ENVIS CENTER
on
ENVIRONMENTAL BIOTECHNOLOGY

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ENVIS CENTRE

on

ENVIRONMENTAL BIOTECHBNOLOGY

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C O N T E N T S

BACKGROUND

Environmental Information System (ENVIS) is established in the year 1984 as a network of Information Centres. It is planned by the Ministry of Environment and Forest. Aim of this centre is to provide descriptive and environmental subject related numerical data.

This ENVIS Centre is established in the focal theme area - Environmental Biotechnology at the Department of Environmental Science, University of Kalyani, Nadia-741235, West Bengal in the year 2002.

The objective of this centre is to collect data related to the above mentioned subject, from different major libraries mainly in West Bengal and also from other states in India, through consultation with different journals, Annual Reviews, Internet and to generate a database and create a website uploaded with these information. Besides, we publish biannualy Abstract Volume on our thematic area Environmental Biotechnology under fifteen sub-heads. The volume contains abstracts of scientific articles from relavent national and international journals. Viewpoint of this abstract volume is to help the interested research workers, scientists, administrators and the general people.

This is the 31st publication of Abstract Volume of this ENVIS Centre. This contains the abstracts of research papers collected from the various areas of Environmental Biotechnology from different journals published in last six months upto December, 2017. In this issue, various topics like Bioenergy, Bioengineering, Bio-degradation, Bio-remediation, Bio-transformation etc. have been covered. We are grateful to the various libraries and their staff for their cooperation extended to us during the collection of the articles.

Abstract Format

The format of the abstract is as follows:

Abstract: The abstracts are arranged in different subheads.

Author: Name of the authors are given in the order in which they appear in the original document. These names are given in succession.

Address of Authors: Address of the author is given in parenthesis at the end of the author's name. When the address of any other author is found, it is written after wards delimited by stop(.).

Locus: The name of the journal is followed by the volume number, issue number, year of publication and the page no.

GENERAL INFORMATION

Abstract have been taken directly from source documents like research report, journals, internet, seminar proceedings, standards and patents. All the resources are published within last six months.

Abstract are broadly classified and arranged under the following 15 heads:

Bioaccumulation: Bioaccumulation means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Compounds accumulate in living things whenever they are taken up and stored at a rate faster than they are broken down (metabolized) or excreted. Understanding the dynamic process of bioaccumulation is very important in protecting human beings and other organisms from the adverse effects of chemical exposure, and it has become a critical consideration in the regulation of chemicals.

Bioremediation: It is a clean-up technology that uses naturally occurring microorganisms to degrade hazardous substances into less toxic or nontoxic compounds. The microorganisms may:

1. Ingest and degrade organic substances as their food and energy source,
2. Degrade organic substances, such as chlorinated solvents or petroleum products, that are hazardous to living organisms, including humans, and degrade the organic contaminants into inert products.

As the microorganisms occur naturally in the environment they are likely to pose little risks of contamination.

Bio-Transformation: This is a process of Biological changes of complex compounds to simpler one or toxic to non-toxic and vice-versa. Several microorganisms are capable of transforming a varity of compounds found in nature but generally in case of synthetic compounds they are unable to show any appropriate action. Biotransfer appears to be one of the major detoxication methods known so far.

Biomarker: It is a biological response to a chemical that gives a measurement of exposure and, sometimes, of toxic effect. It can be defined as any kind of molecule which indicate the existence (past or present) of living organisms. In particular, in the fields of geology and astrobiology biomarkers are also known as biosignatures. However, in environmental science a bio-markers can also be used to indicate exposure to various environmental substances in epidemiology and toxicology.

Biofertilizer: To reduce the impact of excess chemical fertilizers in the field of agriculture the biofertilizer is being considered as a potential tool; biologically fixed nitrogen

is such a source which can supply an adequate amount of Nitrogen to plants and other nutrients to some extent. Many free living and symbiotic bacteria, which fix atmospheric Nitrogen are used as biofertiliser material as a substitute for Nitrogen fertilizer. In general two types of biofertiliser are used

1. Bacterial Biofertilizer
2. Algal Biofertilizer

Biocomposting: It involves combining organic materials under conditions that enables them to decompose more quickly than they would in nature. Think about logs and leaves on the ground in a forest. The leaves will break down and disappear within a year. Logs of course will take much longer to crumble away. Composting is the process of converting all biodegradable wastes into organic manure. In composting process certain input should be made into waste to convert the process in a short time.

Biopesticide: Pest control by biological antagonism appears to be very useful tool in recent years. Bacterial pesticides are being developed. *Heliothis* complex, which lives in close association with plant roots, consists of two major crop pests budworm and ball warm. Biological insecticides against both these insects are being prepared by transfer of a gene from *Bacillus thuringiensis*

Biodegradation: It is nature's way of recycling wastes, breaking down organic matter into nutrients that can be used by other organisms. "Degradation" means decay, and the "bio-" prefix means that the decay is carried out by a huge assortment of bacteria, fungi, maggots, worms, and other organisms that eat dead material and recycle it into new forms.

In the nature, nothing is known as waste, because everything gets recycled. The waste products from one organism become the food for others, providing nutrients and energy while breaking down the waste organic matter. Some organic materials may break down much faster than others, but all will eventually decay.

By harnessing these natural forces of biodegradation, people can reduce wastes and clean up some types of environmental contaminants. Through **composting**, we accelerate natural biodegradation and convert organic wastes to a valuable resource.

Biosensor: Biosensor represents biophysical devices, which can detect the presence and measure the quantities of specific substances in a varity of environments. These specific substances may include sugars, proteins, or humas and varity of toxins in the industrial effluents. In designing a biosensor an enzyme or an antibody or even microbial cells are associated with microchip devices, which are used for quantitative estimate of a substance.

Bioengineering: It is a developing speciality featuring a multidisciplinary approach to the solution of problems in medicine and biology, based on the application of advances in science, engineering and technology. It generally engineers the biological processes through biotechnological or genetic engineering interventions. It may also be a broad-based engineering discipline that involve product design, sustainability and analysis of biological systems.

Pollen-Biotechnology: This is a new field of science dealing with the pollen chemistry and allerginicity of aerospora. This subject also covers genetic manipulation of pollen development of haploid culture. Such haploid plants have immense values in genetic research.

Biotechnology Policy Issue: Biotechnology appears to be an emerging science in present decades. Genetic manipulation and development of genetically modified organism in human welfare is now showed a potential prospect and risk. Thus, researches and application of Biotechnology in diverse field is a major policy issue in the present decades.

Agricultural Biotechnology: Over the years, tremendous success has been made in diverse field of agriculture by applying Biotechnology. It includes development of genetically modified crops, genetic improvement in sericulture practices, improvement in Biofertilizer development and similar other aspects. Production of pest and disease resistant crop is also being considered to be an emerging area of Agricultural Biotechnology.

Bioenergy: In recent decades, efforts have been made for evolving were non-polluting bioenergy sources or energy generation from organic wastes and biomass. These are all ecofreindly solutions. Biomass energy supply-demand balances have become a component of energy sector analysis and planning and is propelled huge importance in the countries. Biomass, Biogas, Hydrogen are the example of Bioenergy.

Nano Biotechnology: Bionanotechnology, nanobiotechnology, and nanobiology are terms that refer to the intersection of nanotechnology and biology. Given that the subject is one that has only emerged very recently, bionanotechnology and nanobiotechnology serve as blanket terms for various related technologies.

This discipline helps to indicate the merger of biological research with various fields of nanotechnology. Concepts that are enhanced through nanobiology include: nanodevices, nanoparticles, and nanoscale phenomena that occurs within the disciple of nanotechnology. This technical approach to biology allows scientists to imagine and create systems that can be used for biological research

Biomimicry: Biomimicry is an applied science that derives inspiration for solutions to human problems through the study of natural designs, systems and processes. Biomimicry on the other hand, which is not a science, is a more subtle way which we can benefit from nature. It is the modern, often high tech, equivalent of the historical practices of emulating nature. . The science of biomimicry is a newly developing field but the application of biomimicry has been around since the beginning of man. The biomimetic technologies (flight controls, bio-robotics, ventilation systems, etc.) and potential technologies (fin geometry, nacre materials, etc.) improve performance. The use of biomimicry as an approach to sustainable engineering, specifically the environmental components.

