMERGDF, V06, TRMM 3B42, GR4J, Haut Drâa, HEC, HMS

The effect of COVID-19 lockdown on water quality and sediment release in Morocco's Sebou River

Lamyae Mardi*[1]

[1]*Laboratory of Materials, Process, Catalysis and Environment , (LMPCE) – Higher School ofTechnology, Sidi Mohamed Ben Abdellah University, B.P. 2427, Fez, Morocco., Morocco*

Abstract: The global spread of COVID-19 has dramatically reduced industrial activity, road transport, and tourism in a relatively short period of time. Overall, the limited interaction betweenhumans and nature during this critical time appears to be a time of recovery for nature and the environment. However, the implementation of the lockdown could lead to improvementsin surface water and sediment quality. The current study's main goal is to determine the levels of physicochemical variables and heavy metals in Sebou River sediments and water samples during and before the lockdown period. Heavy metal concentrations in sediments and watersheds show significant differences before and after the confinement period. The re-duction in industrial activity during the lockdown period reduced the amount of wastewater, resulting in significant improvements in sediment and water quality.

Keywords: COVID, 19, Lockdown, Heavy metals, Water, Sediments, Quality.

CARTOGRAPHIE ET ANALYSE DE LA VARIABILITE SPATIO-TEMPORELLE DES EAUX SOUTERRAINES DE LA NAPPE PHREATIQUE DE SAÏSS PAR UNE APPROCHE GEOSTATISTIQUE

M. EL GAROUANI[1*], A. LAHRACH[2] & H. JARAR OULIDI[3]

1- LEFGE, Faculté des Sciences et Techniques de Fès, USMBA, Fès, Maroc
2- Ecole Nationale des Sciences Appliquées de Fès, USMBA, Fès, Maroc
3- Ecole Hassania des Travaux Publics (EHTP), Casablanca, Maroc
** manalgarouani@yahoo.fr*

Résumé: Comprendre, analyser et étudier le comportement des systèmes aquifères est essentiel pour toute décision de gestion et pour une exploitation optimale et rationnelle des ressources en eau. L'outil de base de cette analyse est la carte régionalisée du niveau piézométrique. Il sert généralement de référence aux études hydrogéologiques et environnementales. Il permet, entre autres, la compréhension de la morphologie, de la géométrie et de l'hydrodynamique de l'aquifère. Dans la zone d'étude qui est la plaine de Saïss au Nord du Maroc, l'eau souterraine est la source principale d'approvisionnement en eau pour les besoins domestiques, agricoles et industriels. Les mesures des niveaux des eaux souterraines issues des puits d'observation constituent une source d'information précise permettant l'analyse de l'état des ressources en eau. Malheureusement, ces séries ne sont pas toujours continues dans le temps et dans l'espace et contiennent généralement des lacunes pour diverses raisons. Par conséquent, une modélisation précise du niveau des eaux souterraines dans les emplacements non suivis est nécessaire pour une meilleure planification et gestion. Dans la première étape de cette étude, on a testé et comparé huit méthodes d'interpolation géostatistiques à savoir des méthodes déterministes et probabilistes pour l'interpolation spatiale des données piézométriques de la nappe phréatique de la plaine de Saïss. Dans la deuxième étape, les séries chronologiques des données piézométriques collectées sur le terrain sont souvent incomplètes du fait de défaillances lors de l'acquisition des mesures. Cela compromet le traitement de l'information. Des approches, dites d'imputation, sont alors à appliquer pour consolider ses séries avec des données manquantes. Dans cette étude, l'outil XLSTAT 2022 a été utilisé pour compléter les séries temporelles des piézomètres sur une période de 20 ans. Enfin, on a analysé l'évolution spatiotemporelle des ressources en eau de la nappe phréatique de Saïss par le suivi de son niveau piézométrique. Cette analyse de la variation de la profondeur de la nappe entre 2000 et 2020 a permis de constater qu'en général le niveau de la nappe a baissé au NW et au centre par contre il s'est amélioré ou il est resté constant dans les autres zones.

Mots-clés : Eau souterraine, Evolution spatiotemporelle, Géostatistique, XLSTAT, Nappe de Saïss.

Utilisation de la t´el´ed´etection radar pour l'´etude du probl`eme de l'envasement des barrages, cas du barrage Abdelkarim el khattabi `a la r´egion d'el Hoceima au Maroc

Mohammed Mourjane*[1], Tabyaoui Hassan*[1], and Elhammichi Fatima*[1]

[1] *Université Sidi Mohamed Ben Abdellah - Fès [Université de Taza] (USMBA) – Morocco*

Abstract: Le problème de l'envasement des barrages est parmi les phénomènes écologiques et géologiques qui nécessitent des fortes interventions de la part des gouvernements des pays comme le cas du maroc qui a donné suivi et intérêt au barrage abdelkarim el khattabi au nord du royaume, car il assure l'alimentation en eau à une large portion de la population et aux activités d'agriculture, et d'autre part il protège les terrains contre les inondations. Les interventions se faisaient à travers des études diverses finies par des recommandations de mise en place des aménagements convenables depuis les années quatre-vingts. La télédétection radar est un fort moyen aux études naturelles, et essentiellement à la quantification et la modélisation des phénomènes écologiques, géologique, et atmosphériques... On a utilisé ce nouveau outil pour déterminer les mouvements des sédiments et des déchets dans la partie qui entoure le barrage de Abdelkarim el Khatibi du bassin versant d'oued nekor, dans le cadre d'estimer le taux de l'envasement, grâce aux données sentinel-1 et par le processus DINSAR (Différence de phase des images SAR (Synthetic-aperture radar)). Les résultats obtenus représentent des cartes d'instabilité de terrain entre deux dates différentes de prise de vue de satellite, avec des valeurs positives (soulèvement) et autres négatif (retrait) en degré variable d'une zone à une autre. Ces résultats présentent des moyens supplémentaires aux études de problème de l'envasement des barrages en déterminants les zones vulnérables aux déplacements des sédiments. Le calcul de l'interférométrie radar par des images récentes de sentinel-1 offre une caractérisation, à partir de l'espace, des zones limitants du barrage, que soit le retrait ou le soulèvement et à une échelle millimétrique par la cartographie des régions de changement de surface. Radar ; DINSAR ; sentinel-1 ; barrage Abdelkarim el Khatibi ; envasement ; retrait; soulèvement.

Keywords: Radar, DINSAR, sentinel, 1, barrage Abdelkarim el Khatibi, envasement, retrait, soulèvement.

Use of coagulation-flocculation process for the treatment of real tannery wastewater from Fes city (Morocco)

O. BAHAMMOU1, H.1, I. EL MRABET2, K. TANJI3, F. KHALIL1, H. ZAITAN1*

1Processes, Materials and Environment Laboratory (LPME), Faculty of Sciences and Technology of Fez, BP 2202, Sidi Mohamed Ben Abdellah University, Morocco
2Department of Physics-Chemistry, Polydisciplinary Faculty of Ouarzazate, University of Ibn Zohr, Morocco
3Independent Scientist, Sidi Mohamed Ben Abdellah University, Fez, Morocco
4Laboratory "Water, Energy and Environment" (LR3E), National Engineering School of Sfax, University of Sfax, Tunisia
5Laboratoire de Chimie Analytique et Moléculaire, Faculté Polydisciplinaire de Safi, Université Cadi Ayyad, Safi, Morocco.
*Email: hicham.zaitan@usmba.ac.ma

Abstract: This study aims to investigate the feasibility to apply a coagulation-flocculation process to treat the tannery wastewater (TWW) of Fez city (Morocco). Three types of coagulants are assessed: ferric chloride (FeCl3), and alum (Al2(SO4)3). Optimum conditions in terms of the removal of chemical oxygen demand (COD), heavy metals, colour and turbidity contents are determined, using a standard jar test apparatus. Optimum coagulant dosages of 6 g FeCl3.l-1 and 0.6 g Al2(SO4)3.l-1 are obtained. Ferric chloride allows to remove 46% of COD, 51% of turbidity, 80% of colour with a low sludge volume generation (20%). When the optimum coagulant dose of FeCl3 is applied a 59% of COD, 98% of turbidity, 80% of colour are removed with less sludge volume generation (21%). Regarding the analysis of metallic elements, the results show that a substantial elimination of heavy metals is reached, particularly of Cr. These results show that coagulation-flocculation could be used as a promising process for the pretreatment of the tannery wastewater from fez city.

Keywords: tannery wastewater treatment; Coagulation, Flocculation

Étude des séquences de sécheresse dans le bassin Guir

Safae Dafouf*, Abderrahim Lahrach, Lahcen Benaabidate[1]

Laboratoire d'Ecologie Fonctionnelle et Génie de l'Environnement, Faculté des Sciences et Techniques, Université Sidi Mohamed Ben Abdellah, Fès 30000, Maroc
** safae.dafouf@usmba.ac.ma*

Résumé: La pénurie d'eau est un risque majeur qui s'accentue par la croissance perpétuelle de la demande en eau dans les différents secteurs usagers et l'impact de la sécheresse. À l'état actuel, le Maroc souffre de la pénurie d'eau en raison de la diminution des précipitations dans le contexte du changement climatique auquel le monde est témoin. Face à cette situation, il est nécessaire dans un premier temps d'étudier la sécheresse en surveillant et en analysant leurs séquences, et appliquer par la suite une politique de gestion d'eau adaptée à l'état étudié afin d'assurer la durabilité des ressources en eau et d'atténuer les impacts de la sécheresse. Le présent travail est établi pour caractériser la sécheresse météorologique dans une zone oasienne qui est le bassin versant Guir qui fait partie du grand bassin versant Guir-Ziz-Rhreis, en tenant compte la vulnérabilité des ressources en eau des zones semi-arides.

Mots clés : sécheresse, température, bassin hydraulique, changement climatique, précipitation, bassin Guir

SYNTHESIS OF FUNCTIONALIZED PHOSPHINE OXIDES: APPLICATION TO TRACE METAL ION DETECTION IN WATER

Samb Issa*[1] and Véronique Michelet*†[1]

[1] *Université Alioune Diop de Bambey (UADB) – Bambey, Senegal*

Abstract

The concept of sustainable development becomes an important benchmark of our societies,it appears necessary to have the means to fight against water pollution by heavy metals.In this work, fluorescence is used as a method of detection of metal ions in water.1-4 We have carried out the synthesis and the study of complexation of new fluorescent structures based on phosphine oxides containing crown ethers.

Keywords: water pollution, fluorescent, phosphine oxides and detection

Water Feature Extraction and Change Detection Using SAR image

Sanae ATTIOUI[1]*, and Said NAJAH[1]*

1 Intelligent Systems and Application Laboratory (LSIA), Faculty of Sciences and Technology, University Sidi Mohamed Ben Abdellah, Fez, Morocco
Sanae.attioui@usmba.ac.ma
Said.najah@usmba.ac.ma

Abstract: Synthetic aperture radar (SAR) is a remote sensing technology that is highly effective in monitoring the earth's surface continuously, even under adverse weather conditions. Water mapping based on SAR imagery has gained increasing attention in recent years, as it can be a cost-effective way to monitor floods and droughts. However, speckle noise in SAR data can make it difficult to interpret and reduce the accuracy of change detection algorithms. Numerous methods have been proposed to map water extent and monitor flood changes using SAR images, with supervised and unsupervised learning approaches being the two broad categories. While supervised learning requires the availability of ground truth information to generate a training set for developing a classification model, unsupervised learning does not require any prior knowledge and can handle complex and diverse data without labeled samples. Therefore, unsupervised methods have become the mainstream in change detection tasks, and this paper focuses on developing an unsupervised approach to address the challenges in SAR image analysis. Convolutional Neural Networks (CNNs) have been successfully applied to remote sensing image change detection due to their ability to automatically extract multi-level image features. However, traditional CNNs have limitations and shortcomings that can restrict their applications. For example, they may struggle to learn spatial hierarchies between features and can potentially result in the loss of valuable spatial information. To address these limitations, Capsule Networks (CapsNets) have been proposed, which aim to achieve translation equivariance by encoding hierarchical relationships between entities. CapsNets consist of multiple layers of capsules, with each capsule representing a small group of neurons that encode instantiation parameters such as position, size, orientation, texture, and deformation. In this work, a Multidimensional Parallel Capsule Network is proposed for SAR image change detection. This architecture is designed to extract richer and more robust features while modeling their hierarchical relationships. The main contributions of this work include the development of a novel architecture for SAR image change detection, as well as the demonstration of its effectiveness through experimental evaluation. The proposed method shows promising results and can be a valuable tool in monitoring floods and droughts.

Hydrological Modeling for Water Resource Management in Data-Scarce Regions: A Case Study of the Upper Ziz Basin, Morocco

Zouhir Dichane*†[1], Abdelah Oumou[1], Anas El Ouali[2], Abdelhadi El Ouali[1], Ali Essahlaoui[1], Ann Van Griensven[3,4], and Anton Van Rompaey[5]

[1] *Geoengineering and Environment Laboratory, Research Group "Water Sciences and EnvironmentEngineering" – Geology Department, Faculty of Sciences, Moulay Ismail University, Zitoune, MeknesBP 11201, Morocco*

2Functional Ecology and Environmental Engineering Laboratory – Faculty of Science and Technology, Sidi Mohamed Ben Abdellah University, Fez BP 2202, Morocco

[3] *Water Resources and Ecosystems Department – IHE Delft Institute for Water Education, 2611 AX Delft, Netherlands*

[4] *Hydrology and Hydraulic Engineering Department – Vrije Universiteit Brussels (VUB), 1050 Brussels,Belgium*

[5] *Geography and Tourism Research Group, Earth and Environmental Science Department, KU Leuven – Celestijnenlaan 200E, 3001 Heverlee, Belgium*

Abstract: Multiple conceptual hydrological models, namely IHACRES, MORDOR, GR4J, and GR2M, are applied in this work to predict the discharge at the Upper Ziz basin's outflowin southeast Morocco. Due to the limited number of rain stations, daily models were onlyapplied to the sub-basin of Foum Tillicht to reduce precipitation spatialization error. The monthly model GR2M, however, was applied to the larger sub-basin of Foum Zaabel using the monthly time series from 2000 to 2014. For the daily models' calibration and validation, the time frames ranged from 2000 to 2016; for the monthly models, they ranged from 2000 to 2014. It was found that as the beds are shifting from one event to another, flow estimations made using rating curves are questionable. However, the monthly measurements appear to be accurate, as is demonstrated by the monthly model's successful replication of the observed discharge, notably for the Foum Zaabel station, which is regarded as the reference station. The monthly model performed the best, with an NSE of 80% and 77% for the calibration and validation periods, respectively. These results highlight the importance of conceptual hydrological models as useful tools for the integrated management of water resources in areas with limited data. Particularly, the successful implementation of the monthly GR2M model demonstrates its potential as a trust-worthy and efficient method of runoff prediction. As a result, using conceptual models in combination with other data sources can be extremely important for ensuring the sustainablemanagement of water resources in places such as the Upper Ziz basin.