ABBREVIATIONS USED IN ADDRESSES AND CITED JOURNALS

Acad	Academy	Chem	Chemistry
Adm	Administration	Cheml	Chemical
Admn	Administrative	Clinl	Clinical
Adv	Advance	Co	Company
Agri	Agriculture	Coll	College
Agricl	Agricultural	Comm	Committee
Amer	American	Commn	Commission
An	Annual	Comp	Comparative
Analyt	Analytical	Conf	Conference
Anat	Anatomy	Conv	Convention
Anim	Animal	Conserv	Conservation
Ann	Annals	Contl	Control
Appl	Applied	Contam	Contamination
Arch	Archives	Corpn	Corporation
Archaeo	Archaeology	Coun	Council
Archaeol	Archaeological	Cult	Culture
Architect	Architecture	Cultl	Cultural
Assoc	Association	Curr	Current
Asst	Assistant	Dept	Department
Atom	Atomic	Dev	Development
Bacterio	Bacteriology	Develop	Developmental
Bacteriol	Bacteriological	Dig	Digest
Bd	Board	Div	Division
Bio	Biology	Divl	Divisional
Biochem	Biochemistry	Dte	Directorate
Biocheml	Biochemical	Dy	Deputy
Bioengg	Bioengineering	Eco	Ecology
Biol	Biological	Ecol	Ecological
Biometeo	Biometeorology	Econ	Economics
Biophys	Biophysics	Ecosys	Ecosystem
Biometeol	Biometeorological	Ecotoxico	Ecotoxicology
Biotech	Biotechnique(s)	Endocrinol	Endocrinological
Biotechno	Biotechnology	Engg	Engineering
Biotechnol	Bitechnological	Engrs	Engineers
Bldg	Building	Env	Environment
Bot	Botany	Environ	Environmental
Botl	Botanical	Epidemic	Epidemiology
Br	Branch	Epidemiol	Epidemiological
Bull	Bulletin	Estd	Establishment
Cent	Centre	Ethnopharmaco	Ethnopharmacology
Centl	Central	Expt	Experiment

Exptl	Experimental	Microbiol	Microbiological
Fac	Faculty	Min	Ministry
Fd	Food	Monit	Monitoring
Fedn	Federation	Myco	Mycology
Fert	Fertiliser	Mycol	Mycological
Fmg	Farming	Nat	Natural
Gaz	Gazette	Natl	National
Genet	Genetics	N-E	North Eastern
Geo	Geology	Nut	Nutrition
Geogr	Geography	No	Number
Geogrl	Geographical	Occ	Occassional
Geol	Geological	Occupl	Occupational
Geosci	Geoscience	Oceanogr	Oceanogoraphy
Govt	Government	Org	Original
Hist	History	Orgc	Organic
Hlth	Health	Orgn	Organisation
Hort	Horticulture	Pharmaco	Pharmacology
Hosp	Hospital	Pharmacol	Pharmacological
Hydro	Hydrology	Phyl	Physical
Hydrol	Hydrological	Patho	Pathology
Immuno	Immunology	Pathol	Pathological
Immunol	Immunlogical	Petrochem	Petrochemical
Ind	Industry	Petro	Petrology
Inf	Information	PG	Post Graduate
Inst	Institute	Phys	Physics
Instn	Institution	Physio	Physiology
Int	International	Phytopath	Phytopathology
Irrig	Irrigation	Phytopathol	Phytopathological
J	Journal	Plang	Planning
Lab	Laboratory	Polln	Pollution
Lett	Letter(s)	Proc	Proceedings
Ltd	Limited	Prot	Protection
Malario	Malariology	Pub	Publication
Malariol	Malariological	Pvt	Private
Manag	Management	Qlty	Quality
Med	Medicine	Qr	Quarter
Medl	Medical	Rad	Radiation
Metab	Metabolism	Radio	Radiology
Metall	Metallurgy	Radiol	Radiological
Metallurg	Metallurgical	Rd	Road
Meteo	Meteorology	Recd	Received
Meteol	Meteorological	Reg	Region
Microbio	Microbiology	Regl	Regional

Rep	Report	Surv	Survey
Reptr	Reporter	Syst	System
Res	Research	Tax	Taxonomy
Rev	Review	Techl	Technical
Sch	School(s)	Techno	Technology
Sci	Sciences(s)	Technol	Technological
Scient	Scientific	Toxico	Toxicology
S-E	South East	Toxicol	Toxicological
Sec	Section	Transc	Transcations
Sect	Sector	Transpt	Transportation
Semin	Seminar	Trng	Training
Ser	Services	Trop	Tropical
Soc	Society	Univ	University
Socl	Social	Util	Utilisation
Stat	Statistics	Vet	Veterinary
Statl	Statistical	Zoo	Zoology
Stnd	Standard(s)	Zool	Zoological
Stud	Study/ (eis)		

Bioaccumulation

Qiang Wang[a1], MengChen[a1], Guoqiang Shan[a], Pengyu Chen[a], Shuo Cui[a], Shujun Yi[a]. Lingyan Zhu[ab]. ([a]Key Laboratory of Pollution Processes and Environmental Criteria, Ministry of Education, Key Laboratory of Environmental Remediation and Pollution Control, College of Environmental Science and Engineering, Nankai University, Tianjin 300350, China, [b]College of Natural Resources and Environment, Northwest A&F University, Yangling, Shanxi 712100, China). **Bioaccumulation and biomagnification of emerging bisphenol analogues in aquatic organisms from Taihu Lake, China. Science of The Total Environment, Volume 598(2017): 814-820**

Due to regulations on bisphenol A (BPA) in many countries, a variety of bisphenol analogues are being widely manufactured and applied. However, there is a big knowledge gap on bioaccumulation and biomagnification of these emerging bisphenols in aquatic organisms. The bioaccumulation and magnification of nine bisphenol analogues in aquatic organisms at different trophic levels collected from Taihu Lake, China, were evaluated. The total concentrations of the nine bisphenols in the lake waters were in the range of 49.7–3480 ng/L (mean, 389 ng/L). BPA, bisphenol AF (BPAF) and bisphenol S (BPS) were the most predominant analogues in the water. The mean natural logarithm bioaccumulation factor (log BAFs) of BPAF, bisphenol C (BPC), bisphenol Z (BPZ) and bisphenol E (BPE) were greater than BPA, and there was a significantly positive correlation between log BAFs of the biphenols and their octanol-water partition coefficients (log K_{ow}). The trophic magnification factors of BPAF, BPC and BPZ were 2.52, 2.69 and 1.71, respectively, suggesting that they had the potential to biomagnify in the food web. The results of this study call for further investigations on risk assessment of these emerging pollutants in the environment.

Keywords: Bisphenol analogues; Bioaccumulation; Biomagnification; Trophic magnification factor

Katerina Grabicova[a], Roman Grabic[a], Ganna Fedorova[a], Jerker Fick[b], Daniel Cerveny[a], Jitka Kolarova[a], Jan Turek[a], Vladimir Zlabek[a], Tomas Randak[a]. ([a]University of South Bohemia in Ceske Budejovice, Faculty of Fisheries and Protection of Waters, South Bohemian Research Center of Aquaculture and Biodiversity of Hydrocenoses, Zatisi 728/II, CZ-389 25 Vodnany, Czech Republic, [b]Department of Chemistry, Umea University, SE-901 87 Umea, Sweden). **Bioaccumulation of psychoactive pharmaceuticals in fish in an effluent dominated stream. Water Research, Volume 124(2017): 654-662**

The treated effluent from sewage treatment plants (STP) is a major source of active pharmaceutical ingredients (APIs) that enter the aquatic environment. Bioaccumulation of 11 selected psychoactive pharmaceuticals (citalopram, clomipramine, haloperidol, hydroxyzine, levomepromazine, mianserin, mirtazapine, paroxetine, sertraline, tramadol and venlafaxine) was examined in Zivny Stream (tributary of the Blanice River, the Czech Republic), which is a small stream highly affected by effluent from the Prachatice STP. Six of the 11 pharmaceuticals were detected in grab water samples and in passive samplers. All pharmaceuticals were found in fish exposed to the stream for a defined time. The organs with highest presence of the selected

pharmaceuticals were the liver and kidney; whereas only one pharmaceutical (sertraline) was detected in the brain of exposed fish. Fish plasma and muscle samples were not adequate in revealing exposure because the number of hits was much lower than that in the liver or kidney. Using the criterion of a bioaccumulation factor (BAF) ≥ 500, citalopram, mianserin, mirtazapine and sertraline could be classified as potential bioaccumulative compounds. In combination, data from integrative passive samplers and fish liver or kidney tissue samples were complimentary in detection of target compounds and simultaneously helped to distinguish between bioconcentration and bioaccumulation.

Keywords: Brown trout; Contamination; Sewage water; Antidepressant; Real exposure

Kaisa Figueiredo[a]. Kimmo Mäenpää[a]. Merja Lyytikäinen[a]. Jouni Taskinen[b]. Matti T.Leppänen[c]. ([a]Department of Environmental and Biological Sciences, University of Eastern Finland, P.O. Box 111, FI-80101 Joensuu, Finland, [b]Department of Biological and Environmental Science, University of Jyväskylä, P.O. Box 35, FI-40014 University of Jyväskylä, Finland, [c]Finnish Environment Institute SYKE, Survontie 9A, FI-40500 Jyväskylä, Finland). **Assessing the influence of confounding biological factors when estimating bioaccumulation of PCBs with passive samplers in aquatic ecosystems. Science of The Total Environment, Volumes 601–602(2017): 340-345**

Passive samplers are promising surrogates for organisms, mimicking bioaccumulation. However, several biological characteristics disturb the passive partitioning process in organisms by accelerating or restraining bioaccumulation, resulting in species-specific body residues of hydrophobic organic contaminants (HOCs). In addition to site-specific characteristics and HOC concentrations, age, sex, diet, biotransformation capability and habitat-specific characteristics may affect body residues.

Two passive sampler types, polyethylene (PE) and polydimethylsiloxane (PDMS) were deployed in a PCB-contaminated freshwater lake water and sediment, respectively, to assess their bioaccumulation prediction capacity. In order to understand the importance of biological characteristics in the bioaccumulation process, we explored bioaccumulation in biota from plants and plankton to mussels and fish. The PCB concentrations in the PE sheet reflected the bioavailable concentration of PCBs slightly better than those in the PDMS samplers. Passive samplers were good predictors of PCB concentrations in fish, whereas concentrations in algae and invertebrates were overestimated. When comparing the measured concentrations in biota to the estimated concentrations using the PE samplers, the average regression slope was 0.87 for all biota and 1.22 for fish, and average modeling efficiency (EF) was 3.02 for all biota and 0.6 for fish. The best model performance was achieved for fish in trophic levels 3–4. Bioaccumulation was species-specific and dependent on the trophic level and diet. Closer examination revealed that metabolic capability changes during the life span, and source of nutrition determined the biomagnification of HOCs, which differed between the fish species. Thus, species composition and available prey selection compose a unique bioaccumulation scenario and the resulting body residues. Due to the existing variation in body residues derived from passive samplers, extrapolating the results from one to another ecosystem must be done with caution. Passive samplers, however, offer a very powerful tool for risk assessment on the ecosystem level.

Keywords: Bioaccumulation; PCB; Food web; Fish; Invertebrates; Sediment; Passive sampling; Risk assessment

Author links open overlay panel Fanny Chevillot[a], Yannice Convert[b], Mélanie Desrosiers[b], Nicole Cadoret[b], Éloïse Veilleux[b], Hubert Cabana[c], Jean-Philippe Bellenger[a]. ([a]Centre Sève, Department of Chemistry, Université de Sherbrooke, Faculty of Sciences, J1K2R1 QC, Canada, [b]Centre d'expertise en analyse environnementale du Québec, Ministère du Développement durable de l'Environnement et de la Lutte contre les changements climatiques, Quebec city, G1P3W8 QC, Canada, [c]Department of Civil Engineering, Université de Sherbrooke, Faculty of Engineering, J1K2R1 QC, Canada). **Selective bioaccumulation of neonicotinoids and sub-lethal effects in the earthworm *Eisenia andrei* exposed to environmental concentrations in an artificial soil. Chemosphere, Volume 186(2017): 839-847**

In this study, we evaluated the bioaccumulation of neonicotinoid insecticides in the earthworm *Eisenia andrei* exposed to environmental concentrations (<200 ng g^{-1} dry weight, nominal concentration) in an artificial soil. We tested the selectivity for neonicotinoids by exposing earthworms to 7 neonicotinoids alone and in more complex mixtures of 54 pesticides then 69 organic contaminants (OCs) (54 pesticides and 15 pharmaceuticals). We applied long-term (56-day) toxicity tests to further evaluate the effect of OCs on earthworms. We monitored adult survival, adult DNA damage using a comet assay on earthworm coelomocyte cells, and reproduction performance (i.e. number of cocoons and number and dry weight of juveniles). A selective bioaccumulation of neonicotinoid insecticides in adult and juvenile earthworms was found. This bioaccumulation is concomitant with a significant increase in adult DNA damage and significant effects on reproduction when earthworms were exposed to neonicotinoid insecticides alone. This study reveals a new potential point of entry of neonicotinoid insecticides into the wildlife food chain and also shows that *E. andrei* reproduction could be affected by long-term exposure to environmental concentrations of OCs.

Keywords: Earthworms; Neonicotinoid insecticides; Environmental concentrations; Bioaccumulation; Reproduction effects; Multiclass organic contaminants

Denise Kurth[ab], Stefan Lips[a], Riccardo Massei[ab], Martin Krauss[a], Till Luckenbach[c], Tobias Schulze[a], Werner Brack[ab]. ([a]UFZ — Helmholtz Centre for Environmental Research, Department of Effect–Directed Analysis, Permoserstr. 15, 04318 Leipzig, Germany, [b]RWTH Aachen University, Department of Ecosystem Analyses, Institute for Environmental Research, Worringerweg 1, 52074, Aachen, Germany, [c]UFZ — Helmholtz Centre for Environmental Research, Department of Bioanalytical Ecotoxicology, Permoserstr. 15, 04318 Leipzig, Germany). **The impact of chemosensitisation on bioaccumulation and sediment toxicity, Chemosphere, Volume 186(2017): 652-659**

Cellular multixenobiotic resistance (MXR) transport proteins enhance the efflux of numerous organic pollutants. However, MXR proteins may be blocked or saturated by xenobiotic compounds, acting as inhibitors — also called chemosensitisers. Although effective on a cellular level, the environmental relevance of chemosensitisers has not been conclusively demonstrated. Since sediments are an important source of bioaccumulating compounds in aquatic ecosystems, sediments and sediment–associated hydrophobic pollutants were investigated for their potential to increase exposure and toxicity in the presence of chemosensitisation. In this study, we address this issue by (1) comparing the net uptake of 17 hydrophobic environmental pollutants by zebrafish (*Danio rerio*) embryos in the presence and absence of the model chemosensitiser

verapamil and (2) investigating the impact of verapamil on the dose–dependent effect on zebrafish embryos exposed to polluted sediment extracts. None of the 17 pollutants showed a reproducible increase in bioaccumulation upon chemosensitisation with verapamil. Instead, internal concentrations were subject to intra–species variation by a factor of approximately two. However, a significant increase in toxicity was observed upon embryo co–exposure to verapamil for one of three sediment extracts. In contrast, another sediment extract exhibited less toxicity when combined with verapamil. In general, the results indicate only a minor impact of verapamil on the uptake of moderately hydrophobic chemicals in zebrafish embryos.