Keywords: Rainfall, runoff, Oued Ziz, water management, GR2M, GR4J

Agriculture & Energy

Exploring Plant Growth-Promoting Rhizobacteria in the Date Palm Tree Rhizosphere of Southern Morocco's Oasis Ecosystem

Ahlam Mbarki*[1,2], Taha Chouati[2,3], Bahia Rached[2,4], Mohammed Ajdig[1,2], Lahcen Ouchari[1,2], Abdelkarim Filali-Maltouf[1], Chouhra Talbi[1], Elmostafa El Fahime[2,3], and Marouane Melloul[†1,2]

[1]*Laboratory of Microbiology and Molecular Biology, Center of Plant and Microbial Biotechnology, Biodiversity and Environment, Faculty of Sciences, Mohammed V University, Rabat, Morocco*

[2]*Functional Genomic Platform/National Centre for Scientific and Technical Research (CNRST), Rabat, Morocco*

[3]*Genomic Center for Human Pathologies (GENOPATH), Faculty of Medicine and Pharmacy, Mohammed V University, Rabat, Morocco*

[4]*Laboratory of Chemistry-Physics and Biotechnology of Biomolecules and Materials, Faculty of Science and Technology, Mohammedia, Morocco*

Abstract: In arid and semi-arid regions, sustainable agriculture is challenging due to limited wa- ter availability, high temperatures, and soil salinity. Plant growth-promoting rhizobacteria (PGPR) can potentially alleviate these challenges by enhancing plant growth and mitigating the impact of biotic and abiotic stresses. This study aimed to explore the potential of PGPR in the date palm tree rhizosphere of southern Morocco's oasis ecosystem. 98 bacterial strains were isolated and screened for their morphological and physico-chemical properties, including tolerance to high temperature, pH, salinity, and drought stress. Results showed that 74 (76 %) strains were thermotolerant (55 C), 94 (96%) strains were tolerant to a 10% concentration of NaCl and 68 (70%) were tolerant to a 15% concentration of NaCl. Regarding pH tolerance, 84 (85%) strains were acid tolerant, and 90 (92%) strains were ba-sic tolerant. Under osmotic stress concentrations, applied with 55% of D-sorbitol, 5 isolates (5%) were categorized as highly sensitive, 3 (3%) as sensitive, 31 (32%) as tolerant, and 59 (60%) as highly tolerant. These results suggest that the rhizospheric bacterial strains can thrive in the harsh environment of the oasis, and can help enhance plant growth in arid and semi-arid regions, where water is a limiting factor. Building on these initial screening results, the study will further investigate the plant growth- promoting and biocontrol traits of the selected PGPR candidates. Specifically, the study will investigate nutrient solubilization, production of secondary metabolites, and enzymes. These traits can have a significant impact on plant growth and health. This work highlights the potential use of plant growth-promoting rhizobacteria (PGPR) from date palm trees in southeastern Morocco's oasis ecosystem for sustainable agriculture practices in arid and semi-arid regions. The study's findings could help enhance crop pro-ductivity, improve soil health, and mitigate the impact of biotic and abiotic stresses on agriculture. Future research will focus on investigating the mechanisms of action of selected PGPR candidates and their interactions with the plant and soil microbiome.

Keywords: PGPR, date palm, biocontrol, salinity, drought

Nematicidal activity of Moringa oleifera and Chamaemelum nobile against citrus nematode Tylenchulus semipenetrans

Btissam Zoubi*[1,2], Fouad Mokrini[3], Abdelilah Iraqi Housseini[1], and Ahmed Qaddoury[2]

[1]*Laboratory of Biotechnology, Environment, Agri-Food and Health, Faculty of Sciences Dhar El Mahraz, Fez, USMBA. – Morocco*

[2]*Agro-Biotechnology and Bioengineering Laboratory, UCA, Marrakech – Morocco*

[3]*National Institute for Agricultural Research, CRRA-Rabat, Biotechnology Unit, Rabat – Morocco*

Abstract: Tylenchulus semipenetrans is among the most damaging obligate plant parasitic nema- todes (PPNs) in citrus. The use of chemical nematicides have successfully been used to lower down the population of T. semipenetrans, but the repetitive use of these compounds can be environmentally harmful requiring the implementation of ecological strategies. The present study aimed at assessing the biological control potential of essential Oils (EOs) of two aromatic and medicinal plants (AMP), Moringa oleifera and Chamaemelum nobile, against the citrus nematode T. semipenetrans in terms of juvenile J2 mortality and eggs hatch inhibition. Obtained results showed that the both EOs exhibited high toxicity against T. semipenetrans. At low EOs concentration (5 µl/ml), the percentage of J2 mortality ranged from 5.78% to 11.9% recorded in Moringa oleifera and Chamaemelum nobile, respectively, after 24h of incubation. However, at high EOs concentration (20 µl/ml), J2 mortality reached 100% after 96 h for both EOs. Eggs hatch inhibition increased with increasing EOs concentration and incubation period reaching complete eggs hatch inhibition after 144h of incubation at EOs concentration of 20 µl/ml. As a result of this study, EOs of the AMP studied, could be used as healthy nematicidal products that are highly effective against T. semipenetrans.

Keywords: Citrus nematode, Tylenchulus semipenetrans, Plant Essential Oil, Healthy nematicide.

EVALUATION DES IMPACTS DU CHANGEMENT CLIMATIQUE SUR LE NEXUS WEF"

Ghizlane El Majdoubi*[1]

[1] *UAE Tétouan – https://www.uae.ma/website/fr, Morocco*

Abstract: L'eau, l''energie et l'alimentation sont les trois composantes fondamentales de toute 'economie. Elles ne sont pas ind'ependantes l'une de l'autre. NEXUS WEF (Eau, énergie et sécurité alimentaire) a pour objectif de créer des synergies entre les secteurs et les ressources pour une gestion intégrée de l'ensemble et la réalisation d'une croissance inclusive et durable. Cette démarche est conçue pour évaluer aussi comment la production et l'utilisation de ces ressources peuvent contribuer au changement climatique,et comment le changement climatique peut affecter les systèmes de ressources. Un certain nombre d'interdépendances cruciales et sectorielles font l'objet d'une étude au Maroc que ce soit en raison des limites des ressources en eau, en énergie ou de la pénurie alimentaire en période de sècheresse. Les ressources en eau sont très vulnérables aux changements climatiques générant la chute des eaux pluviales et l'augmentation de la fréquence des événements extrêmes (crues, inonda- tions et sécheresses). L'agriculture est le secteur le plus dépendant des ressources hydriques, notamment, l'alimentation. La demande en énergie dans l'agriculture (par exemple, pour le pompage de l'eau) est également en forte augmentation et reste principalement satisfaite par les ressources fossiles, dont notre pays est un principal importateur. L'utilisation rationnelde l'eau et de l'énergie est cruciale à la sécurité alimentaire. Par notre travail, nous visons à clarifier les liens de fonctionnement entre ces systèmes et leurs interactions par le biais des modèles de systèmes climatiques, d'utilisation des ter- res, d'énergie et d'eau (CLEW). Nous évaluons la façon dont l'approche NEXUS est conçue pour maximiser les synergies et réduire les compromis, et améliorer l'efficience des ressources.

Keywords: Nexus WEF, Changement climatique, CLEW, Eau, Energie, Sécurité alimentaire

CHARACTERIZATION OF ZIZIPHUS LOTUS' ACTIVATED CARBON: ISOTHERMAL STUDY AND METHYLENE BLUE'S ADSORPTION KINETICS

Ibrahim Touzani*[†1,2], Kawtar Fikri Benbrahim*[‡2], and Otmane Boudouch*[3]

[1]*Laboratory of Microbial Biotechnology and Bioactive Molecules, Sciences and Technologies Faculty,Sidi Mohamed Ben Abdellah University, P.O. Box 2202, Fez, Morocco*

[2]*Laboratory of Microbial Biotechnology and Bioactive Molecules, Sciences and Technologies Faculty, Sidi Mohamed Ben Abdellah University, P.O. Box 2202, Fez, Morocco*

[3]*Environmental Agro-Industrial Processes team, Sciences and Technologies Faculty, Sultan MoulaySlimane University, P. O. Box 523, Beni-Mellal, Morocco*

Abstract: This study aims to prepare activated carbon from the cores of this interesting biomaterial,for the first time to the best of our knowledge, according to a manufacturing process based on its chemical and thermal activation. The cores of Ziziphus lotus (Nbeg) were chemically activated by sulfuric acid (H2SO4, 98%) for 24h with a mass contribution (1:1), and then carbonized at a temperature of 500 C for 2 hours. The obtained activated carbon was characterized by scanning electron microscopy, X-ray diffraction, Fourier transform infrared spectroscopy and specific surface measurement. The characterization results showed an important porosity (pore sizes ranging from 10 to 45µm), a surface structure having acid groups and carboxylic functions, and a specific surface of 749.6 m^2/g. Results of the MB adsorption showed that this process is very fast as more than 80% of MB is adsorbed during the first 20 minutes. In addition, increasing the contact time and temperature improves the MB removal process efficiency. Moreover, this adsorption's kinetic modeling follows the pseudo-second order model. Furthermore, Data on the adsorption isotherm showed a maximum adsorp- tion capacity of 14.493 mg/g and fit better with the Langmuir model. The thermodynamic parameters (G0, S0 and H0), indicate that the adsorption process is endothermic and spon- taneous. Therefore, Ziziphus lotus can be used as a low-cost available material to prepare a high quality activated carbon having a promising potential in the wastewater treatment.

Keywords: Adsorption, activated carbon, kinetics, methylene blue, isotherm.

Potential of rhizobacteria isolated from Opuntia ficus- indica in improving plant growth and resistance to water stress

Ilham Zouitane*[1], Mohamed Ferioun[1,2], Khawla Bouamri[1], Hicham Oukfi[1], Khalid Derraz[3], Saad Ibnsouda Koraichi[1], and El Ghachtouli Naïma[†1]

[1]*Laboratory of Microbial Biotechnology and Bioactive Molecules, Sciences and Technology Faculty, SidiMohamed Ben Abdellah University, Fez, Morocco. – Morocco*

[2]*Laboratory of Natural Resources and Environment. Polydisciplinary faculty of Taza, Sidi Mohamed Ben Abdellah University, Taza, Morocco. – Morocco*

[3]*Laboratory of Functional Ecology and Environment, Sciences and Technology Faculty, Sidi MohamedBen Abdellah University, Fez, Morocco. – Morocco*

Abstract: Researchers have projected that droughts would become more severe and frequent world-wide as a result of global warming. This problem is a limiting factor for agricultural output. A creative way to deal with abiotic stress is plants inoculation with plant growth-promoting rhizobacteria (PGPR). The major goal of this work is to find bacteria that can boost plant growth under both normal and severe circumstances by having PGP potential and being resistant to water stress. Thus, 75 bacteria were isolated from O. ficus- indica's rhizosphere. These isolates were tested for resistance to various degrees of water stress caused by polyethy- lene glycol 6000 as well as for PGP trait characterization using a variety of in vitro methods. The findings showed that the bacterial isolates displayed different PGP traits. 21.33% of the isolates exhibited organic phosphate solubilization, 60% were capable of fixing atmospheric nitrogen, 62.66% produced ammonia and demonstrated antagonistic activity against thephytopathogenic fungus Fusarium solani, and 73.33% produced siderophores. Other abili- ties included the ability to produce hydrocyanic acid (22.66%), indole acetic acid (45.33%) and exo-polysaccharides (52%). The findings also revealed varying degrees of resistance to water stress, with variances amongst isolates (30.67% of the isolates were susceptible to waterstress, while 17.33%, 26.67%, 14.67%, and 10.66% exhibited resistance to osmotic pressures of -0.05, -0.15, -0.49, and -1.76 MPa, respectively). The results were statistically analyzed, and 26 possibly effective isolates were chosen. The rhizospheric bacteria discovered in this study show intriguing potential for application as inoculants for enhancing the development of plants, including O. ficus-indica, in a variety of environmental conditions.

Keywords: Opuntia ficus indica, Plant growth promoting rhizobacteria (PGPR), growth promotion,rhizosphere, water stress

SYNTHESIS AND CHARACTERIZATION OF ACTIVATED CARBON DERIVED FROM OLIVE POMACE FOR LI-ION BATTERIES

Imad Alouiz*[1], Mohamed Aqil[2], Mouad Dahbi*[2], Mohamed Yassine Amarouch*[1], and Driss Mazouzi*[1]

[1]*R.N.E Laboratory, Multidisciplinary Faculty of Taza, University Sidi Mohamed Ben Abdellah, Fez,Morocco. – Morocco*

[2]*Materials Science and Nanoengineering Department, Mohamed VI Polytechnic University, Lot 660 –Hay Moulay Rachid, Benguerir, 43150, Morocco – Morocco*

Abstract: L'obtention de matériaux d'électrodes en carbone à partir de ressources de biomasse a suscité l'intérêt des chercheurs pour le développement durable de dispositifs de stockage d'énergie électrochimiques à haute performance. Dans ce travail, le grignon d'olive est utilisé comme matière première abondante pour préparer des anodes en carbone dur pour les bat- teries Li-ion grâce à un processus en deux étapes : activation chimique par l'acide phospho- rique H3PO4 comme agent d'activation et suivie d'une pyrolyse à 500 C. Les échantillons electroniques ont été caractérisés et testés comme électrode négative pour batteries li-ion afin d'étudier l'influence de l'activation chimique et de l'étape de pyrolyse sur les propriétés du carbone dur et sur leurs performances chimiques.Les électrodes en grignons d'olive crus et activées ont fourni une capacité réversible de 57 mAh/g et une rétention de capacité de 84% après 25 cycles, et pour l'électrode de carbone pyrolysé, les résultats électrochimiques sont encore au stade expérimental du cyclage pour déterminer la capacité de charge et de décharge. Par conséquent, une telle valorisation des grignons d'olive qui reste disponible et sous-utilisée, est susceptible de susciter l'intérêt des différentes filières industrielles, ce qui peut contribuer à la protection de l'environnement et à la maîtrise de l'énergie .

Keywords: olive pomace, hard carbon, anode, Li, ion batteries.

Determination of the optimal fertilization rate by a new bioorganic fertilizer to enhance the nitrate and betanin contents in red beetroot (Beta vulgaris L. ssp. vulgaris)

Khadija Atfaoui*[†1], Karima El Kabous[2], Fatima Ebich[3], Abdessamad Ettouil[4], and Mohammed Ouhssine[4]

[1]*Laboratory of Natural Resources and Sustainable Development – Faculty of Sciences.Ibn Tofail University. P.O. Box: 242. Kenitra,/Morocco., Morocco*

[2]*Laboratory of Natural Resources and Sustainable Development – Faculty of Sciences.Ibn Tofail University. P.O. Box: 242. Kenitra,/Morocco., Morocco*

[3]*Laboratory of Agroresources, Polymer and Process Engineering, Faculty of Sciences, University Ibn Tofail, B, P14000 Kenitra, Morocco – Morocco*

[4]*Laboratory of Natural Resources and Sustainable Development – Faculty of Sciences.Ibn Tofail University. P.O. Box: 242. Kenitra,/Morocco., Morocco*

Abstract: The aim of this research was to investigate the effect of different rates of a new bioorganic fertilizer on nitrate and betanin contents in red beetroot. A field trial was conducted using the randomized complete block design with 6 treatments and six replications: (T1= inorganic fertilizer, NPK 20-45-25 ha–1, T2= Bio-Organic Fertilizer "BOF" at 10%, T3= BOF at 20%, T4= BOF at 30%, T5= BOF at 60% and T6= unfertilized control). The nitrate content of harvested red beetroot was analytically measured, while the quantification of batanin was determined spectrophotometrically. Statistical analysis of soils treated with 20 and 30% of BOF significantly ($p < 0.05$) increased the betanin contents of red beetroot by 16 % compared to the conventionally grown samples. In contrast, organically and conventionally growing red beetroot had similar average nitrate levels. In light of the crucial role of BOF rates, high levels of macro and micronutrients in the soil negatively affect all quality parameters of red beetroot.