Keywords: Micro–QuEChERS; Multi–mode inlet (MMI) GC–MS/MS; Large volume injection (LVI); Small volume internal concentration; Chemosensitisation; Bioaccumulation; Sediment toxicology; Zebrafish embryo toxicity

Lígia M.B.M.Santana[a], Julián Blasco[b], Denis M.S.Abessa[c], Olivia Campana[b]. ([a]Laboratório de Ecotoxicologia Marinha, Instituto de Ciências do Mar (LABOMAR), Universidade Federal do Ceará (UFC), Av. da Abolição, 3207, Meireles, 60165-081 Fortaleza, CE, Brazil, [b]Departamento de Ecología y Gestión Costera - Instituto de Ciencias Marinas de Andalucía (CSIC), Campus Rio San Pedro, 11510 Puerto Real, Cadiz, Spain, [c]Núcleo de Estudos em Poluição e Ecotoxicologia Aquática (NEPEA), Campus Experimental do Litoral Paulista (UNESP), Praça Infante Dom Henrique s/n, Parque Bitaru, 11330-90 São Vicente, SP, Brazil). **Bioaccumulation kinetics of copper in *Ruditapes philippinarum* exposed to increasing, continuous and pulsed exposure: Implications for growth. Science of The Total Environment, Volume 595(2017): 920-927**

Metal bioaccumulation and toxicity to aquatic organisms depends on factors such as magnitude, duration and frequency of the exposure. The type of the exposure affects the toxicokinetic processes in the organisms. In this study, we carried out 30-day toxicity tests on juveniles of *Ruditapes philippinarum* exposed to increasing, continuous and pulsed exposure. Organisms were exposed to copper-spiked sediments followed by a 10-day recovery period. We assessed the interaction between the kinetics of subcellular copper partitioning and the growth response. Results showed that the growth rate of the bivalve was inversely correlated to the bioaccumulation rate and that sublethal copper concentrations stimulated the detoxification mechanisms inside the organism regardless the type of the exposure. However, a large stimulatory effect on growth was observed during the recovery period, associated with significant negative accumulation rate values and dependent on the type of antecedent exposure. This suggested that on individual and short-term basis pulsed exposures have a more adverse effect compared to increasing or continuous exposure scenarios.

Keywords: Copper; Growth; Sediment; Bioaccumulation kinetics; *Ruditapes philippinarum*

Bioremediation

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Shan Medical University, Taichung, 402, Taiwan, ROC, [d]Department of Family and Community Medicine, Chung Shan Medical University Hospital, Taichung, 402, Taiwan, ROC). **Innovative encapsulated oxygen-releasing beads for bioremediation of BTEX at high concentration in groundwater. Journal of Environmental Management, Volume 204(Part 1) (2017):12-16**

Both a low concentration of dissolved oxygen and the toxicity of a high concentration of BTEX inhibit the bioremediation of BTEX in groundwater. A novel method of preparing encapsulated oxygen-releasing beads (encap-ORBs) for the biodegradation of BTEX in groundwater was developed. Experimental results show that the integrality and oxygen-releasing capacity of encap-ORBs exceeded those of ORBs. The use of polyvinyl alcohol (PVA) with high M.W. to prepare encap-ORBs improved their integrality. The encap-ORBs effectively released oxygen for 128 days. High concentration of BTEX (480 mg L^{-1}) inhibited the biodegradation by the free cells. Immobilization of degraders in the encap-ORB alleviated the inhibition. Scanning electron microscope analysis reveals that the BTEX degraders grew on the surface of encap-ORB after bioremediation. The above results indicate that the encap-ORBs were effective in the bioremediation of BTEX at high concentration in groundwater.

Keywords: Encapsulated oxygen-releasing bead; BTEX; Immobilization; Polyvinyl alcohol; Bioremediation

Angel Orts[a], Sonia Cabrera[b], Isidoro Gómez[c], Juan Parrado[a], Bruno Rodriguez-Morgado[a], Manuel Tejada[c]. ([a]Departamento de Bioquímica y Biología Molecular, Facultad de Farmacia, Universidad de Sevilla, C/Prof. García González 2, 41012 Sevilla, Spain, [b]Departamento de Ingeniería Agrícola y Uso de la Tierra, Facultad de Agronomía, Universidad de Buenos Aires, Av. San Martín 4453, C1417DSE, Argentina, [c]Grupo de Investigación Edafología Ambiental, Departamento de Cristalografía, Mineralogía y Química Agrícola, E.T.S.I.A. Universidad de Sevilla, Crta de Utrera km. 1, 41013 Sevilla, Spain). **Use of okara in the bioremediation of chlorpyrifos in soil: Effects on soil biochemical properties. Applied Soil Ecology, Volume 121(2017): 172-176**

The main objective of this manuscript was to study the bioremediation capacity of okara (a byproduct of soy milk production) in soils contaminated by organic xenobiotics. To this aim, and under controlled laboratory conditions, a soil was contaminated with chlorpyrifos insecticide at a dose of 5 l ha^{-1}. Okara was added to this contaminated soil in two different manners: (1) pure okara (Op); and (2) a biostimulant/biofertilizer made from pure okara using the pH-stat technique. Several enzymatic activities (dehydrogenase, urease, β-glucosidase and phosphatase) and the evolution of the insecticide in soil were studied over an 80-day period. The results suggested that both forms of okara stimulated soil microorganisms and accelerated the degradation of chlorpyrifos in soil. It was, however, the biostimulant/biofertilizer that showed the greatest acceleration in insecticide degradation, possibly due to its higher content in low molecular weight (<300 Da) peptides, easily available to soil microorganisms.

Keywords: Okara; Biostimulant/biofertilizer; Bioremediation; Chlorpyrifos; Soil biochemical properties

Damien McCarthy[a], Grant C.Edwards[b], Mae S.Gustin[c], Andrew Care[a], Matthieu B.Miller[b], Anwar Sunna[ad]. ([a]Department of Chemistry and Biomolecular Sciences, Faculty of Science and Engineering, Macquarie University, Sydney, NSW 2109, Australia, [b]Department of Environmental Sciences, Faculty of Science and Engineering, Macquarie University, Sydney, NSW 2109, Australia, [c]University of Nevada, Department of Natural Resources and Environmental Science, Reno, NV, USA, [d]Biomolecular Discovery and Design Research Centre, Macquarie University, Sydney, NSW 2109, Australia). **An innovative approach to bioremediation of mercury contaminated soils from industrial mining operations. Chemosphere, Volume 184(2017): 694-699**

Soils contaminated with mercury (Hg) have proved expensive and logistically difficult to remediate. Research continues into finding suitable environmentally-friendly and efficient ways of achieving this end. Bioremediation is an option, which employs the strategies microorganisms have evolved to deal with Hg. One microbial strategy involves uptake and intracellular volatilisation of mercuric ions, which passively diffuse from the cell and back into the atmosphere. In this work, *Pseudomonas veronii* cells grown to stationary phase were immobilised in a xanthan gum-based biopolymer via encapsulation. The *P. veronii*-biopolymer mix was then coated onto natural zeolite granules. Zeolite immobilised cells remained viable for at least 16 weeks stored under ambient room temperature. Furthermore, the immobilised cells were shown to retain both viability and Hg volatilisation functionality after transportation from Australia to the USA, where they were applied to Hg contaminated soil. Maximum flux rates exceeded 10 μg Hg m^2 h^{-1} from mine tailings (≈7 mg kg^{-1} Hg with 50% v/v water). This was 4 orders of magnitude above background flux levels. It is envisioned that emitted gaseous elemental mercury (GEM) can be readily captured, and transformed back into metallic Hg, which can then be stored appropriately or recycled. This breaks the Hg cycle, as GEM is no longer translocated back to the atmospheric compartment. The immobilising excipients used in this research overcome many logistical issues with delivery of suitable microbial loads to locations of mercury contamination and presents a facile and inexpensive method of augmenting contaminated sites with selected microbial consortia for bioremediation.