Keywords: bioorganic fertilizer, red beetroot, betanin, nitrate

Comparative study of functional activity and microorganism's community in agro ecological and conventional soil of tomato crops

Khawla Bouamri*[†1], Hicham Oukfi[1], Ilham Zouitane[1], Said Louahlia[2], Rachid Bouamri[3],Khalid Derazz[1], Saad Ibnsouda[1], and Naima El Ghachtouli[1]

[1]*Sidi Mohamed Ben Abdellah University, Faculty of science and technology of Fez, Morocco – Morocco*

[2]*Sidi Mohamed Ben Abdellah University, Polydisciplinary Faculty of Taza, Morocco – Morocco*

[3]*National School of Agriculture Meknes, Department of Plant and Environment Protection, Morocco –Morocco*

Abstract: Land management practices are widely known to influence soil quantity. In this ecosys- tem, telluric microorganisms participate in the biogeochemical cycles of the soil, in particular the transformation of organic matter essential for plant nutrition. The aim of this study was to assess the differences in the functional diversity and structure of microbial communi- ties of soil from two different cultures of tomato plants in Morocco, one with conventional management and the other with agroecological practices. The soil functional diversity was assessed by evaluating the microbial metabolic capabilities using the Biolog EcoPlate™ mi- croplate method and measuring soil enzyme activities. The microbial biomass of bacteria, actinomycetes, and fungi was evaluated by medium-based cultures. The analysis demonstrated that the soil microbial community reacts differently depending on the mode of fer- tilization. Recording, the biological soil exhibited a significantly upright metabolic activity (AWCD) and diversity compared with the conventional soil. Similarly, the soil activities of b-galactosidase, urease, and phosphatase and the number of bacteria, actinomycetes, and fungi were higher in the agroecological soil.

Keywords: Tomato, functional diversity, enzyme activity, soil management.

Isolement et identification de bact´eries issues de la rhizosph`ere de l'olivier du sud du Maroc : Tol´erance au stress hydrique, favorisation de la croissance des plantes et potentiel antagoniste contre la verticilliose

Mohammed Ajdig*[1,2], Taha Chouati[2,3], Bahia Rached[2,4], Ahlam Mbarki[1,2], Lahcen Ouchari[1,2], Abdelkarim Filali-Maltouf[1], Chouhra Talbi[1], Elmostafa El Fahime[2,3], and Marouane Melloul[†1,2]

[1] *Faculté des Sciences - Rabat (FSR) – 4 Avenue Ibn Batouta BP 1014 RP, RABAT, Morocco* [2] *Centre National pour la Recherche Scientifique et Technique (CNRST) – Angle avenues des FAR etAllal El Fassi, Hay Ryad, B.P. 8027 N.U, Rabat 10102, Morocco*

[3] *Faculté de médecine et de pharmacie - Rabat (FMP-Rabat) – Avenue Mohammed Belarabi Elalaoui BP 6203, Morocco*

[4] *Faculté des Sciences et Techniques - Mohammedia (FST-Mohammedia) – BP 146 Mohammedia 28806 Maroc, Morocco*

Abstract: Récemment, au vu des problèmes environnementaux mondiaux, la production alimen- taire durable est apparue comme un défi important. L'utilisation des rhizobactéries dans le biocontrôle et la médiation du stress abiotique est une approche prometteuse et de plus en plus explorée. L'objectif de cette étude est d'isoler, de caractériser et d'identifier des rhizobactéries favorisant la croissance des plantes (PGPR) tolérantes au stress abiotique et possédant une activité antagoniste contre Verticillium dahliae Klebahn, l'agent causal de la verticilliose de l'olivier. Au total, 94 souches bactériennes rhizosphériques ont été isolées de la rhizosphère d'oliviers dans la région de Zagora au Maroc. Vingt-quatre isolats ont montré, au cours de la phase de sélection, capables d'inhiber significativement la croissance du champignon in vitro. En outre, ces isolats tolèrent bien la croissance face à trois princi- paux stress abiotiques : sécheresse (Aw 0,91), salinité (10% NaCl) et haute température ((55 C). Également, des caractéristiques PGP ont été révélées, telles que la solubilisation de phosphate ainsi que la production significative de sidérophores, d'acide indole-3-acétique (IAA) et d'enzymes protéases et lipases. Grâce à l'analyse des séquences de l'ADNr 16S et la MLST (Multi-Locus Sequence Typing), trois isolats identifiés comme étant Bacillus paranthracis (OZ-60) et Bacillus paralicheniformis (OZ-48 et OZ-77) ont montrée des taux les plus élevés en termes de tolérance au stress, de propriétés PGP et d'activité antagoniste. Ces isolats pourraient être utiles en tant qu'approche écologique pour soutenir la durabilité de l'agriculture oléicole. Cependant, des études utilisant ces souches comme des inoculants afin de vérifier leur efficacité in situ sont nécessaires.

Keywords: Stress abiotique, Rhizosphère, PGPR, Verticillium dahliae, ARNr 16S, MLST

Update of the list of medicinal plants traditionally used in the Province of Alhoceima

M. LAHMASS[1], FZ. ELABOUI[1], I. GHABBOUR[1], M. LAGHMARI[1], T.BENALI[1], A. KHABBACH[2] & K. HAMMANI[1]*

1- Natural Resources and Environment Laboratory, Polydisciplinary Faculty of Taza, Sidi Mohamed Ben AbdellahUniversity, Fez, Morocco
2- Biotechnology, conservation and Valorization of Natural Resources Laboratory, Faculty of Sciences Dhar El Mahraz, Sidi Mohamed Ben Abdellah University, Fez, Morocco

**Email : lahmass.mouad@gmail.com*

Abstrat: Morocco is a country with a long history of traditional knowledge. The vast majority of rural populations use medicinal plants as remedies for diseases. The medicinal and aromatic plants (MAPs) present real opportunities for development based on socio-economic valorization as local resources. the province of alhoceima localized in the north of morocco (Rif), is an interesting region rich in MAPs of which tribe of Beni Ouriaghel is a part. Thus, a recent survey was conducted in the Rif Beni Ouriaghel (region of Al'Hoceima), among the rural population, between June / 2022 and March / 2023, with the aim of carrying out an inventory of medicinal plants and a collection of information relating to their therapeutic uses using a questionnaire. The series of visits carried out made it possible to inventory 70 species belonging to 34 floristic families with a predominance of the following families: Lamiaceae (44%), Asteraceae (8%), and Apiaceae (5%). 70 species are used to fight different pathologies: the digestive system (10%), Colds (8%), Influenza (8%). The leaves (54%), the stems (12%) and the aerial part (8%) are the main parts used to prepare the recipes. Alone or in combination, these parts are involved in the development of recipes by processes mainly using decoction (45%), infusion (35%) and powder (6%). The products obtained are administered mainly orally (82%) and by external applications represent 12%.

Keywords : Ethnobotanical survey, pharmacologic benefits, Rif, valorization, MAPs.

Comparative analyzes of activated carbons based on different agricultural by-products

B. MOUHSSINE*, I. ALOUIZ, M. AMAROUCH, M. SENNOUNE & D. MAZOUZI

1- Laboratory, Affiliation, City, Country Natural Resources and Environment Laboratory, Polydisciplinary Faculty of Taza Sidi Mohamed Ben Abdellah University
**Email: benhadj.mouhssine@gmail.com*

Abstract: Activated carbon is considered the most efficient adsorbent of major industrial importance due to its high surface area and variable surface chemistry characteristics. However, the application of commercially available activated carbon has been limited because it is mainly derived from wood and coal. Wood and coal are natural and expensive resources. Therefore, much attention has been given to the efficient use of locally available and less expensive raw materials, from an economic and environmental point of view. Agricultural wastes and by-products are good candidates as they are renewable and inexpensive sources. The purpose of the present study is to elaborate on different activated carbon based on the straws of durum wheat, soft wheat, and barley, also Ammi visnaga, and Scolymus hispanicus, like precursors, in order to compare them. To do this, we chose the chemical activation method using phosphoric acid (H_3PO_4) as the activating agent. The biomass samples were characterized in terms of their component analysis, constituents and proximate analysis, bulk and particle densities were also carried out for the adsorbents. The results suggest of physicochemical characterizations such as infrared analysis, scanning electron microscopy, and X-ray diffraction, suggest that, the prepared activated carbons has an outer surface full of cavities and has shown to be a promising adsorbent for the removal of organic pollutants.

Keywords: activated carbon, adsorbent, durum wheat straw, soft wheat straw, barley straw, Ammi visnaga, Scolymus hispanicus.

Assessing Seasonal Variations in Water Status and Pigment Content of Tetraclinis Articulata (Vahl) Master Across a climatic gradient

Touaf Mourad[1], Nait Douch Aicha[1], El Asbahani Abdelhafid[2], Hssaissoun Mohamed[3], Boutaleb Said[3], Boukhalef Laila[1], Ain-Lhout Fatima[1].

[1]Equipe d'Ecologie et Sciences de l'Environnement, Faculté des Sciences Appliquées, Université Ibn Zohr, Azrou 86153, Morocco
[2] Laboratoire de Chimie Appliquée et Environnement, Faculté des Sciences, Université Ibn Zohr, Agadir 80000, Morocco
[3]Laboratoire de Géologie appliquée et de géo-environnement, Université Ibn Zohr, Agadir 80000.

Abstract: Tetraclinis Articulata (Vahl) Master is an endemic tree of the western Mediterranean region. In Morocco, this tree has an important socioeconomic interest since it is used in several areas extending from carpentry to pharmacy and folk medicine. Despite its significant socioeconomic role, T. articulata is suffering a pronounced fragmentation of its habitat. Indeed, the distribution area went from 900000 hectares in 1984 to 566000 hectares in 2016. Climate change has become evident in Morocco. Specifically, a half-century decreases in annual precipitations. To better understand the effect of climate alteration on the T. articulata we conducted a comparative field experiment to assess seasonal variations of relative water content (RWC), and pigment content along a latitudinal gradient from north to south, ranging from Sub-humid to sub-Saharan climates. From a temporal sense, the lowest values of RWC, total chlorophyll, and chla/b ratio were detected during the spring and summer seasons, while autumn and winter showed the highest values in almost all the studied sites. Comparing sites from north to south, the populations from the north show maximal values of chlorophyll and carotenoid content. In contrast, chla/b and car/chla+b values were more seasons dependent regardless of the tree's sites. Our results indicate that all populations exhibit similar tree behavior in response to climatic conditions (such as higher temperatures and water deficit). Notably, the southern populations of T. articulata appear to be more affected than the northern populations. Our study is preliminary Work, and additional ecophysiological investigations are needed to further understand the impact of climate change on the T. articulata populations.

Keywords: Relative water content; Total chlorophyll; Carotenoids; Drought.

Influence of extraction method on the yield and chemical composition of olive leaf extracts from three Moroccan varieties

Rachid Boulfia*[1], Mohammed Elmeknassia[†2], and Yahia Rharrabti[‡2]

[1]*Natural Ressources and Environment Laboratory, Polydisciplinary Faculty of Taza, Sidi Mohamed BenAbdellah university – Morocco*

[2]*Natural Resources and Environment laboratory, Polydisciplinary Faculty of Taza, Sidi Mohamed Ben Abdellah University – Morocco*

Abstract: Olive leaves are considered to be a promising source of natural bioactive compounds suchas polyphenols or flavonoids. The extraction of high-added value products is an issue of great interest with regard to their exploitation in food sustainability and circular economy. How- ever, the content of these compounds can differ between varieties and extraction methods. In the present work, dried leaves from three Moroccan olive varieties (Moroccan Picholine, Haouzia, and Menara) were subjected to two extraction processes (maceration and Soxhlet) in order to be evaluated and compared towards the selective recovery of three bioactive com-pounds: total polyphenols, flavonoids, and condensed tannins. The results showed that the extraction yield obtained by the Soxhlet method ranged from 311.7 g/kg to 360.4 g/kg of dry olive leaves. As for the maceration method, the yield changedbetween 128.4 g/kg and 272.7 g/kg of dry olive leaves. The superiority of extraction yield from Soxhlet in comparison to maceration could be attributed to higher temperatures usedin Soxhlet equipment. Analyses of variance for the three bioactive compounds revealed that the extraction method was the most important source of data variability. Mean comparisons among varieties using the Duncan test indicated that Moroccan Picholine exhibited the highest values for total polyphenols and flavonoids. Haouzia recorded the lowest value for condensed tannins while Menara had the lowest score for flavonoids. Between extraction methods, Duncan's test revealed that the maceration method allowed the release of higher amounts of polyphenols and tannins while leaf extracts obtained by Soxhlet registered the highest flavonoid content.

Keywords: Bioactive compounds, olive leaves, Soxhlet, maceration

Effect of Cadmium Stress on Flag Leaf Morpho-Physiological Traits in Hulless Barely Developed in North Africa

Said Bouhraoua*[1], Mohamed Ferioun[1], Nassira Srhiouar[1], Abdelali Boussakouran[1], Douae Belahcen[1], and Said Louahlia[1]

[1]*Natural Ressources and Environment Laboratory, Polydisciplinary Faculty of Taza,Sidi Mohamed BenAbdellah university (LRNE) – Morocco*

Abstract: In North Africa, barley (Hordeum vulgare L) is the second most cultivated cereal. In Morocco, barley is cultivated in mining sites with potential Cadmium (Cd) soil pollution, which its growth and yield can be negatively affected. Cd is a heavy metal pollutant, knownis one of the most serious contaminants to accumulate in the soil, and water due to var- ious anthropogenic activities. Cadmium toxicity decreases nutrients and water absorption and translocation, increases oxidative damage, affects the metabolism of plants, and in- hibits plant morphology and physiology. This experiment was carried to study the effects of different concentrations of Cd (0, 15, 30 mg kg-1) in the flag leaf of three North Africa hulless barley varieties: Assiya (Morroco), Tombari (Tunisia), and Giza130 (Egypt). Several morphological and physiological parameters were measured at vegetative stage including: Flag leaf length (FLL), Flag leaf width (FLW), Flag leaf area (FLA), Flag leaf dry weight (FLDW), water relative content (RWC), total chlorophyll content (SPAD), and Fluorescence (Fv/Fm). ANOVA analysis showed that all morphological traits (except for FLDW) were primarily affected by the variety effect (62% of total variance). In contrast, physiological traits were controlled to a large extent by the treatment of Cd (90% of total variance). Moreover, the interaction between the two factors was in general of lower importance. Com- parison among varieties showed significant differences for all traits. In fact, the Moroccan variety (Assiya) displayed the highest values for physiological and morphological parameters. Concerning treatment effect, we noticed a general decrease in values of all traits from the control (0 mg kg-1) to stress 1 (15 mg kg-1) and stress 2 (30 mg kg-1).

Keywords: Cadmium, Hulless barley, Hordeum vulgare L, North Africa, Flag leaf

Modes of Action of Biocontrol Agents and Elicitors for sustainable Protection against Bacterial Canker of Tomato

Salma Benchlih*[1,2,3], Qassim Esmaeel[2], Kamal Aberkani[3], Abdessalem Tahiri[1], Zineb Belabess[4], Rachid Lahlali[†1], and Essaid Ait Barka[‡2]

[1] *Ecole Nationale d'Agriculture de Meknès (ENA) – Meknès, Morocco*

[2] *Université de Reims Champagne-Ardenne (URCA) – Laboratoire Résistance Induite et Bioprotection des Plantes – 2 avenue Robert Schuman, 51100 Reims., France*

[3] *Université Mohamed 1 Oujda MAROC – Morocco*

[4] *Institut National de Recherche Agronomique Meknes – Morocco*

Abstract: Tomato is one of the world's most commonly grown and consumed vegetables. However, it can be attacked by the Gram-positive bacterium Clavibacter michiganensis subsp. michi- ganensis (Cmm), which causes bacterial canker on tomato plants, resulting in significant financial losses in field production and greenhouses worldwide. The current management strategies rely principally on the application of various chemical pesticides and antibiotics, which represent a real danger to the environment and human safety. Plant growth-promoting rhizobacteria (PGPR) have emerged as an attractive alternative to agrochemical crop pro- tection methods. PGPR act through several mechanisms to support plant growth and per- formance, while also preventing pathogen infection. we discuss the importance of bacterial canker disease and the pathogenicity of Cmm. We emphasize the application of PGPR asan ecological and cost-effective approach to the biocontrol of Cmm, specifying the complex modes of biocontrol agents (BCAs), and presenting their direct/indirect mechanisms of ac- tion that enable them to effectively protect tomato crops. Herein, we further discuss elicitors as a new management strategy to control Cmm, which are found to be highly effective in stimulating the plant immune system, decreasing disease severity, and minimizing pesticide use.

Keywords: bacterial canker, C michiganensis subsp. michiganensis, biocontrol, plant growth pro-moting rhizobacteria, elicitors, sustainable agriculture

Agroecological concepts and alternatives to the problems of contemporary agriculture: Monoculture and chemical fertilization in the context of climate change

Y. ELOUATTASSI[1,2,3]*, M. FERIOUN[3] & N. EL GHACHTOULI[3], K. DERRAZ[1], F. RACHIDI[2]

1-Laboratory of Functional Ecology and Environmental Engineering, Department of Biology, Faculty of Sciences and Technique Fez, Université Sidi Mohamed Ben Abdellah, Fez, Morocco
2- Department of Plant and Environment Protection, National School of Agriculture, Meknes, Morocco
3- Microbial biotechnology laboratory, Faculty of Sciences and Technique Fez, Université Sidi Mohamed Ben Abdellah, Fez-Morocco.
**Email : Yasmina.Elouattassi@gmail.com*

Abstrat: The modernization of agriculture has transformed natural agrarian systems into other new conventional ones, making it possible to exponentially increase agricultural production. This leads to the destruction of ecological functions, services, and has negative impacts on human health. This critical situation has given rise to a new model of agriculture called agroecology, which has emerged as a systemic approach that can understand the practices of traditional agricultural systems, as a scientific discipline that defines, classifies and studies agrosystems from an ecological and socio-economic point of view. This paper explores the major problems of agriculture, including climate change, monoculture, and chemical fertilization at the local, regional and global scale. Equally, we defined the different concepts that bring together the agroecological approach. We based on agroecology as a scientific discipline, as a practice by defining the different agroecological practices and their scale of application, as well as the politico-economic aspect of this concept. Further, we have proposed the agroecological alternatives that can remedy the three problems recorded in the first section, based on several recent studies and research that can examine whether agroecological practices have positive results on monoculture, chemical fertilization, and climate changes. However, more advanced studies, using rigorous research design, such as case controls, longitudinal studies, and surveys in regions where agriculture is their main source of income, such as Morocco, are still needed. These investigations are suggested to fill the gap of data on such areas and fields of research.

Keywords : Agriculture, agroecology, agroecosystem, chemical fertilization, climate change, monoculture.

Agriculture

SITE EFFECTS ESTIMATION IN A DIFFERENT REGION OF MOROCCO USING THE STANDARD SPECTRAL RATIO

Abderrahim Boulanouar*[†1], Himanshu Mittal[2], Abdelaali Rahmouni[3], Anas El Ouali[4], and Ahmed Zian[5]

[1]*Laboratory of Applied Sciences, National School of Applied Sciences of Al Hoceima, AbdelmalekEssaadi University, Tetuan, Morocco (ENSAH) – Ctre Ait Youssef Ou Ali 32003, Morocco* [2]*National Center for Seismology – Ministry of Earth Sciences, New Delhi, 110003, India., India*

[3]*Laboratory of Solid State Physics, Department of Physics, Faculty of Science – Dhar El Mahraz, SidiMohamed Ben Abdellah University, Fez, Morocco, Morocco*

[4]*Functional Ecology and Environmental Engineering Laboratory, Fez – Sidi Mohamed Ben Abdellah University, Faculty of Science and Technology, Morocco*

[5]*Laboratory of Engineering Sciences and Applications , National School of Applied Sciences of AlHoceima, – National School of Applied Sciences of Al Hoceima, Abdelmalek Essaadi University Tetouan, Morocco, Morocco*

Abstract: Morocco has a varied soil cover, and some areas may have thick sediments that can possibly amplify the earthquake ground motion. Estimates of site effect in Morocco usingthe standard spectral ratio technique are not available to date. The site effects are influencedby a variety of factors, including geology, topography, earthquake magnitude, and distance. The purpose of this article is to evaluate the site effect impacts in a different area in Moroccoby identifying regions exposed to higher levels of ground motion during earthquakes. The seismic local site effects of 12 Picasso Project seismological stations installed in Morocco between 2009 and 2012 are investigated in this paper. The geology of these broadband stations varies from rock formations to soft soils. Based on the geology of the area and the spectral ratio test, the site PM21 has been chosen as the reference site. The results obtained through the conventional spectral ratio method, reveal that the amplification factor varies greatly from one place to another. High amplification is felt at lower frequencies in locations on soil sites, while lower amplification is felt at higher frequencies in locations on stiff orrock sites. These site effects may differ from those computed using horizontal to vertical ratio (HVSR), yet their knowledge is significantly inadequate to assess true nature of ground amplification. The results of this article could be used to analyze seismic risk and construct structures near station sites.

Keywords: Site effect, Morocco, Picasso, earthquake, and spectral ratio method

Foliar analysis: Towards a novel method for estimating nitrogen content in cherry tomato plants using NIRS, Chemometrics, and Machine Learning

Abderrahim Diane*[†1,2], Taoufiq Saffaj[1], Bouchaib Ihssane[1,3], and Reda Rabie[1,2]

[1] *University Sidi Mohamed Ben Abdellah, Faculty of Sciences and Techniques of Fez, Laboratory ofApplied Organic Chemistry, Fez, Morocco – Morocco*

[2] *Moroccan Foundation for Advanced Science, Innovation Research (MAScIR), Rabat, Morocco – Morocco*

[3] *University Mohammed V, Ecole Normale Supérieure, Physio-Chemical Laboratory of Inorganic and Organique Materials (LPCMIO), Materials Science Center (MSC), Rabat, Morocco – Morocco*

Abstract: Plant health and crop yield are directly affected by the variation in the nutritional statusof the plant during the crop season. Therefore, optimal methods for monitoring the nutritional status of plants should be adopted to maximize their productivity while preserving its health. The primary goal of this study is to present an innovative, low-cost, non-invasive, rapid, and accurate method for monitoring plant nutritional status using leaf tissue analysisas a proxy. The technique combines near-infrared spectroscopy, chemometrics, and machine learning. In this study, several spectral pre-processing and regression algorithms were tested to accurately map the relationship between the spectral signature of plant leaf tissue and its nitrogen content. The method output was highly correlated with the output of the standard wet-chemistry method ($R^2 > 80$), demonstrating that this novel method is reliable andcan be used in smart agriculture as an efficient alternative for within-field monitoring plant nutritional status during the agricultural season.

Keywords: Machine Learning, Chemometrics, NIRS, Nitrogen, Leaf analysis.

Analysis of Phytochemicals in Thymus zygis L. and Salvia officinalis L. from Fez-Meknes region, Morocco

Asmae Benabderrahmane*[1,2], Majid Atmani[3], and Saadia Belmalha[2]

[1]*Laboratory of functional ecology and environmental engineering, faculty of Sciences and Technique, Sidi Mohamed Ben Abdellah University, Fez, Morocco – Fes, Morocco*

[2]*Department of Plant Protection and Environment, National School of Agriculture, Meknes, Morocco –Morocco*

[3]*Laboratory of functional ecology and environmental engineering, faculty of Sciences and Technique, Sidi Mohamed Ben Abdellah University, Fez, Morocco – Morocco*

Abstract: Thymus and Salvia are among the most popular plants both in traditional medicine and in the culinary arts. This study has the aims to detect the chemical composition of the extracts and the powder of Thymus zygis L. (T) and Salvia officinalis L. (S) collected from the Fez-Meknes region. Two extracts were prepared: aqueous and essential oil. Phytochemical tests were performed to qualitatively evaluate the presence or absence of phytoconstituents using standard methods. The essential oils were analyzed by gas chromatography-mass spectrometry (GC/MS). Two powder analyses were performed: Fourier transform infrared spectroscopy (FTIR) analysis and elemental analysis. The drying of both plants took a similar amount of time with a noticeable loss in weight for Salvia. The phytochemical screening revealed the abundant presence of terpenoids, catechic tannins, steroids and sterolsin the two plants. GC/MS analysis showed richness in carvacrol for Thymus zygis L. and in thujone for Salvia officinalis L. The analysis by FTIR showed characteristic peak readings of various functional groups in the powders, citing proteins, aliphatic compounds, carbonyl compounds and aromatic rings. In the elemental analysis, there is a high carbon content for Thymus and Salvia (T: 66.70%, S: 53.34%), followed by oxygen (T: 36.45%, S: 37.88%) andhydrogen (T: 6.08%, S: 5.61%). Altogether, this study highlights the richness of these two species in chemical compounds that can be used in the pharmaceutical industry.

Keywords: Elemental analysis, FTIR, Phytochemical screening, Thymus zygis L., Salvia officinalis

High-Efficiency Adsorption of the resin by the anionic MO dye

A. EL ABBOUDI MARYEM *, B. EL-Housseine Rifi & NABILA ELAZZOUZI

1- Affiliation: Laboratory of Advanced Materials and ProcessEngineering (LAMPE), Department of Chemistry, Faculty of Sciences, Ibn Tofaïl University ,kènitra
Email: *meryelabboudi@gmail.com*

Abstract: In this work, we study the removal of the anionic dye (MO) by adsorption on the resin synthetic polymer. EDX, SEM and FTIR did the characterization of the anion resin. The effects of physicochemical factors on the process adsorption ability of the anionic resin for MO dye, as well theefficiency of the polymer resin, contact time, pH imposed study on the organic solution and initial concentration of organic solution is examined. Experiments revealed that adsorption at a various massare achieved at saturation that corresponds to the complete disappearance of the organic solution. Thebalance is reached at time, pH and temperature optimal.

Keywords: Adsorption, Anionic MO dye, Characterization: FTIR/SEM/EDX, Anionic resin

Microbiological monitoring of the environment using the ”Association Rules” approach in a hospital centre in Morocco

Flouchi Rachid*[1], Abderrahim Elmniai[2], Mohamed El Far[3], Ibrahim Touzani[1], NaoufalEl Hachlafi[1], and Kawtar Fikri-Benbrahim[†1]

[1]*Laboratory of Microbial Biotechnology and Bioactive Molecules, Science and Technologies Faculty, SidiMohamed Ben Abdellah University, Fez, Morocco – Morocco*

[2]*Human Pathology, Biomedicine and Environment Laboratory, Faculty of Medicine and Pharmacy, Sidi Mohamed Ben Abdellah University, Fez, Morocco – Morocco*

[3]*Laboratory of Applied Physics, Computer Science and Statistics Sciences Faculty Dhar El Mahraz,Sidi Mohamed Ben Abdellah University, Fez, Morocco – Morocco*

Abstract: The hospital environment, in particular surfaces and medical devices, constitute a source of contamination for patients and healthcare professionals.This study carried out, to our knowledge, for the first time at the Taza hospital in Morocco aimed to assess the microbi- ological quality of surfaces and medical devices in surgical departments and to assess the disinfection procedure over time and in space. Samples were taken by swab after cleaning the hospital surface or the medical device, to isolate and identify the germs which were in- oculated on semi-selective culture media and then identified by standard biochemical and physiological tests, using Analytical Profile Index Galleries (API). In addition, a model for extracting the rules of association between the sites on the one hand and the germs on the other hand was used for the sampling. The study showed that 83% of the samples were contaminated after the bio-cleaning. The most contaminated departments were male and female surgeries. 62% of the isolated germs were identified as Gram-positive bacteria, 29% as Gram-negative bacteria and 9% as fungi. Regarding the association rule extraction model, a strong association between certain con- taminated sites and the presence of germs was found, such as the association between wall and bedside table and doorknob, which means that the contamination of the wall and bedsidetable is systematically linked to that of the door handle. The evaluation of the effectiveness of the disinfection procedure made it possible to propose renewing it every 4 hours. Microbiological monitoring of surfaces is necessary at the hospital level through the useof the association rule extraction model, which is very important to optimize the scenarios for sampling, cleaning and disinfection of the most contaminated sites. .

Keywords: hospital, microbiology, association rule, germs, surgery

Enhance barley (Hordeum vulgare L.) tolerance to drought stress using plant growth-promoting rhizobacteria (PGPR)

Mohamed Ferioun*[†1,2], Said Bouhraoua[1], Ilham Zouitane[2], Nassira Srhiouar[1], Douae Belahcen[1], Abdelali Boussakouran[1], Said Louahlia[1], and Naima El Ghachtouli[‡2]

[1]*Natural Ressources and Environment Laboratory, Polydisciplinary Faculty of Taza,Sidi Mohamed BenAbdellah university – Morocco*

[2]*Microbial biotechnology and Bioactives Molecules Laboratory, Faculty of Sciances and Techniques,Sidi Mohamed Ben Abdellah university – Morocco*

Abstract: Barley is among the most cultivated cereals in areas suffering water deficit, which impactstheir growth and crop production. Here, we aimed to select plant growth-promoting rhizobacteria (PGPR) that have the potential to enhance barley growth under drought stress. Thus, 15 bacterial isolates were selected for drought tolerance (more than -0.49 MPa) and screenedfor PGP characteristics: phosphate solubilization, production of exopolysaccharides, hydro- gen cyanide, ammonia, siderophores, and indole-3-acetic acid, and enzyme activities such as phosphatase, cellulase, pectinase, and chitinase. The top four isolates (MFC1, MFE3, MFF2, and MFF5) regarding PGP traits were tested on barley plants in irrigated and under drought conditions. The inoculation of barley plants by the isolates increased the indexes of plant tolerance to drought stress, such as shoot dry weight, relative water content, chloro- phyll pigments content, photosynthesis efficiency (Fv/m ratio), and proline content. On the other hand, plant sensitivity indexes such as electrolytes leakage and MDA and hydrogen peroxide contents were decreased. Principal component analysis discriminates clearly be- tween uninoculated and inoculated plants. Indeed, under stressful conditions, MFE3 showed high plant tolerance index values, making it a potent isolate. Our current study showed that the interaction between barley plants and MFE3 might lead to an effective plant-bacteria system under drought stress.