Keywords: Volatilisation; Mercury bioremediation; Xanthan gum; Zeolite; Biopolymer

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Actinobacteria exhibit cosmopolitan distribution since their members are widely distributed in aquatic and terrestrial ecosystems. In the environment they play relevant ecological roles including recycling of substances, degradation of complex polymers, and production of bioactive molecules. Biotechnological potential of actinobacteria in the environment was demonstrated by their ability to remove organic and inorganic pollutants. This ability is the reason why actinobacteria have received special attention as candidates for bioremediation, which has gained importance because of the widespread release of contaminants into the environment. Among organic contaminants, pesticides are widely used for pest control, although the negative impact

of these chemicals in the environmental balance is increasingly becoming apparent. Similarly, the extensive application of heavy metals in industrial processes lead to highly contaminated areas worldwide. Several studies focused in the use of actinobacteria for cleaning up the environment were performed in the last 15 years. Strategies such as bioaugmentation, biostimulation, cell immobilization, production of biosurfactants, design of defined mixed cultures and the use of plant-microbe systems were developed to enhance the capabilities of actinobacteria in bioremediation. In this review, we compiled and discussed works focused in the study of different bioremediation strategies using actinobacteria and how they contributed to the improvement of the already existing strategies. In addition, we discuss the importance of omic studies to elucidate mechanisms and regulations that bacteria use to cope with pollutant toxicity, since they are still little known in actinobacteria. A brief account of sources and harmful effects of pesticides and heavy metals is also given.

Keywords: Actinobacteria; Bioremediation; Pesticides; Heavy metals; Environmental pollution; Co-contamination

Ying Cheng[ab], Liang Wang[ab], Vilma Faustorilla[bc], Mallavarapu Megharaj[ab], Ravi Naidu[ab], Zuliang Chen[ab]. ([a]Global Centre for Environmental Remediation, Faculty of Science and Information Technology, University of Newcastle, Callaghan, NSW 2308, Australia, [b]CRC for Contamination Assessment and Remediation of Environment, Mawson Lakes Boulevard, Mawson Lakes, SA 5095, Australia, [c]Future Industries Institute, Mawson Lakes Boulevard, Mawson Lakes, SA 5095, Australia). **Integrated electrochemical treatment systems for facilitating the bioremediation of oil spill contaminated soil. Chemosphere, Volume 175(2017): 294-299**

Bioremediation plays an important role in oil spill management and bio-electrochemical treatment systems are supposed to represent a new technology for both effective remediation and energy recovery. Diesel removal rate increased by four times in microbial fuel cells (MFCs) since the electrode served as an electron acceptor, and high power density (29.05 W m^{-3}) at current density 72.38 A m^{-3} was achieved using diesel (v/v 1%) as the sole substrate. As revealed by Scanning electron microscope images, carbon fibres in the anode electrode were covered with biofilm and the bacterial colloid**s** which build the link between carbon fibres and enhance electron transmission. Trace metabolites produced during the anaerobic biodegradation were identified by gas chromatography–mass spectrometry. These metabolites may act as emulsifying agents that benefit oil dispersion and play a vital role in bioremediation of oil spills in field applications.

Keywords: Bioremediation; Microbial fuel cell; Diesel; GC-MS

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Identification of polar transformation products and high molecular weight polycyclic aromatic hydrocarbons (PAHs) in contaminated soil following bioremediation. Science of The Total Environment, Volumes 599–600(2017): 1099-1107

Bioremediation is a technique commonly used to reduce the toxicity associated with polycyclic aromatic hydrocarbons (PAHs) in contaminated soils. However, the efficacy of bioremedial applications is evaluated based on the removal of a subset of parent (or unsubstituted) PAHs and does not incorporate toxic polar transformation products or the more mutagenic high molecular weight PAHs (MW ≥ 302 amu or MW302-PAHs). Previously, an effects-directed analysis approach was used to assess the effect of bioremediation on the toxicity of a coal tar-contaminated soil. Increased genotoxicity and developmental toxicity was measured postbioremedation in the more polar soil extract fractions, as compared to the less polar fractions where the targeted PAHs eluted, and could not be attributed to the 88 target PAHs analyzed for (including selected oxygen-containing PAHs). In this study, comprehensive two-dimensional gas chromatography time-of-flight and liquid chromatography quadrupole time-of-flight mass spectrometry were used to characterize transformation products in the soil extract fractions identified as toxic, previously. Additionally, the degradation of 12 MW302-PAHs, picene (MW = 278) and coronene (MW = 300) were evaluated following bioremediation. Non-targeted analysis resulted in the tentative identification of 10 peaks with increased intensity postbioremediation (based on mass spectral library matching and fragmentation patterns from > 5000 candidate peaks in the soil extracts). Several of these compounds contained oxygen, suggesting they would be relatively polar. MW302-PAHs were not significantly degraded during bioremediation, suggesting that the carcinogenic potential associated with these PAHs might remain unchanged. The results of this study suggest that polar transformation products, and MW302-PAHs, should be considered for realistic risk assessment of bioremediated soils.

Keywords: Bioremediation; PAH transformation products; Toxicity; Non-targeted analysis; High molecular weight 302 PAHs

Biotransformation

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The sediments from Chinese coastal waters contain relatively high concentrations of arsenic (As), mainly arsenate As(V), which may be transferred along the marine benthic food chain. The prey-specific determination of As bioaccumulation and transformation in marine benthic fish remains little known. In this study, we focused on a typical marine benthic food chain comprising of sediments, deposit-feeding invertebrates (polychaete *Nereis succinea* and clam *Gafrarium tumidum*) and goby fish *Mugilogobius chulae*. Graded exposed experiments using different As exposure durations and concentrations were conducted to examine their transformation rate and efficiency. Radiotracer techniques were used to determine the rates of As

uptake (as arsenate) from seawater, assimilation from two prey and its subsequent efflux in the goby fish. We demonstrated that the two prey (polychates and clams) displayed different As biotransformation in the goby fish. Biotransformation rate was higher in the goby fish fed on the clams than on the polychaetes, and biotransformation efficiency was lower with increasing inorganic As concentration in the prey. The As overall bioaccumulation in the goby fish was very low, mainly because of the low dissolved uptake and dietary assimilation and high efflux. Combining the biotransformation and biokinetics measurements, our findings highlighted that different prey containing different As concentrations and As species resulted in the comparable As bioaccumulation in the goby fish.

Keywords: Arsenic; Biotransformation; Bioaccumulation; Biokinetics; Goby fish

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Surfactants were used to permeabilize cells of *Pseudomonas putida* KT2440 so as to maximize retention of the arginine deiminase (ADI) activity within the treated cells. The surfactants cetyltrimethylammoniumbromide (CTAB), sodium dodecyl sulfate (SDS) and Triton X100 were tested separately. Statistical models were developed for the effects on the ADI activity of the following factors: the concentration of the surfactant, the length of the treatment period and the concentration of the cells. For all surfactants, the concentration of cells was the most significant factor in influencing permeabilization. All permeabilization treatments used mild conditions (pH 7, 37 °C). The permeabilized cells were immobilized in alginate beads for the biotransformation of arginine to citrulline. The optimal conditions for immobilization and biotransformation were as follows: 2% (w/v, g/100 mL) sodium alginate, 100 g/L of treated cells, 40 mM arginine, pH 6.0, a temperature of 35 °C and an agitation speed of 150 rpm. The immobilized biocatalyst retained nearly 90% of its initial activity after nine cycles of repeated use in batch operations. In contrast, the freely suspended cells were barely active after the second use cycle.