Keywords: plant growth, promoting rhizobacteria (PGPR), barley, Hordeum vulgare, droughtstress

ENHANCING CSP AND PV PLANTS EFFICIENCY WITH A NEW DYNAMIC CLEANING STRATEGY

Mounir Abraim*[1,2], Hicham Ghennioui[1], Mohamed Boujoudar[1,2], Omaima El Alani[1,2],and Abdellatif Ghennioui[1,2]

[1]*Laboratory of Signals, Systems, and Components, Sidi Mohamed Ben Abdellah University – Fez, Morocco*

[2]*Green Energy Park Research Platform (GEP, IRESEN/UM6P) – BenGuerir, Morocco*

Abstract: Many suitable sites for photovoltaic (PV), concentrating solar power (CSP) or hybrid CSP/PV plants are located in arid and semi-arid regions or deserts, where the surfaces of the solar collectors are prone to the accumulation of soiling. Soiling reduces the efficiency of CSP and PV technologies and increases operation and maintenance (O&M) expenses. To mitigate the negative effects of soiling, cleaning is considered the most effective solution. However, the costs incurred for cleaning activities can potentially increase O&M costs and electricity prices. Thus, optimizing the cleaning frequency is necessary to keep the performance of the solar power plant at an acceptable level while reducing cleaning costs. This is especially important for large-scale solar power plants located in areas that suffer from water scarcity. The aim of this study is to provide an effective and reliable approach to facilitate decision making regarding cleaning requirements for PV and CSP projects during the feasibility study phase. This approach is based on real soiling measurements, ground weather data, and economic inputs, providing valuable information on the optimal cleaning frequency and corresponding costs to improve yield prediction and reduce financial risks associated with such projects.

Keywords: Dust accumulation, CSP, PV, Soiling monitoring, Soiling mitigation, Cleaning strategy.

A techno-economic study of battery energy storage systems for grid-scale applications

O. MAHIR[1,2]*, H. GHENNIOUI[1] & A. BENAZZOUZ[2]

1- Laboratory of Signals, Systems, and Components, University Sidi Mohamed Ben Abdellah, Fez, Morocco
2- Green Energy Park, Benguerir, Morocco
**Email : oumaima.mahir@usmba.ac.ma*

Abstrat: The importance of battery systems is growing in the stationary and automotive industries as the world moves toward a more sustainable and renewable energy future. In the automotive industry, battery systems are becoming increasingly important as electric vehicles become more common. The stationary industry is also turning to batteries as a storage solution. As a technology, battery-based energy storage systems (BESS) can enhance the reliability and stability of power systems. Since renewable energy sources, like wind and solar, have been integrated more into the grid, energy storage solutions have become more important to manage these resources' intermittent and variable nature. BESS can provide grid balancing services by storing excess renewable energy generated during low-demand times and releasing it during high-demand periods. Consequently, fossil-fuel-based peaking plants are less needed, grid oscillations are reduced and grid stability is improved. Including a trend analysis of current and future energy storage technologies. The study aims to provide a comprehensive analysis of each battery technology studied (Lithium-ion, Lead-acid, Redox Flow Battery (RFB), Sodium–sulfur battery (NA-S)), their performance metrics, and cost-effectiveness for different stationary energy storage applications. The national and international market research study will identify the key players in the energy storage industry, their market share, and the growth potential of different battery technologies in various regions. In addition, the results of this study will enable energy stakeholders to make informed decisions on the most appropriate energy storage technology for specific applications and identify investment and growth opportunities in the energy storage industry.

Keywords : BESS, Grid-scale, stationary market, Battery technology, lithium-ion, RFB

THE EFFECT OF AMF AND PGPR CONSORTIA ON THE TOLERANCE OF DATE PALM AGAINST FUSARIUM WILT

Salma Ouladziane*†[1], Zainab El Alaoui-Talibi[1], Amir Soumia[1], Saad IbnsoudaKoraichi[2], Allal Douira[3], Abdelilah Meddich[1], and Cherkaoui El Modafar[1]

[1] *Centre d'Agrobiotechnologie et Bioingénierie, Unité de Recherche Labellisée CNRST (URLCNRST05), Université Cadi Ayyad, Marrakech, Maroc – Morocco*

[2] *Laboratoire de Biotechnologie Microbienne, Faculté des Sciences et Techniques, Université Sidi Mohamed Ben Abdellah, Fès, Maroc – Morocco*

[3] *Laboratoire de Botanique Biotechnologie et de Protection des Plantes, Faculté des Sciences, Université Ibn Tofail, Kenitra, Maroc. – Morocco*

Abstract: Moroccan date palm is one of the most cultivated palms in the world that is widely known for its fruits. Over the last century, several abiotic and biotic stresses have limited date palm expansion and cultivation. The Bayoud disease, caused by Fusarium oxysporum f. sp. albedinis (Foa), is the most destructive vascular disease of date palm in Morocco, where it has destroyed over 12 million date palms during a century. Thus, it is a necessityto find innovative and eco-efficient solutions to suppress this soil-borne pathogen and ensure the long-term sustainability of phoeniculture. In this context, the purpose of our work is to suppress this telluric disease through the management of the pathogen by beneficial microorganisms. This study investigates the effects of single or dual inoculation of an autochthonous consortium of AMF and PGPR consortium, isolated from particular biotopes, on Fusarium wilt in date palm seedlings. The results show that the AMF and PGPR consortia, alone or combined, significantly reducethe disease incidence and the disease severity as well as the mortality rate of date palm plants. The synergistic effect between the consortia is reflected through the improvementof the mycorrhizal symbioses on date palm seedlings. Furthermore, the study reveals that the suppressive effects are associated with the suppression of the pathogen in the soil by antagonistic strains. This work shows that autochthonous consortia of AMF and PGPR are effective as biocontrol agents and could contribute to the suppression of date palm Fusarium wilt.

Keywords: Date palm, Arbuscular mycorrhizal fungi, PGPR, Fusarium wilt, Bio, protection.

Poster Sessions

POLLUTION EFFECT ON SOIL AND SEDIMENT MICROBIAL ACTIVITY IN ICHKEUL SALINE WETLAND, TUNISIA

Aziza Kouchou*†[1], Fadwa Tadist[1], Zeina Bourhane[2], Olfa Ben Said[3], Naoual Rais[1], Saad Ibnsouda[1], Robert Duran[2], and Naima El Ghachtouli[1]

[1]*Faculty of Sciences and Techniques, University Sidi Mohammed Ben Abdellah, Fez, Morocco – Morocco* [2]*Universit´e de Pau et des Pays de l'Adour, UPPA/E2S, IPREM CNRS 5254, Pau, France – Universit´e de Pau et des Pays de l'Adour, UPPA – France*
[3]*Laboratoire de Biosurveillance de l'Environnement, Tunisia – Tunisia*

Abstract: This study aims to characterize in the effect of anthropogenic activities on functional features of microbial communities in a saline lake, Ichkeul (Tunisia). This lake is a hydrologic network contaminated with multiple compounds from intense human activities including agriculture, mining, oil refinery and metallurgy. Analyses were investigated in transects along soil-river-lake continuum located in three stations around the Lake during summer and winter periods. Biolog® EcoPlates. (Biolog Inc., Hayward, CA, USA) were used to analyze the functional diversity of bacterial communities by means of measuring their ability to oxidize carbon substrates. This technique has been successfully adopted for studying bacterial soil communities from different soil environments. The average well colour development AWCD, substrate average well colour development S-AWCD, Shannon-Wiener diversity index (H') and evenness index (E) were determined to quantify the metabolic capabilities and functional diversity. Overall, the AWCD values generally followed the same pattern with incubation time for all samples, with higher values in winter than in summer and in river and lake sediments than in soil. Analysis of Pearson's correlations between substrates metabolization and physical-chemical characteristics of the samples showed significant positive correlation ($p < 0.05$) between polymers and aminoacides utlisation and OCPs, between carbohydrates and alkanes, and between amines and PHAs. While, there were significant negative correlations ($p < 0.05$) between carboxylic acids utilisation and alkanes and between amines utilization and OCPs. Our data showed also that the concentration of Na and Cl ions, ie, salinity was significantly negatively correlated ($p < 0.05$) with carbohydrates and amines and positively correlated with aminoacides metabolization, indicating a shift in functional diversity with salinity. The H' and E indices did not show significant differences between the analyzed samples, suggesting the adaptation of the microbial communities to pollutants and to salinity (legacy effect). The parallel use of general metabolic capabilities and functional diversity indices may improve the output information of the effects of the anthropic activities on saline lakes environment.

Keywords: Biolog® EcoPlates, microbial communities, saline lake, microbial metabolic responses, biodiversity.

Phytochemical, antioxidant, antimicrobial and antiproliferative potential of Inula Viscosa

Douae Belahcen*[1], Houda Chtibi[1], Nassira Srhiouar[1], Mohamed Ferioun[1], SaidBouhraoua[1], Said Louahlia[1], and Khalil Hammani[1]

[1]*Natural Ressources and Environment Laboratory, Polydisciplinary Faculty of Taza,Sidi Mohamed BenAbdellah university (LRNE) – Morocco*

Abstract: Medicinal plants make an important contribution to the health systems of almost all rural areas, and play a key role in the development and advancement of scientific studiesby serving as a starting point for the development of new medicines. Recently, there has been a growing interest in natural antioxidants, with the aim of reducing the toxic effectsof free radicals in the human body. We aimed to promote plant Inula viscosa recognizedby its use by the local population, in the treatment of various diseases, and the demonstra- tion of the antimicrobial, antioxidant and antiproliferative properties of its extracts. The extraction of this plant was carried out by macerating the powder of the dried leaves us-ing different solvents of increasing polarity. Qualitative phytochemical analysis performed revealed that the leaves of this plant contain phenols, flavonoids, tannins, steroids and ter- penoids. While saponins absent in all extracts except the aqueous extract. The contentof polyphenols, flavonoids and tannins of the leaves of Inulaviscosa were determined by the Folin-Ciocalteu method, the AlCl3 method and the vanillin method with HCl, respectively.The antioxidant activity was evaluated by two methods: the DPPH test, which gave the following inhibition percentages 77%, 77%, 69%, 19% for methanolic, aqueous, ethyl acetate and hexane extracts respectively. And Ferric reducing antioxidant power where the aqueous and methanolic extracts exhibit a better reducing power of iron than that of the ethyl acetate and hexane extracts. The antimicrobial activity was evaluated by agar diffusion as- say against five microbial strains (Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Proteus mirabilis). The results demonstrated an inhibitory effect in particular on Bacillus subtilis Proteus mirabilis, with no inhibition for Pseudomonas aeruginosa. The antiproliferative test has demonstrated the power of hexanic, methanolic and ethyl acetate extracts to inhibit root growth. And this was confirmed by the techniqueof zymography.

Keywords: Inula viscosa, Antioxidant activity, Antimicrobial activity, antiproliferative activity

Analyse chimique, caractérisation phytochimique et quantification des composés phénoliques des différents extraits des fleurs et stigmates du Crocus Sativus L. (Safran) au Maroc

D. EL MERABET*, FZ. RHEBBAR, J. LAARIFI, I. KHOURRAJ, M. AOUJI, Y. TABOZ.

Laboratoire des Ressources Naturelles et Développement Durables, Unité de recherche « Physiologie, Métabolisme et Nutrition », Département de Biologie, Faculté des Sciences, Université Ibn Tofail, Kenitra, Maroc
**Email correspondant : douae.elmerabet@uit.ac.ma*

Résumé: Le Maroc est le quatrième producteur mondial du Safran (Crocus Sativus L.). Cette épice, reconnue comme la plus chère au monde, est fréquemment utilisée dans différents domaines tels que la médecine, la cosmétique et la cuisine. L`objectif de notre étude est la valorisation de cette plante à travers l`analyse biochimique de ses extraits, la caractérisation phytochimique, ainsi que la quantification des composés phénolique en utilisant la chromatographie en phase gazeuse couplée à la spectroscopie de masse (GC-MS), des réactions colorimétriques en tube et des analyses spectrophotométrique Les résultats ont révélé la présence des tanins, des flavonoïdes, d'huiles essentielles, des iridoides et de composés réducteurs dans les deux extraits, avec une abondance au niveau des stigmates. En revanche, nous avons observé l'absence des anthocyanines, saponosides, protéines, lipides, mucilage et des glycosides cardiaques. Les taux de polyphénols totaux se situent entre 3.769 ± 1.24 et 28.106 ± 0.63 mg EAG/g MS, les flavonoïdes totaux étaient compris entre 2.948 ± 0.05 et 25.502 ± 0.02 mg EQ/g MS, et les taux de tanins condensés se situaient entre 1.981 ± 0.57 et 21.065 ± 0.43 mg EC/g MS avec une abondance des principes actifs au niveau des stigmates. L'analyse par GC-MS des extraits a révélé la présence des esters, des cétones, des acides carboxyliques, des alcanes et des alcènes. Les conclusions tirées mettent en évidence l'abondance du Crocus Sativus L. en composés bioactifs, ce qui souligne l'intérêt pour son utilisation dans les domaines médicaux, pharmaceutiques et cosmétiques.

Mot clés : Crocus Sativus L., caractérisation phytochimique, composition chimique, molécules bioactives, GC-MS, Maroc.

THE EFFECT OF SHADING ON THE MICROCLIMATE OF A CANARIAN GREENHOUSE IN THE CHTOUKA REGION

Errami Younes*[1]

[1] *Université Ibn Zohr [Agadir] – Nouveau complexe universitaire Agadir 80000, Maroc, Morocco*

Abstract: Nowadays, the use of photovoltaic (PV) energy in greenhouses has become an important solution and an appropriate option to achieve the goals of environmentally sustainable agri- culture, the integration of photovoltaic panels on the greenhouse structure is one of those applications of photovoltaic technologies in agriculture. However, the shading produced by the photovoltaic panels has good effects during the summer period on the microclimate of the greenhouse. In this sense, our study was conducted to evaluate the shading effects induced by photovoltaic panels on the microclimate of the Canary Islands greenhouse in which 40% of the roof surface was covered with flexible photovoltaic panels in a checkerboard format.

Keywords: Greenhouse, Photovoltaic panels, microclimate, Solar radiation.

BIOLOGICAL EFFECTS OF TWO ESSENTIAL OILS ON SOME POST-HARVEST FUNGAL PATHOGENS

Faiza El Hajli*[1,2]

[1]*valorization of Medicinal and Aromatic Plants and Environment – Faculty of Sciences, Moulay Ismail University, B.P. 11201, Zitoune, Meknes, Morocco, Morocco*

[2]*Ecology Unit, Department of Plant Protection and Environment – National School of Agriculture of Meknes, BP S 40, Meknes, Morocco, Morocco*

Abstract: Post-harvest losses include all losses of agricultural products, mainly food, along the agri- cultural value chain from the crop in the field to the consumer's plate. Losses of agricultural products are an important problem in the post-harvest chain. During this storage period many fruits are subject to multiple post-harvest rots. In order to study biological control methods against phytopathogenic fungi of strawberries (B.cinerea) and oranges (P.digitatum and P.italicum) after harvest, tests on the antifun- gal activity of the essential oil of artemesia herba alba and Pistachia lentiscus were carried out. The essential oil, obtained by hydrodistillation was analyzed by several methods. The extraction of essential oils of Artemisia herba-alba was performed by hydrodistillation and analyzed by GC-MS. The majority constituents were chrysanthenone , camphor , α-pinene , α-thujone and β-thujone .In the essential oil of P. lentiscus leaves and twigs, germacrene D and myrcene are the dominant compound. The investigation of the antifungal activity of the essential oil of artemesia herba alba and Pistachia lentiscus was carried out in vitro using the agar diffusion method. For this test, three phytopathogens responsible for fruit deterioration were selected: Botrytis cinerea, Peni- cillium digitatum and Penicillium italicum. The results obtained in this study indicate that the essential oil of artemesia herba Albaand Pistachia lentiscus has bioantifungal potential as a bioantifungal preservative for the control of postharvest diseases.

Keywords: Keywords: essential oils, post, harvest, fungal pathogens, Antifungal activity

Etude phytochimique, quantification des compos´es ph´enolique et analyse GC-MS Des extraits aqueux et alcooliques des feuilles de P´elargonium Zonale

Fatima Zahra Rhebbar*†[1], Douae El Merabet[1], Jihane Laarifi[1], Ilhame Khourrag[1], Marouane Aouji[1], and Lalla Aicha Lrhorfi[1]

[1] *Laboratoire des Ressources Naturelles et Développement Durable, Université Ibn Tofail, Faculté des sciences Kénitra (RNDD) – Morocco*

Abstract: Pélargonium Zonale une plante vivace herbacé a souche ligneuse appartenant à la famille des Géraniacées genre Pélargonium, contient 280 espèces, la plupart d'entre elles sont originaires d'Afrique du Sud et cultivé commercialement au Maroc. Les feuilles de Pélargonium Zonale étaient utilisées largement en médecine traditionnelle pour traiter différentes mal- adies de la peau, la gorge ou comme des styptiques grâce à sa richesse en composés bioactifs et aussi dans les activités environnementales. Notre travail vise à un criblage phytochimique des feuilles de Pélargonium Zonale. La méthode d'extraction choisie est la macération par trois solvants de polarité différentes : extraits méthanolique, éthanolique et aqueux. Ce criblage phytochimique, a été réalisé par des réactions de caractérisation en tube, des techniques spectrophotométriques et par la chromatographie en phase gazeuse couplée à la spectroscopie de masse (GC-MS). Les résultats des analyses phytochimiques ont montré une présence abondante des Polyphénols, Tanins libres et Tanins cathéchiques avec l'absence des Anthocyanes et Leucocyanes pour les trois extraits. La quantification des molécules phénoliques a révélé que les meilleures teneurs en flavonoïdes (1132,82 0,02 mg/g MS) et en polyphénols (3,32 0,54 mg/g MS) sont affirmé à l'extrait méthanolique, par contre la valeur la plus élevé des tanins condensés etait détecté avec l'extrait éthanolique (28,934 0,12 mg/g MS). L'analyse des échantillons par GC-MS a montré la présence des alcènes, des alcanes, des alcools de la vitamine E et des huiles essentielles. Ces résultats ont confirmé, donc la richesse de Pélargonium Zonale en principes actifs qui peuvent être valorisés dans plusieurs domaines.

Keywords: Pélargonium Zonale, métabolites secondaires, criblage phytochimique, chromatographie gazeuse.

Update of the list of medicinal plants traditionally used in the Province of Taza

FZ. ELABOUI[1]*, I. GHABBOUR[1], A. KHABBACH[2] & K. HAMMANI[1]

1- Natural Resources and Environment Laboratory, Polydisciplinary Faculty of Taza, Sidi Mohamed Ben AbdellahUniversity, Fez, Morocco
2- Biotechnology, conservation and Valorization of Natural Resources Laboratory, Faculty of Sciences Dhar ElMahraz, Sidi Mohamed Ben Abdellah University, Fez, Morocco
**Email : fatimaZahra.elaboui@gmail.com*

Abstrat: A large number of plants have very interesting biological properties, which find application in various fields, namely in medicine, pharmacy, cosmetology and agriculture. The objective of thiswork is to list these uses of plants used in traditional medicine in unexplored areas of the provinceof Taza. Thus, a recent survey was conducted in the Pre-Rif of Taza (North-East of Morocco), among the rural population, between May / 2022 and January / 2023, with the aim of carrying out an inventoryof medicinal plants and a collection of information relating to their therapeutic uses using a questionnaire. The series of visits carried out made it possible to inventory 90 species belonging to 46 floristic families with a predominance of the following families: Lamiaceae (30%), Asteraceae (8%), Myrtaceae (6%) and Fabaceae (5%). 90 species are used to fight different pathologies: the digestive system (13%), Diabetes (10%), Colds (9%). The leaves (52%), the aerial part (13%) and the seeds (9%) are the main parts used to prepare therecipes. Alone or in combination, these parts are involved in the development of recipes by processes mainly using infusion (38%), decoction (29%) and powder (13%). The productsobtained are administered mainly orally (76%) and by external applications represent 16%.

Keywords : Ethnobotanical survey, Therapeutic uses, Pre-rif of Taza, traditional medicine, plants.

Effect of healthy eating habits on physical activity levels

Hamid El Oirdi*[1,2]

[1]*EL OIRDI – MEKNES, Morocco*

Abstract: Contexte : De saines habitudes alimentaires peuvent avoir un impact significatif sur le niveau d'activité physique d'une personne. Le contexte de cette relation est que la nutrition fournit l'énergie nécessaire à l'activité physique et qu'une alimentation saine peut augmenter la quantité d'énergie disponible pour l'exercice. Méthodes : Un questionnaire autodéclaré a été utilisé pour recueillir des informations complètes sur la durée, la fréquence et l'intensité d'une variété d'activités physiques. Il a également été utilisé pour décrire de saines habitudes alimentaires, pour examiner la relation entre les habitudes alimentaires et les niveaux d'activité physique. Résultats : Les résultats ont montré que les adolescents scolarisés qui ont de saines habitudes alimentaires ont tendance à être plus actifs physiquement que ceux qui ont une alimentation moins saine. Conclusion : De saines habitudes alimentaires peuvent avoir un effet significatif sur le niveau d'activité physique d'un individu. Il est donc important de promouvoir une alimentation saine pour encourager les niveaux d'activité physique et améliorer la santé globale de la population.

Keywords: diet, physical activity, teenagers, Morocco

EXTRACTION ET CARACTERISATION DE LA CHITINE ET DU CHITOSANE A PARTIR DES CARAPACES DES CRUSTACES

Hanane Ibaghlin*[1], Souad El Alami*[†1], Hakima Elknidri*[‡1], Rajae Belaabed*[§1], Ahmed Lahsini*[¶1], Abdellah Addaou*[‖1], and Ali Laajeb*[1]**

[1] *Université Sidi Mohammed Ben Abdellah (USMBA) – ROUTE IMOUZZER B.P. 2427,FES 30003 MAROC., Morocco*

Abstract: Plusieurs millions de tonnes de déchets des crustacés sont produits annuellement dans le monde, ces déchets sont très dangereux pour environnement en raison de leur forte demande bi- ologique et chimique en oxygène. Cependant, ils sont considérés comme une ressource potentielle à haute valeur ajoutée, car ils contiennent, principalement, des protéines, des minéraux et de la chi- tine. La chitine et le chitosane sont des biopolymères aux propriétés chimiques et biologiques intéressantes, telles que la biodégradabilité, la biocompatibilité, la non-toxicité et les activités antibactériennes et antimicrobiennes, etc. Ils ont été largement utilisés dans de nombreuses applications allant de l'agriculture à la médecine. Dans cette étude, l'extraction de la chitine et du chitosane a été effectuée en utilisant les carapaces des crevettes comme matière première, selon les étapes suivantes : la déminéralisation en utilisant l'acide chlorhydrique, la déprotéinisation par un traitement basique en utilisant l'hydroxyde de sodium dilué et la désacétylation qui consiste à convertir la chi- tine en chitosane par une solution concentrée d'hydroxyde de sodium à des températures élevées. La chitine et le chitosane obtenus ont été caractérisées par la spectroscopie infrarouge à transformée de Fourier (FTIR), la diffraction des rayons X (DRX) et la microscopie électronique à balayage (MEB).

Keywords: Chitine, chitosane, degré de désacétylation, valorisation des déchets.

PHYSICOCHEMICAL AND GEOCHEMICAL CARACTERISTICS OF BOUAAZZA'S MINE EMBANKMENTS AND RIVER SIDEMENTS (TAZA PROVINCE, MOROCCO)

Ikram Lahmidi*[1], Narmine Assabar[1], and Raouf Jabrane[1]

[1]*Laboratory of Intelligent System, Georesources and Renewable Energies – Faculty of Science andTechnology of Fez, Morocco*

Abstract: Mining production industry generates high quantities of mine tailings often placed on the surface. They evoke sources of contamination generally mine drainage, to all environmental compartments according to their physicochemical and geochemical characteristics that show their richness in residual metals and sulphide mineral dust such as pyrite and galena. Bouaazza's mine (NE Morocco) lead and sulfides exploitation resulted the exposure of large superficies of acid discharges in the surface. To determine the impact caused by acid mine drainage in the area, samples were collected from the river sediments near the mine and from the embankments. According to the physicochemical and geochemical analyzes, it was possible to discern a pollution by acid mine drainage, with pH values of sediments reaching5. These results indicate the high risk generated by the absence of environmental monitoringof the mining operations which threaten the environment.

Keywords: Acid mine drainage, Bouaazza's mine, mining discharges, pollution.

Etude phytochimique, dosage des composes ph´enoliques des extraits m´ethanoliques des feuilles et des tiges du thymus vulgaris.

Ilhame Khourrag*†[1], Marouane Aouji[1], Jihane Laarifi[1], Fatima Zahra Rhebbar[1], DouaeEl Merabet[1], and Zineb Guessous[1]

[1] *Laboratoire des Ressources Naturelles et Développement Durable, Faculté des Sciences Université Ibn Tofail, Kenitra. – Morocco*

Abstract: Le ± thym (Thymus vulgaris), famille des Lamiacées, ± est un petit ± arbuste vivace sous la forme d'un sous-arbrisseau ramifié, utilisé en médecine traditionnelle (infusion, décoction et macération) et en cosmétologie (huile essentielle). L'objectif de cette étude est de val- oriser Thymus vulgaris collecté dans la région Atlas du Maroc. Le travail porte sur la caractérisation phytochimique, la quantification des polyphénols, des flavonoïdes et des tan- nins en utilisant des réactions colorimétriques en tube et des techniques spectrophotométrie, respectivement des extraits méthanolique des feuilles et des tiges, ainsi que l'analyse par spectroscopie infrarouge afin d'identifier les groupements fonctionnels. Les résultats révèlent la présence des polyphénols, des tanins, des flavonoïdes, des cyanidines, des anthocyanes, des huiles essentielles, des C-hétérosides et des lipoïdes dans les ± deux extraits ± de la plante avec plus d'abondance au niveau des ± feuilles. Au contraire, les saponines, les protéines, les stérols et terpènes et les stupéfiants sont totalement absents. Les taux des polyphénols totaux se situent entre 7.455 0.5 et 5.910 0.63 mg EAG/g MS, les flavono¨ıdes totaux entre 0.210 1.32 et 0.094 0.43 mg EQ/g MS et les tanins condensés entre 1.311 0.53 et 1.529 0.98 mg EC/g MS. L'analyse des échantillons par spectroscopie infrarouge montre la présence des groupements O-H, N-H, C-H, C-C. Ces résultats confirment la richesse de Thymus vul- garis en molécules bioactives permettant d'entrevoir des perspectives d'application dans les domaines médical, pharmaceutique et cosmétique.

Keywords: Thymus vulgaris, caractérisation physicochimique, huiles essentielles, spectroscopie in- frarouge.

Environmental impact of landfill leachate: Application of Principal Component Analysis

Imane El Machrafi*[1], Jamal Naoura[2], and Abdennasser Baali*[3]

1 Laboratoire d'Ingénierie des Matériaux Organométaliques, Moléculaires et Environnement, Faculté des Sciences Dhar El Mehraz de Fès, USMBA – Morocco

[2]laboratoir ressources naturelles et environnement, faculte POLYDISCIPLINAIRE, Taza, USMB – Morocco

[3]Laboratoire d'Ingénierie des Matériaux Organométaliques, Moléculaires et Environnement, Faculté des Sciences Dhar El Mehraz de Fès, USMBA – Morocco

Abstract: Au Maroc, la priorité pour la gestion des déchets ménagers et assimilés a été accordée à la réalisation d'infrastructures primaires composées de décharges contrôlées et de centres de transferts dans les grandes villes et à la réhabilitation des dépotoirs sauvages. Le lixiviat de la décharge constitue une menace environnementale importante en raison de la complexité et de la variété de ses polluants. Dans ce contexte, Les objectifs principaux de cette étude portant sur lixiviat de la décharge public sont les suivants: Evaluer la qualité physicochim- ique et bactériologique du lixiviat et de proposer une stratégie adaptée pour améliorer la qualité du lixiviat. La caractérisation du lixiviat a montré une forte pollution organique. Ainsi que l'analyse des germes de pollution fécale du lixiviat a montré la présence de forte concentration en coliformes totaux (CT), coliformes fécaux (CF) et streptocoques fécaux (SF). Le traitement statistique des données nous a donné une idée sur la corrélation entre les différentes variables, ainsi l'analyse en composante principale (ACP) nous a permis de réduire les dimensions de notre base de données en collectant le maximum d'informations sur leurs tendances.

Keywords: Décharge, lixiviat, physico, chimiques, analyse en composante principale

NITRATE TRANSPORT SIMULATION IN MENZEL BOURGUIBA AQUIFER SYSTEM (NORTHEASTERN TUNISIA)

Ines Ayari*†[1], Mohsen Ben Alaya*[2], and Mounira Zammouri*[1]

[1]*Faculty of Sciences of Tunis El Manar – Tunisia*
[2]*National Institute of Research and Physical Chemical Analysis (INRAP) – Tunisia*

Abstract: In the Menzel Bourguiba Basin (NE Tunisia), groundwater resources are contaminated by nitrate, with concentrations that exceed the World Health Organization's international stan- dard of 50 mg/l due to intensive agricultural activities (NO32- concentrations vary between 0.1 and 175 mg/l). Indeed, to understand well this severe problem, contaminant transport modeling is a perfect tool for any risk management related to groundwater quality. This study was conducted to simulate the nitrate transport in the Menzel Bourguiba aquifer sys- tem, based on the flow model calibrated in 1981 under steady-state conditions and using the MT3D code coupled with the MODFLOW program. Nitrate concentration measurements of 35 water samples from 18 wells and 17 boreholes collected during October 2019 were carriedout in this simulation. The results showed a high correlation of 0.95 between the observed and the calculated concentrations. The numerical model provided a satisfactory reproduc- tion of the nitrate distribution in the study area. It constitutes a helpful framework for the predictive modeling of future nitrate concentrations and may therefore constitute a basis for developing groundwater management plans.

Keywords: Modeling. Aquifer system. Contamination. Nitrate transport. Menzel Bourguiba (NETunisia).

Unlocking the Potential of Digestate as a Bio Fertilizer for Sustainable Agriculture and Renewable Energy

Jalal Hsaine*[†1,2], Ghizlane Echchgadda[2], and Fouad Rachidi[2]

[1] *Institut Agronomique et Vétérinaire Hassan II (IAV Hassan II) – Madinat Al Irfane, BP 6202Rabat, MAROC., Morocco*

[2] *Ecole Nationale d'Agriculture de Meknès (ENA) – Meknès, Morocco*

Abstract: Reusing biowastes for agricultural purposes has received increased attention in recent years because it can be a sustainable method of waste disposal as well to enhance soil fer-tility and crop performance with socioeconomic benefits and a promising renewable energy alternative. By combining the biodegradability of organic materials with anaerobic digestion (AD) tech- nology, biogas, and digestate are the two major products that are produced as an outcomeof a series of metabolic processes by diverse microorganisms in the anaerobic environment. Due to its significant agronomic qualities brought on by the presence of essential nutrients like nitrogen, phosphate, and potassium, the nutrient-rich digestate derived from (AD) can function as an effective bio-fertilizer for crops. Even though biogas is a potential renewable energy source that may be utilized to produce both heat and power. This study aims to investigate how digestate application affects crop growth and yield. Field trials will be conducted to determine the right/best rates and methods of application for different crops. This will entail evaluating the effects of varying digestate application rates and methods, such as concentration, volume, surface application, or soil incorporation, on crop growth, yield, and quality.

Keywords: : Biogas, Digestate, Anaerobic digestion, Biowastes, Bio, fertilizer, Crops, Renewable energy.