Keywords: *Pseudomonas putida;* Cell permeabilization; Arginine deiminase; Whole-cell immobilization; Biotransformation; Citrulline

Sunah Kim[a1], Karen Rossmassler[a1], Corey D.Broeckling[b], Sarah Galloway[b], Jessica Prenni[b], Susan K.De Long[a]. ([a]Colorado State University, Department of Civil and Environmental Engineering, USA, [b]Colorado State University, Proteomics and Metabolomics Facility, USA). **Impact of inoculum sources on biotransformation of pharmaceuticals and personal care products. Water Research, Volume 125(2017): 227-236**

Limited knowledge of optimal microbial community composition for PPCP biotreatment, and of the microbial phylotypes that drive biotransformation within mixed microbial communities, has hindered the rational design and operation of effective and reliable biological PPCP treatment technologies. Herein, bacterial community composition was investigated as an isolated variable

within batch biofilm reactors via comparison of PPCP removals for three distinct inocula. Inocula pre-acclimated to model PPCPs were derived from activated sludge (AS), ditch sediment historically-impacted by wastewater treatment plant effluent (Sd), and material from laboratory-scale soil aquifer treatment (SAT) columns. PPCP removals were found to be substantially higher for AS- and Sd-derived inocula compared to the SAT-derived inocula despite comparable biomass. Removal patterns differed among the 6 model compounds examined (diclofenac, 5-fluorouracil, gabapentin, gemfibrozil, ibuprofen, and triclosan) indicating differences in biotransformation mechanisms. *Sphingomonas, Beijerinckia, Methylophilus,* and unknown *Cytophagaceae* were linked with successful PPCP biodegradation via next-generation sequencing of 16S rRNA genes over time. Results indicate the criticality of applying engineering approaches to control bacterial community compositions in biotreatment systems.

Keywords: Biodegradation; Biotransformation; Pharmaceuticals and personal care products; Trace organic contaminants; Wastewater treatment; Next-generation sequencing

Qian Gao, Yuqian Qiao, Yanbing Shen, Min Wang, Xibo Wang, Yang Liu. (Key Laboratory of Industrial Fermentation Microbiology, Ministry of Education, College of Biotechnology, Tianjin University of Science & Technology, Tianjin 300457, People's Republic of China). **Screening for strains with 11α-hydroxylase activity for 17α-hydroxy progesterone biotransformation. Steroids, Volume 124(2017): 67-71**

Various corticosteroids are prepared by using 11α,17α-diOH-progesterone (11α,17α-diOH-PROG) as an important intermediate and raw material. Hence, strains that can improve the yields of 11α,17α-diOH-PROG should be screened. *Cunninghamella elegans* CICC40250 was singled out from five common 11α hydroxylation strains. The reaction parameters of 11α,17α-diOH-PROG production were also investigated. *C. elegans* CICC40250 could efficiently catalyze the hydroxylation of 17α-hydroxy progesterone (17α-OH-PROG) at C-11α position. This strain could also effectively convert 11α,17α-diOH-PROG at high substrate concentrations (up to 30 g/L). After the coenzyme precursor glucose was added, the rate of 11α,17α-diOH-PROG formation reached 84.2%, which was 11.4% higher than that of the control group. Our study established a simple and feasible mechanism to increase 11α,17α-diOH-PROG production levels. This mechanism involves *C. elegans* CICC40250 that can be efficiently applied to induce the biotransformation of 17α-OH-PROG with a hydroxylation biocatalytic ability.

Keywords: 17α-Hydroxy progesterone; Biotransformation; *Cunninghamella elegans;* Hydroxylation

Gurusamy Raman[ab], Seon JooPark[b], Natarajan Sakthivel[a], Anil K.Suresh[c]. ([a]Department of Biotechnology, School of Life Sciences, Pondicherry University, Kalapet, Puducherry 605014, India, [b]Department of Life Sciences, Yeungnan University, Gyeongsan, 712749, South Korea, [c]Bio-Nanotechnology Laboratory, Department of Biotechnology, Faculty of Humanities and Sciences, SRM University, Kattankulatur, Chennai 603202, India). **Physico-cultural parameters during AgNPs biotransformation with bactericidal activity against human pathogens. Enzyme and Microbial Technology, Volume 100(2017): 45-51**

Production of AgNPs with desired morphologies and surface characteristics using facile, economic and non-laborious processes is highly imperative. Cell extract based syntheses are emerging as a novel technique for the production of diverse forms of NPs, and is assured to meet the requirements. Therefore, in order to have a better understanding, and to improvise and gain

control over the NPs morphological and surface characteristics, the present investigation systematically evaluates the influence of various major physico-cultural parameters including diverse growth media, concentrations of precursor salts; pH and temperature on the biotransformation of ionic silver (Ag^+) to nanopariculate silver nanoparticles (AgNPs), utilizing the cell free extract of the bacterium, *P. plecoglossicida*. The synthesis, purity, morphology and surface characteristics of the AgNPs during optimization studies were measured. The bactericidal effect of these AgNPs was assessed using multi-drug resistant human pathogens; *Acinetobacter baumannii*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Salmonella enterica* based on the diameter of inhibition zone in disk diffusion tests. The nanoparticles were found to be of higher toxicity to *E. coli* and *S. enterica* than *A. baumannii* and *P. aeruginosa*. The results demonstrate that the chosen parameters in whole or in part could have a significant influence on the morphology, surface characteristics, duration of production, overall yield and production of AgNPs.

Keywords: Antibacterial activity; Biotransformations; Cell-free extract; Optimization; Physico-cultural parameters; Silver nanoparticles

Biomarker

Zhongxue Tang, Zhanfang Ma. (Department of Chemistry, Capital Normal University, Beijing 100048, China). Multiple functional strategies for amplifying sensitivity of amperometric immunoassay for tumor markers: A review. Biosensors and Bioelectronics, Volume 98(2017): 100-112

Multiple functional strategies have shown great potential in ultrasensitive amperometric immunoassays for tumor markers, which promote conductivity and signal multiple amplification. The sensitivity of amperometric immunoassays is significantly affected by the conductivity and specific area of the sensing interface as well as the electrochemical activity of redox species. Thus, these strategies are generally based on integrating various materials together and endowing immunosensing systems with many advantages, such as large specific area, high electrochemical activity, good conductivity, biocompatibility, and catalytic performance. Owing to the rapid development of functional materials (such as conductive hybrids, catalytic hybrids, enzyme-like materials, highly electrochemical active species, redox nanocomposites, porous materials, hydrogels, and metal-organic framework) and new bioactive substances (including new blocking agents and receptors like peptides and oligonucleotide chains), the sensitivity of related biosensors is usually higher than that of traditional ones, indicating that multiple functional strategies are promising in amperometric immunoassays. Herein, we provide an overview of recent advances in multiple functional strategies that have proven to dramatically enhance the sensitivity of amperometric immunoassays, which incorporate the following materials: (1) conductive nanomaterials hybrids; (2) catalytic nanomaterials hybrids; (3) new redox materials; (4) three-dimensional porous materials; (5) new receptors and blocking agents.

Keywords: Amperometric immunoassay; Multiple functional strategies; Tumor marker; Multifunctional nanohybrids; Redox hydrogel; Peptides

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This work reports a novel optical microfluidic biosensor with highly sensitive organic photodetectors (OPDs) for absorbance-based detection of salivary protein biomarkers at the point of care. The compact and miniaturized biosensor has comprised OPDs made of polythiophene-C_{70} bulk heterojunction for the photoactive layer; whilst a calcium-free cathode interfacial layer, made of linear polyethylenimine, was incorporated to the photodetectors to enhance the low cost. The OPDs realized onto a glass chip were aligned to antibody-functionalized chambers of a poly(methyl methacrylate) microfluidic chip, in where immunogold-silver assays were conducted. The biosensor has detected IL-8, IL-1β and MMP-8 protein in spiked saliva with high detection specificity and short analysis time exhibiting detection limits between 80 pg mL^{-1} and 120 pg mL^{-1}. The result for IL-8 was below the clinical established cut-off of 600 pg mL^{-1}, which revealed the potential of the biosensor to early detection of oral cancer. The detection limit was also comparable to other previously reported immunosensors performed with bulky instrumentation or using inorganic photodetectors. The optical detection sensitivity of the polythiophene-C_{70} OPD was enhanced by optimizing the thickness of the photoactive layer and anode interfacial layer prior to the saliva immunoassays. Further, the biosensor was tested with unspiked human saliva samples, and the results of measuring IL-8 and IL-1β were in statistical agreement with those provided by two commercial assays of ELISA. The optical microfluidic biosensor reported hereby offers an attractive and cost-effective tool to diagnostics or screening purposes at the point of care.

Keywords: Immunosensor; Saliva diagnostics; Optical biosensor; Integrated microfluidics; Organic photodetector; Point-of-care

Margherita Ferrante[a], Anna Maria Pappalardo[b], Venera Ferrito[b], Valentina Pulvirenti[b], Carmelo Fruciano[c], Alfina Grasso[a], Salvatore Sciacca[a], Concetta Tigano[b], Chiara Copat[a]. ([a]Department of Medical Sciences, Surgical and Advanced Technologies "G.F. Ingrassia", Hygiene and Public Health, University of Catania, Via Santa Sofia 87, Catania, Italy, [b]Department of Biological, Geological and Environmental Sciences, University of Catania, Via Androne 81, 95124 Catania, Italy, [c]School of Earth, Environmental and Biological Sciences, Queensland University of Technology, Gardens Point, Brisbane, QLD 4000, Australia). **Bioaccumulation of metals and biomarkers of environmental stress in *Parablennius sanguinolentus* (Pallas, 1814) sampled along the Italian coast. Marine Pollution Bulletin, Volume 122(1–2)(2017): 288-296**

Heavy metal pollution is one of the greatest threats to the ecosystems because it degrades the habitat and is potentially toxic to wildlife and human populations. In the last few decades, bioaccumulation studies performed with a multimarker approach have been a valuable tool for the investigation of environmental and animal safety.

We perform an analysis of a benthic teleost fish species – *Parablennius sanguinolentus* – sampled at several Italian coastal sites with different degrees of anthropogenic pressure. Our integrative analysis encompasses bioaccumulation of 10 metals, biomarkers of environmental stress (micronuclei and nuclear abnormalities) and neutral genetic variation (using sequences of the mtDNA control region).

We find a clear and significant correlation of metal bioaccumulation with micronuclei and nuclear abnormalities, especially with undisputed genotoxic metals, such as Cd, Cr, Hg and Pb. Furthermore, the molecular genetic analysis revealed a decrease of genetic variability in the populations more subjected to anthropic pressure.

Keywords: Metal bioaccumulation; Biomarkers; Mitochondrial control region; *Parablennius sanguinolentus*

Biofertilizer

Hamzeh Amiri, Ahmad Ismaili & Saeed Reza Hosseinzadeh. (Department of Biology, Faculty of Sciences, Lorestan University, Khorramabad, Iran). Physiological Features of Chickpea (*Cicer arietinum* L. cv. karaj). Compost Science & Utilization, Volume 25, 3(2017): 152-165

One goal in the face of deficit water conditions is to increase growth and yield. Agro-industrial production frequently causes environmental pollution by using chemical fertilizers. In recent decades, bio-fertilizers such as vermicompost have been used as a safe alternative to chemical fertilizer. The present study considered the response of the chickpea to different combinations of vermicompost and water deficit stress in a greenhouse environment. Plant response was determined by measuring a range of morpho-physiologic parameters. The treatments were addition of 0%, 10%, 20%, and 30% of vermicompost to soil, and water deficit stress at the following levels: non-stress (100% of field capacity), moderate water stress (75% of field capacity), and severe water stress (25% of field capacity). The results showed that vermicompost had a significant effect on all traits under stress and non-stress conditions. The vermicompost treatments under non-stress conditions significantly increased plant height, number of pods, leaf area, stem and leaf dry weight, pod dry weight, chlorophyll a, carotenoid, total chlorophyll content, CO_2 assimilation rate, internal CO_2 concentration, and water-use efficiency over that of the control condition. The addition of 30% vermicompost under moderate and severe water stress conditions significantly increased plant height, number of pods, leaf area, leaf dry weight, carotenoids, and water-use efficiency over that of the control level. This study confirmed that vermicompost improved the morphological features, soil biological activity, and quality of the chickpea, but did not positively influence the physiological features under moderate and severe water deficit stress.

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Nanjing Agricultural University, Nanjing 210095, PR China). Development of a novel bio-organic fertilizer for plant growth promotion and suppression of rhizome rot in ginger. Biological Control, Volume 114(2017): 97-105

Rhizome rot of ginger caused by *Fusarium oxysporum* f. sp. *zingiberi* (*Foz*) is a soil-borne disease that adversely affects the seed rhizomes and crop production. *Bacillus amyloliquefaciens* NJPRHSDAQ-1 (NP-1), which has a substantial inhibitory effect on *Foz in vitro*, was isolated from the ginger rhizosphere. A pot experiment indicated that a bio-organic fertilizer made from NP-1 (BIO2) or other universal biocontrol agents (BIO1), the suspension of NP-1 (NP-1), and its cell-free fermentation broth (NP-1fb), all effectively reduced the disease incidence of rhizome rot, stimulated plant growth, and improved the microbial community compared to the control. The best control effect (78.3%) and the most significant suppression of *Foz* abundance (75.8% compared to control) were all observed in the BIO2 treatment. Two field experiments further indicated that BIO2 amendment can significantly increase ginger yield by 8.0–11.5% and can decrease the *Foz* population by 30.8–51.0% compared to control plants receiving only chemical fertilizer. Application of BIO2 also increased the growth and nutrient quality of ginger and soil enzyme activity. Pearson correlation analysis indicated a significant negative relationship between the abundance of culturable bacteria and *Foz*, while a negative correlation between culturable actinomycetes/fungi population and invertase/urease activity was observed. This study highlights the application prospect of a novel bio-organic fertilizer in ginger production for both disease suppression and growth promotion.

Keywords: Ginger rhizome rot; *Fusarium oxysporum* f. sp. *zingiberi* (*Foz*); *Bacillus amyloliquefaciens;* Biocontrol; Plant growth promotion

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In terrestrial ecosystems, changes in soil nutrient availability, plant growth or natural enemies can generate important shifts in abundance of organisms at various trophic levels. In agroecosystems the performance of (invasive) herbivores and their impacts on crops is of particular concern. Scientists are presently challenged with making reliable inferences on invader success, natural enemy performance and efficacy of biological control, particularly in tropical agroecosystems. In this study, we assess how trophic regulatory forces (bottom-up vs. top down) influence the success of three globally important pests of cassava. We examine the mealybug species (Hemiptera: Pseudococcidae) of differing host breadth and invasion history: *Phenacoccus manihoti*, *Paracoccus marginatus*, and *Pseudococcus jackbeardsleyi*. Potted plant fertilizer trials were combined with a regional survey in Vietnam, Laos and Cambodia of 65 cassava fields of similar size and age, but with varying soil fertility. Relative abundance of each mealybug invader was mapped along a soil fertility gradient, and contrasted

with site-specific measures of parasitism. Potted plant trials revealed strong bottom-up effects for *P. manihoti*, such that impacts of nitrogen and potassium additions were propagated through to higher trophic levels and substantially boost development and fitness of its specialist parasitoid, *Anagyrus lopezi* (Hymenoptera: Encyrtidae). Field surveys indicate that mealybug performance is highly species-specific and context-dependent. For example, field-level abundance of *P. jackbeardsleyi* and *P. marginatus*, was related to measures of soil fertility parameters, soil texture and plant disease incidence. Furthermore, for *P. manihoti*, in-field abundance is equally associated with soil texture (i.e., silt content). Principal component analysis (PCA) and regression suggested that *P. manihoti* and *P. marginatus* are disproportionately favored in low-fertility conditions, while *P. jackbeardsleyi* prospers in settings with high organic carbon and phosphorus. Parasitism of *P. manihoti* by *A. lopezi* varied greatly with field and soil fertility conditions, and was highest in soils with intermediate fertility levels and where management practices include the addition of fertilizer supplements. Our characterization of the relative performance of invasive mealybugs and strength of parasitism across variable soil fertility conditions will help guide parasitoid release programs and soil management practices that enhance mealybug biological control.