Etude phytochimique et quantification des compos´es ph´enoliques des extraits m´ethanoliques et aqueux du noyau de Persea americana (Fuerte)

Jihane Laarifi*†[1], Marouane Aouji[1], Ilhame Khourrag[1], Fatima Zahra Rhebbar[1], Douae El Merabet[1], and Youness Taboz[1]

[1]*Laboratoire des Ressources Naturelles et Développement Durable, Facult´e des Sciences, Universit´e Ibn Tofail, K´enitra, Maroc (RNDD) – Morocco*

Abstract: Persea americana, est un arbre de la famille des Lauraceae qui nous a donn´e le fruit d'avocat, originaire du Mexique et d'Am´erique centrale, se développe dans un climat tropi- cal à sous-tropical, et le Maroc est parmi les pays qui cultivent cet arbre. Le noyau du fruit de Persea americana est fr´equemment utilis´e en cosm´etique et en m´edecine traditionnelle. Notre objectif est la valorisation du noyau par une caract´erisation phytochimique et une quantifica- tion des composés ph´enoliques des extraits m´ethanoliques et aqueux, ainsi qu'une analyse par spectroscopie infrarouge. Les r´esultats du criblage ont montr´e la pr´esence des flavono¨ıdes, des tanins, des leucoanthocyanes, des sucres r´educteurs, des alcalo¨ıdes, des saponosides et des anthocyanes avec une intensit´e ´elev´ee au niveau des extraits m´ethanoliques par-apport aux extraits aqueux. La quantification des mol´ecules ph´enoliques a montr´e que les teneurs en Polyph´enols totaux allant de (20.53 ± 0.12mg/g MS) à (25.70 ± 0.07mg/g MS), de (12.46 ± 0.03 mg/g MS) à (13.01 ± 0.2 mg/g MS) pour les flavono¨ıdes totaux, les Tanins ´etaient compris entre (3.78 ± 0.005 mg/g MS) et (4.00 ± 1,03 mg/g MS) et en sucres totaux les teneurs se situent entre (360.04 ± 1.37 mg/g MS) et (580.00 ± 0,25 mg/g MS) avec une abondance au niveau des extraits aqueux. L'analyse par l'infrarouge d'´echantillon a r´ev´el´e la pr´esence de groupements fonctionnels tels que O-H, C=O, C-H et les halog`enes. Les r´esultats montrent la richesse du noyau de Persea americana (fuerte) en métabolites secondaires ce qui nous a permis de le valoriser dans les domaines pharmaceutique et cosm´etique.

Keywords: Persea americana, Fuerte, métabolites secondaire, phytochimie, Maroc

First report of genetic relationship and diversity among Moroccan and introduced rapeseed (Brassica napus l.) varieties as revealed by molecular markers

Karim Houmanat*[1], Abdelghani Nabloussi[1], Yousra Rhazlaoui[2], Hakima Bahri[2],Mohamed El Fechtali[1], and Charafi Jamal†[1]

[1]*National Institute of Agricultural Research – Morocco*
[2]*National School of Agriculture of Meknes – Morocco*

Abstract: Rapeseed (Brassica napus L.) crop can be a lever for the development of oilseed sectorin Morocco due to its adaptation to local conditions and its major economic and food importance. Breeding isthe key to the success of this crop and judicious choice of crossing parents is a prerequisite to the successof the selection program and the development of new varieties that perform better than the oldones. In this regard, genetic variation within the existing germplasm must be explored and characterized.Therefore, the present study was carried out to investigate the genetic diversity among 22 varieties fromMorocco as well as other origins, using twenty ISSR primers. The selected primers have generated atotal of 319 markers. Polymorphic amplified bands varied from 8 to18, with an average of 13 per primer. The diversity index (PIC) ranged from 0.295 to 0.509, with a mean value of 0.37 per primer, indicating agood genetic diversity level for the primers used. The average similarity coefficient was 0.31, fluctuatingbetween 0.176 and 0.456, and the pairwise comparison of the studied varieties showed a great discriminatingpower of primers and a large genetic diversity among accessions. Hierarchical classification allowedidentifying three groups with some phylogeographic structuring. This is the first report of molecularcharacterization of rapeseed germplasm in Morocco and Africa. The obtained results have important impli-cations for management of this germplasm to conserve the existing genetic diversity and use it properlyin breeding programs in Morocco as well as in other Mediterranean and African countries.

Keywords: Brassica napus L., Crossbreeding, Genetic diversity, ISSR markers, Moroccan germplasm

Use of spirulina as an alternative to synthetic antioxidants

KARIMA EL KABOUS*, KHADIJA ATFAOUI, MOHAMMED OUHSSINE

Laboratoire des Ressources Naturelles et Développement Durable. Département de Biologie. Faculté des Sciences. Université Ibn Tofaïl. BP : 133. Kénitra, Maroc.
E. mail: *karima062014@gmail.com*

Abstract: Spirulina, a blue-green alga, was the subject of this study for its antioxidant properties and potential health benefits. In addition to its nutritional properties, spirulina has also shown promising results for use in the cosmetic field. Antioxidant compounds in spirulina, such as polyphenols, flavonoids, and tannins, can help protect the skin from free radicals that can cause cell damage and promote premature skin aging. Several studies have shown that topical use of spirulina can improve skin texture and reduce visible signs of aging, such as fine lines and age spots. In terms of established nutritional composition, the spirulina studied is rich in nutrients such as fiber (1.16%), protein (68.57%), and fat (6.01%), as well as total and reducing sugars with values of 2.95 and 0.61 mg GE/100DP, respectively. It can be used to help moisturize and deeply nourish the skin, and can help reduce the appearance of large pores. In summary, spirulina has potential benefits for cosmetic products due to its high content of antioxidant compounds and nutrient-rich nutritional composition. It can help protect the skin from free radical damage, reduce the visible signs of aging, and provide deep hydration.

Keywords: Spirulina, cosmetics, antioxidants, potential benefits

A techno-economic study of battery energy storage systems for grid-scale applications

O. MAHIR[1,2]*, H. GHENNIOUI[1] & A. BENAZZOUZ[2]

1- Laboratory of Signals, Systems, and Components, University Sidi Mohamed Ben Abdellah, Fez, Morocco
2- Green Energy Park, Benguerir, Morocco
**Email : oumaima.mahir@usmba.ac.ma*

Abstrat: The importance of battery systems is growing in the stationary and automotive industries as the world moves toward a more sustainable and renewable energy future. In the automotive industry, battery systems are becoming increasingly important as electric vehicles become more common. The stationary industry is also turning to batteries as a storage solution. As a technology, battery-based energy storage systems (BESS) can enhance the reliability and stability of power systems. Since renewable energy sources, like wind and solar, have been integrated more into the grid, energy storage solutions have become more important to manage these resources' intermittent and variable nature. BESS can provide grid balancing services by storing excess renewable energy generated during low-demand times and releasing it during high-demand periods. Consequently, fossil-fuel-based peaking plants are less needed, grid oscillations are reduced and grid stability is improved. Including a trend analysis of current and future energy storage technologies. The study aims to provide a comprehensive analysis of each battery technology studied (Lithium-ion, Lead-acid, Redox Flow Battery (RFB), Sodium–sulfur battery (NA-S)), their performance metrics, and cost-effectiveness for different stationary energy storage applications. The national and international market research study will identify the key players in the energy storage industry, their market share, and the growth potential of different battery technologies in various regions. In addition, the results of this study will enable energy stakeholders to make informed decisions on the most appropriate energy storage technology for specific applications and identify investment and growth opportunities in the energy storage industry.

Keywords : BESS, Grid-scale, stationary market, Battery technology, lithium-ion, RFB

Phenological Evaluation of Four Fig (Ficus carica L.) Varieties Grown in Northern Morocco

Mohammed Elmeknassia*†[1], Abdelali Boussakouran[1], Rachid Boulfia[1], and YahiaRharrabti[1]

[1]*Natural Ressources and Environment Laboratory, Polydisciplinary Faculty of Taza,Sidi Mohamed BenAbdellah university – Morocco*

Abstract: The fig (Ficus carica L.) is a fruit tree of the Moraceae family that is extensively grown and produced in northern Morocco. This tree has an extraordinary potential for vegetative renewal and fruit production without a visible flower development. To properly planify the calendar of agronomic treatments and to standardize the phenological observations amongstscientists and producers, a precise phenological scale of the fig tree is required. The present work aims to describe the reproductive and vegetative phenological development phasesof fig tree using the BBCH scale, via the determination of the main growth stages: bud development, leaf development,, flowering and polination, fruit development, fruit ripening, onset of defoliation, and dormancy period. Four moroccan fig varieties (Fassi, Ghoudan, Nabout, and Ounk hmam) are chosen from the most cultivated Moroccan figs and periodical visits will be carried out between February and September in three sites from northern Morocco : Beni ahmed (Chefchaouen), Khlalfa (Taounate) and Brarha (Taza) to determinewth accuracy the occurence of the different phenoogical stages during the grown season.

Keywords: Fig, phenology, BBCH scale, growth stages, northern Morocco

An assessment of sea turtle bycatch by bottom trawlers and purse-seiners in the central Atlantic coast of Morocco (Agadir)

M. TOUAF[1]*, M. AKSISSOU[1]

[1] LESCB, URL-CNRST N°18, DEPT.OF BIOLOGY, FACULTY OF SCIENCE, UNIVERSITY OF ABDELMALEK ESSAADI TETOUAN 93002 MOROCCO
**Email: mouniatouaf@gmail.com*

Abstrat: The bycatch of sea turtle whether in coastal or artisanal fisheries has become a serious problem worldwide. Recently, bycatch has been increasingly receiving attention due to the significant impact it causes on these threatened species. This study aims to assess sea turtle bycatch by bottom trawlers and purse-seiners, based on a tracking survey with 10 fishermen (skippers) in Agadir port from April 2022 to Mars 2023, in the central Atlantic coast of Morocco (Agadir). Results obtained by the present study showed that loggerhead turtles, Caretta caretta, was the most observed and the most captured sea turtle in the fisheries. In general, fishermen release the turtles caught regardless of their physical situation (alive, almost dead or dead). This study provides general information about the status of sea turtle bycatch around Agadir revealing a widespread impact of fisheries on this species.

Keywords : Bycatch, sea turtles, bottom trawlers, purse-seiners, Agadir, Morocco

Inspection of structures in the Province of Moulay Yaacoub: Scouring is the major danger

CHAYMAE NAAZA[1*], ABDELLAH ELBARKANY[1], RAFIK ABSI[2], IKRAM ELABASSI[2],

1-Mechanical Engineering Laboratory, Faculty of Science and Techniques,Sidi Mohammed Ben Abdellah University, Fez, Morocco
2-ECAM-EPMI, 13 Boulevard de l'Hautil, 95092, Cergy Pontoise Cedex, France

Abstract: In order to preserve the heritage of engineering structures, an inspection mission was carried out to detect the various anomalies affecting the civil engineering structures of the provinceof Fes-Moulay Yacoub and find technical solutions to avoid the collapse of these structures. The structures concerned by the inspection are those defined in the "Instruction for the surveillance andmaintenance of engineering structures", namely temporary or permanent crossing structures:

- Viaducts and bridges with a length between abutments greater than or equal to 2 m.
- Weirs and submersible inverts with a length of 10 m or more.
- Retaining structures ensuring the safety and the protection of a road
- Other special structures: tunnels and covered trenches.

During the mission, 72 structures were inspected including :

- 4 Concrete bridges;
- 64 scuppers;
- 2 masonry vaults;
- 2 sills and submersible structures.

It was found that the major problem of most structures is scouring which is defined as the lowering of the level of a river bed by the erosive action of the water, which will cause instabilityof the structures. It is caused by any flow condition except that it can be very severe during a flood,which results in the appearance of a deep pit near the piles of the Structures

Keywords : Scour, Bridges, Instability, Flood

Heavy metal contamination assessment of spoil heaps in Ain Aouda mine (Taza-Morocco)

Narmine Assabar*†[1], Ikram Lahmidi[1], and Raouf Jabrane[1]

[1] *Intelligent Systems, Georesources and Renewable Energies laboratory (SIGER) – Faculty of sciences and technologies Fez, Morocco*

Abstract: The aim of this research is to evaluate the level of heavy metal pollution found in the slag heaps located at the former Ain Aouda mine (Taza). In order to achieve this objective,a total of 20 solid samples were obtained from the study area. The ICP-AES analysis conducted revealed that these metallic waste samples contain various heavy metal(oid)s including zinc (Zn), lead (Pb), copper (Cu), arsenic (As), and nickel (Ni) exceeding the standards required by the World Health Organization (WHO). Pollution indices such as the geo-accumulation index (Igeo), enrichment factor (FE), and contaminated soil pollution index (IP) were employed to estimate the degree of heavy metal pollution. The results of this study indicate that the slag heaps demonstrate contamination from multiple heavy metals, with zinc being the most prominent, followed by lead, copper, arsenic, and nickel. It is noteworthy that the degradation of the natural environment resulting from these present elements could be further exacerbated by the alteration and erosion of this stock of mining waste.

Keywords: Ain Aouda mine, Geo, accumulation index, Enrichment factor, Pollution index

Salinity Effect on Morphological and Biochemical Traits in Medicago sativa Varieties Cultivated in Morocco

Nassira Srhiouar*[1], Mohamed Ferioun[2], Said Bouhraoua[1], Douae Belahcen[1], Khalil Hammani[1], and Said Louahlia[1]

[1]*Natural Ressources and Environment Laboratory, Polydisciplinary Faculty of Taza,Sidi Mohamed BenAbdellah university (LRNE) – Morocco*

[2]*LRNE BMMB – Morocco*

Abstract: Alfalfa (Medicago sativa L.) is the principal cultivated forage crop in Morocco, However, salinity reduces the growth and the crop production of this plant. Here, we aimed totest the impact of two-level of salt stress (induced by NaCl) on physiological and biochemical parameters of two alfalfa varieties used by Moroccan farmers. Stress was applied gradually using tap water with NaCl until 7 dS/m and 12 dS/m. The root and shoot dry weight (RDW and SDW respectively) were measured as morphological parameters, chlorophyll a (Chl a), b (Chl b), and total chlorophyll (Chl T) contents were quantified in leaves to estimate the impact of salt stress on the photosynthesis process. Furthermore, Soluble proteins, total soluble sugars (TSS), and proline contents were quantified both in leaves and root parts. The results showed that morphological parameters and leaves photosynthetic pigment content were significantly decreased, an important significant accumulation of proline and soluble protein were recorded in roots part. Soil salinity affect various alfalfa parameters cutuved in Morocco which can threatens alfalfa production.

Keywords: Alfalfa, Medicago sativa, salt stress.

Influence of the maturity index of olives on the chemical composition of the olive oil ”Moroccan Picholine”

Siham Bechar*†[1], Mohamed Khamar*[1], Essediya Cherkaoui*[1], and AbderrahmanNounah*[1]

[1] *Civil Engineering and Environment Laboratory (LGCE), Materials, Water and Environment Team.higher school of technology of salé, mohammed V university of rabat – Morocco*

Abstract: Olive growing is one of the oldest living crops and is widely spread throughout the Mediterranean region. It is a historical food product in an increasingly competitive in- ternational market requiring continuous research. The chemical composition of virgin olive oil is influenced by many factors, including genetic and environmental. Therefore, the stage of maturity can directly or indirectly affect the quality of the oil throughout the production process. This study aims to classify olive oils according to the stage of maturity of theolives used for their crushing and to study the impact of this indicator on the composition of polyphenols, chlorophylls and carotenoids of single variety olive oils ”Moroccan Picholine”. The results of this study show a progressive decrease of the total phenol content and pigment concentration as the maturity stage advances, with negative correlations between polyphenol and chlorophyll content and the maturity index (-0.92, -0.72 respectively). Principal com- ponent analysis allowed for the graphical differentiation between three groups of olive oils according to the maturity stage of the olives.

Keywords: Olive oil, ripeness index, polyphenols, pigments, ACP

PREPARATION DE CHARBON ACTIF A PARTIR DES DECHETS SOLIDES INDUSTRIELS : EFFET DES PARAMETRES OPE´RATOIRE SUR LES CARACTERISTIQUES ET LE RENDEMENT

Souad El Alami*[1], Hanane Ibaghlin*[†1], Raja Belaabed*[‡1], Hakima Elknidri*[§1], Ahmed Lahsini*[¶1], Abdellah Addaou*[‖1], and Ali Laajeb*[1]**

[1] *Université Sidi Mohamed Ben Abdellah (USMBA) – route imouzzerB.P. 2427,Fès, Maroc, Morocco*

Abstract: Depuis des décennie l'utilisation des sources d'énergie durables et renouvelables (solaire, hydraulique, éolien, biomasse, etc.) est une tendance scientifique et industrielle au Maroc, compte tenu de la demande toujours croissante en énergie. Parmi toutes les alternatives proposées, la biomasse est une source d'énergie renouvelable prometteuse en raison de son potentiel à fournir divers biocarburants et produits biochimiques de manière écologique. Le charbon actif est un matériau poreux issu de la combustion incomplète de toute matière riche en carbone. Il est considéré comme un matériau important pour différentes applications environnementales et pour une agriculture durable. Avec la croissante du charbonactif et ses nombreuses possibilités d'utilisation, plusieurs recherches ont été effectuées pour préparer le charbon actif à partir des matières premières à faible coût, respectueuses de l'environnement et facilement disponibles, notamment à partir des déchets solides d' origine végétale ou animale. L'utilisation de ces déchets pour produire du charbon actif offre une alternative durable aux sources de charbon actif traditionnelles et atténue les problèmes environnementaux causés par le rejet de ces déchets dans l'environnement. L'objectif de cette étude, est la valorisation des déchets solides industriels en les utilisant pour produire un produit à forte valeur ajoutée, qui le charbon actif. L'effet de quelques conditions opératoires sur le rendement de production et la structure du charbon actif obtenu ont été examinés, notamment l'effet de la température et du temps de calcination ainsi que l'effet de l'agent activateur. Le charbon actif ainsi obtenu a été caractérisé par la Spectro- scopie Infrarouge à Transformée de Fourier (FTIR), la Diffraction aux Rayons X(DRX) et la Microscopie Électronique à Balayage (MEB). Le charbon actif produit peut être appliqué pour le traitement des eaux, la séquestration du CO2, comme amendement pour le sol ou comme une source énergétique durable.

Keywords: Charbon actif, valorisation des déchets, déchets solides, activation, calcination, rendement

Effect of chromium on the physicological parameters of faba bean (Vicia faba)

Soukayna Azzouzi*[1,2], Mohamed Khamar[2], Abderrahman Nounah[2], and Essediya Cherkaoui[2]

[1] *Laboratoire Génie Civil et Environnement um5 Rabat – Morocco*

[2] *Civil and Environmental Engineering Laboratory (LGCE), Salé High School of Technology, Mohammed V University In Rabat, Morocco – Morocco*

Abstract: Legumes are very old crops in Morocco. They are mainly located in regions with favor-able rainfall. During the period 20115-2016, they covered an area of 385,000 HECTARES, i.e. 3% of the UAA (useful agricultural area), including 48% of beans, 19% of chickpeas...) after cereals. In view of the importance of this species on a national scale, our subject aims to evaluatethe response of broad beans to stress by heavy metals. Chromium was chosen as the first test. Given their use in industries, especially tanneries. Heavy metals are not only a problem for air pollution: they are biopersistent, disturb ecosys- tems, deteriorate soils, surface waters, forests, crops, and accumulate in the food chain. Someare carcinogenic to humans. To better understand the subject, the relative water content and cell integrity of the control leaves and different chromium concentrations are measured the addition of this element af- fects the relative water content of bean leaves. The first results show that the addition of this element affects the relative water contentof bean leaves. Indeed, for a concentration of 0.06 mg/l, the relative water content does not exceed 40% against 68% with the control. Similarly, the leaf surface is reduced by 54% compared to the control.

Keywords: chromium stress, bean, relative water content, cell integrity

In situ deposition of Ag nanoparticles onto CF/rGO hybrids for the Dip-catalytic hydrogenation of 4-nitrophenol into 4-aminophenol

I. TAZI[1], ,A. MAJDOUBA[1]*, M. MAJDOUB[3], F. KHALIL[1], H. ZAITAN[1]*

[a]*Processes, Materials and Environment Laboratory (LPME), Faculty of Sciences and Technology of Fez, BP 2202, Sidi Mohamed Ben Abdellah University, Morocco*
[b] *Laboratory of Materials, Catalysis & Valorization of Natural Resources, Hassan II University, 20000 Casablanca Morocco*
[*]*Email of the corresponding author (hicham.zaitan@usmba.ac.ma ; ali.majdoub@usmba.ac.ma)*

Abstract: This study was focused on the design and development of a new heterogeneous catalyst based on Canvas (CF) fabric modified with graphene oxide nanosheets decorated with silver metallic nanoparticles (CF-rGO/Ag0). PE fabrics were coated with graphene oxide (GO) nanosheets by sonication followed by in situ deposition and reduction of silver nanoparticles over the GO surface, covering the CF fabric and producing CF-rGO/Ag0. The catalytic performance of the prepared CF-rGO/Ag0 was assessed during the hydrogenation of 4-nitrophenol (4-NP) in the presence of sodium borohydride (NaBH4). Experimental results indicate that PE-rGO/Ag0 with a surface of 6 cm2 showed the highest catalytic activity. In addition, CF-rGO/Ag0 activity resulted to be comparable and significantly higher than previous reported values of silver-based catalysts. Remarkable stability values were achieved during different operating cycles without significant degradation in the catalytic activity, suggesting that CF-rGO/Ag0 can be used as a strong candidate in long-lasting chemical catalytic processes.

Keywords: 4-nitrophenol; 4-aminophenol; graphene oxide; hydrogenation; Canevas fabric, reduction deposition

EFFECTS OF ORGANIC AND INORGANIC MULCHING, NETTLE EXTRACT, AND MANUAL WEEDING ON WEED MANAGEMENT IN A DIRECT-SEEDED LENTIL FIELD.

Wijdane Rhioui*[1,2], Jamila El Figuigui[3], Saadia Belmalha[4], and Abdulatif Boutagayout[5]

[1]*Laboratory of Functional Ecology and Environmental Engineering – Department of Biology, Sidi Mohamed Ben Abdellah University, Route d'Imouzzer, PoBox 2202, Fez, Morocco., Morocco* [2]*Department of Plant and Environment Protection – Ecole Nationale d'Agriculture de Meknes, RouteHaj Kaddour, BP S/40 50000 Meknes, Morocco., Morocco*

[3] *Laboratory of Functional Ecology and Environmental Engineering – 1- Laboratory of FunctionalEcology and Environmental Engineering, Department of Biology, Sidi Mohamed Ben Abdellah University, Route d'Imouzzer, PoBox 2202, Fez, Morocco., Morocco*

[4] *Department of Plant and Environment Protection – 2- Department of Plant and Environment Protection, Ecole Nationale d'Agriculture de Meknes, Route Haj Kaddour, BP S/40 50000 Meknes,Morocco., Morocco*

[5]*The Environment and Soil Microbiology Unit, – The Environment and Soil Microbiology Unit, Facultyof Sciences-Moulay Ismail University, B.P.11201 Zitoune, Meknes., Morocco*

Abstract: Weeds represent a significant problem for agricultural production worldwide, Morocco was one of the exporting countries of lentils (Lens culinaris Medik), but now it is an importer to cover their needs, this transition is due to seasonal fluctuations in yield and many factors such as weed competition that have a direct impact on the yield of lentils. To address this issue, the present study was conducted at the National School of Agriculture in Meknes, Morocco, in 2021 and 2022, to investigate the effects of some ecological strategies such as manual weeding, fermented nettle extract, black plastic, and wheat straw mulch, on lentil yield and quality and weed management, as well as to find economically efficient practices adapted to the needs of the farmers of the region to manage the weeds associated withthis crop. The weed flora studied was very diverse with 27 different species. Data analysis revealed a significant decrease in weed density and dry plant biomass at flowering and maturestages by more than 50%. All treatments provided effective weed management compared to the control (untreated), as well as essential economic gain, particularly hand weeding, black plastic, and wheat straw. The nettle extract treatment was less effective than the other treatments but did not show phytotoxic effects on the crop. In conclusion, the ecological practices tested in this study showed the highest yield and yield components of the lentilcrop compared to the control, leading us to conclude that reducing weed infestation is usefulin cropping systems where chemical or mechanical weed control is not feasible and for crops with low competitive ability against weeds.

Keywords: Black plastic, Lens culinaris, mulching, weed management, nettle extract.

Analyse phytochimique des extraits aqueux de feuilles et de fruits de caroubier (Ceratonia siliqua L.) : évaluation de leur potentiel bioactif pour une utilisation durable dans l'agriculture et l'environnement

YASSINE MOUNIANE[1]*, AHMED CHRIQUI[1], ISSAM EL-KHADIR[1], RIDA ARABI[1] & DRISS HMOUNI[1]

1- Laboratoire des Ressources Naturelles et Développement Durable, Faculté des Sciences Kenitra, BP 133, Kénitra, Maroc.
**Email: Yassine.mouniane@uit.ac.ma*

Abstrat: The carob tree (Ceratonia siliqua L.) is a Mediterranean shrub that has been used for centuries for its therapeutic properties and medicinal qualities. In this study, we examined aqueous extracts of female and male leaves and pods from the Safi region to identify secondary metabolite components and evaluate their antioxidant activity. The male and female leaves and pods were shade dried, crushed and sieved to a fine powder to prepare a 10% infusion. We detected the presence of polyphenols, free tannins, catechic tannins, gall tannins, flavonoids, and reducing sugars in the leaves and pods. Saponins and leucoanthocyanins are absent in the pods, conversely these two components were present in the leaves of both sexes. The Folin-Ciocalteu method was used to evaluate the amount of polyphenols, tannins were quantified using vanillin reagent and flavonoids were quantified using aluminum chloride, and the concentrations are measured in mg GAE/g DM, mg QE/g DM and mg CE/g DM respectively for polyphenols, flavonoids and tannins. Concerning the determination of phenolic compounds, the leaves gave a high concentration of polyphenols compared to the pods, in fact we obtained 4.84 mg GAE/g DM for females and 4.45 mg GAE/g DM for males. The concentration of flavonoids is high in male leaves, reaching 238.2 µg EQ/g DM, while for tannins higher in female leaves with a concentration of 4.71 mg EC/g DM. The evaluation of antioxidant power which was carried out using FRAP iron reduction method indicated that the aqueous extract of female stem leaves has higher reducing power (IC_{50}=25.19 µg/ml) than that of male stem leaf (IC_{50}=83.10 µg/ml) and pod (IC_{50}=33.12 µg/ml) but relatively low than that of ascorbic acid (Positive Control).

Keywords : Carob, phytochemicals, antioxidant capacity, FRAP.

Application de la télédétection à l'analyse structurale et hydrogéologique de la dorsale calcaire (Rif interne, Maroc)

Youness Taybi[1], Mohamed Elgettafi[1], Youssef Gharmane[2]

E-mail: y.taybi@ump.ac.ma

1 Laboratoire de Chimie Moléculaire, Matériaux et Environnement (CM2E), Université Mohammed Premier, Faculté Pluridisciplinaire de Nador, B.P : 300 Selouane 62700 Nador.
[2]Laboratoire Système Intelligents, Géoressources et Energies Renouvelables (SIGER), Université Sidi Mohammed Ben Abdellah, Faculté des Sciences et Techniques, B.P. 2202, Route d'Imouzzer, Fès, Morocco.

Résumé: La chaîne calcaire du Rif faite l'objet de cette étude couvre une superficie de près de 1057 km², de forme convexe vers le centre de paye, elle s'étend de la région de Sebta au nord à la région d'Al Hoceima à l'est. La zone est composée de calcaires massifs, grès et de marnes, avec des lits remanient quelques blocs calcaires dont les âges stratigraphiques correspondent à l'Eocène moyen-supérieur et à l'Oligocène supérieur, voire au Miocène. En effet, pour d'obtenir de nouveaux indicateurs sur le potentiel hydrogéologique de la chaîne Rifaine, il a été considéré utile d'étudier les liens entre les structures et les formes de linéaments et le potentiel aquifère connu. L'analyse statistique des linéaments donne un aperçu sur la rosace des directions dominantes, la géométrie et la cinématique des réseaux de fracturations à l'échelle régionale, où nous avons pu distinguer par ordre décroissant trois directions principales : NE-SW, N-S et NW-SE :

- les failles NE-SW sont marqués par des tracés d'extensions plurimétriques, très remarquable dans les formations calcaires, et montrent un jeu décrochante dextre voir chevauchant, dont les plus importantes sont les failles de Fahies et de Jbel Moussa.
- les failles N-S sont matérialisées par des failles normales à composante décrochante senestre.
- les failles longitudinales NW-SE sont formées par des failles décrochantes dextres et des failles inverses à composante senestre.

Les travaux de terrains nous ont permis de constater que les failles NE-SW sont responsable de la rotation anti-horaire de certains massifs calcaro-dolomitiques. L'analyse des linéaments établies nous a permis de mettre en évidence trois classes de densité de réseau de failles qui suit parfaitement l'organisation des structures géologiques majeures, ainsi que nous avons constaté que le centre du chaînon présentait une forte densité, notamment les zones de jonction de failles à directions opposées, en particulier les failles décrochantes NE-SW. La méthode employée consiste à identifier les croisements et les jonctions entre les failles N-S, NW-SE et NE-SW, dont l'objectif de déterminer leurs densités qui dévarié présenter un fort potentiel d'alimentation en eau.

Mots clés : Télédétection, structurale, dorsale calcaire, Maroc

Evaluation of drought in the Mediterranean region, case study of the Upper Oum Er Rabia basin, Morocco

M.M. MLIYEH, L. BENAABIDATE.

Laboratory of Functional Ecology and Environment Engineering, Faculty of Sciences and Techniques, University of Sidi Mohammed Ben Abdellah, Fez – Morocco

Drought is one of the most critical disasters affecting the world, regardless of the country or region. Morocco with its predominantly arid to semi-arid climate is one of the most drought-prone countries. The objective of this study is to provide an assessment of the drought phenomenon in the Upper Oum Er Rabia basin. Drought indices have proven their effectiveness and have been the subject of several studies in many areas of the world. For this purpose, a combination of remote sensing data (NDVI) from MODIS Terra and the drought indices SPI, SPEI and RDI were applied in the Upper Oum Er Rabia catchment. The trend study of precipitation, potential evapotranspiration, temperature, SPI, SPEI, RDI and NDVI was established by Mann-Kendall and Sen's Slope. Indeed, a strong correlation was found between the SPI and RDI indices for the different time steps. While NDVI has a better correlation with SPEI than with the other indices. During the period 2010-2022, the trends of precipitation and drought indices showed a critical decrease, of -44 mm/year and -0.2/year, respectively. As well as temperature, potential evapotranspiration showed an increasing trend.