Keywords: Classical biological control; Trophic dynamics; Soil fertility; Biotic resistance; Invasive species

Xiaojing Hu[ab], Junjie Liu[a], Dan Wei[c], Ping Zhu[d], Xi'an Cui[e], Baoku Zhou[c], Xueli Chen[c], Jian Jin[a], Xiaobing Liu[a], Guanghua Wang[a]. ([a]Key Laboratory of Mollisols Agroecology, Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Harbin 150081, China, [b]University of Chinese Academy of Sciences, Beijing 100049, China, [c]Institute of Soil and Fertilizer and Environment Resources, Heilongjiang Academy of Agricultural Sciences, Harbin 150086, China, [d]Institute of Agricultural Resource and Environment, Jilin Academy of Agricultural Sciences, Changchun 130033, China, [e]Heihe Branch of Heilongjiang Academy of Agricultural Sciences, Heihe 164300, China). **Effects of over 30-year of different fertilization regimes on fungal community compositions in the black soils of northeast China. Agriculture, Ecosystems & Environment, Volume 248(2017): 113-122**

In this study, we investigated the effects of four long-term fertilization regimes that were performed over 30 years, namely, non-fertilization (NoF), chemical fertilization (CF), manure fertilization (M) and chemical fertilization plus manure (CFM), on a range of soil properties and fungal communities at three locations which located in the northern, middle and southern parts of the black soil region of northeast China. The fungal communities were primarily analyzed by Illumina MiSeq sequencing targeting fungal rRNA operon ITS1 region. The results showed that the fertilizers (organic or inorganic) generally increased the soil nutrient contents and fungal abundances. Principal coordinate analysis (PCoA) revealed that all fungal communities were separated into three groups according to their sampling locations, and the soil pH was the most influential factor in determining the total fungal communities across the three locations. Similar fertilization treatments had inconsistent influences on the fungal community compositions and the most influential soil factor in shaping fungal community structures varied among the three locations. Amending with inorganic fertilizers increased the relative abundances of potentially pathogenic fungi in the southern location, while the addition of manure suppressed possible

pathogenic fungal growth and enhanced the growth of beneficial fungi in the three locations. Our findings highlighted that the influences of geographical separation along with fertilization regimes should be considered when examining the responses of fungal communities to fertilization regimes in agricultural management.

Keywords: Fungal ITS region; Geographical separation; Illumina MiSeq sequencing; Indicator species; Long-term fertilization

Yafang Tang, Miaomiao Zhang, Anlei Chen, Wenzhao Zhang, Wenxue Wei, Rong Sheng. (Key laboratory of Agro-ecological Processes in Subtropical Regions and Taoyuan Agro-ecosystem Research Station, Soil Molecular Ecology Section, Institute of Subtropical Agriculture, Chinese Academy of Sciences, Changsha 410125, China). **Impact of fertilization regimes on diazotroph community compositions and N_2-fixation activity in paddy soil. Agriculture, Ecosystems & Environment, Volume 247(2017): 1-8**

Nutrient status in soil is crucial for the growth and activity of resident microorganisms, which in turn regulate nitrogen transformation in the terrestrial biosphere. Biological nitrogen fixation (BNF) is an important N input in agricultural ecosystems, but the influence of fertilization on the structural and functional behavior of diazotrophs is not clear. In this study, we assessed the nutrient limitations on the abundance and N_2-fixation activity of diazotrophs in a long term (20 years) fertilization experiment. Although both phosphorus (P) deficiency and potassium (K) deficiency resulted in significant decreases in *nifH* gene expression and N_2-fixation activity, P deficiency exhibited more restrictive effects. Assessments of community structures based upon transcripts also indicated that the active diazotroph populations were more sensitive to P deficiency than K deficiency, and some diazotroph groups were detected in the P deficiency treatment. Long-term rice straw addition significantly increased diazotroph abundance, but in contrast, sharply reduced *nifH* gene expression and N_2-fixation activity. The close relationship between N_2-fixation activity and *nifH* gene expression rather than its copy number suggests that the *nifH* gene transcript level is a suitable indicator for predicting the N_2-fixation activity of N_2-fixing microorganisms in paddy soil of various fertility status.

Keyword: N_2-fixation; Diazotroph community; Fertilization; Phosphorus; Paddy soil

Ji Hwi Jang[a], Su Young Woo[a], Sun Hyung Kim[a], Inkyin Khaine[a], Myeong Ja Kwak[a], Hyun Kyung Lee[a], Tae Yoon Lee[a], Wi Young Lee[b]. ([a]Department of Environmental Horticulture, University of Seoul, Seoul 02504, South Korea, [b]Division of Forest Tree Improvement, National Institute of Forest Science, Suwon 16631, South Korea). **Effects of increased soil fertility and plant growth-promoting rhizobacteria inoculation on biomass yield, energy value, and physiological response of poplar in short-rotation coppices in a reclaimed tideland: A case study in the Saemangeum area of Korea. Biomass and Bioenergy, Volume 107(2017): 29-38**

This study aims to investigate the physiological response, biomass yield and its bio-energy value to charcoal mineral fertilizer and *Bacillus subtilis* strain JS, a plant growth-promoting rhizobacteria, under nine different soil-enrichment procedures, and to provide a reference for suitable management strategies for short-rotation coppices on the marginal soils of reclaimed tidelands in Saemangeum area of Korea. The treatments used in this experiment were as follows: 1) 1:100 (volume basis) diluted rhizobacteria inoculation {B1, (*B.* subtilis: double-distilled water, v/v)}, 2) 1:50 diluted rhizobacteria inoculation (B2), 3) mineral fertilization {F1,

(charcoal 200 kg ha^{-1})}, 4) additional mineral fertilization {F2, (charcoal 300 kg ha^{-1})}, 5) F1+B1, 6) F2+B1, 7) F1+B2, 8) F2+B2, and 9) control plot with no soil enrichment (C). The plant species used in this study is *Populus* euramericana. Net photosynthetic assimilation using leaves acclimated for 2 min at 1500 μmol m^{-2} s^{-1} was the highest in F1+B2, followed by B2+F2 and B2. Total biomass yield in F2+B2 was the highest by a significant margin among the nine soil-enrichment procedures, whereas that in the control soil was lowest. Plants in all soil conditions provided similar net calorific values of dry mass, and they all fell within the third grade of wood pellet quality criteria of the National Institute of Forest Science standard specification (Korea), within the premium category in the Pellet Fuels Institute standard specification (US), and within the A1 category in the EN-Plus standard specification (EU). Moreover, it was confirmed that the poplar was suited to produce wood pellets for heating energy.

Keywords: Bioenergy; Charcoal mineral fertilizer; Plant growth-promoting rhizobacteria; Poplar; Reclaimed tideland; Short-rotation coppices

Biocomposting

Jason M. Matlock & D. Bradley Rowe. (Dept. of Entomology, Michigan State University, East Lansing, Michigan). Does Compost Selection Impact Green Roof Substrate Performance? Measuring Physical Properties, Plant Development, and Runoff Water Quality. Compost Science & Utilization, Volume 25, 4(2017): 231-241

Six green roof substrate blends were created by using composts sourced from local suppliers and the Michigan State University Student Organic Farm. Bulk density, field capacity, total porosity, and saturated hydraulic conductivity were determined for each substrate and compared to an un-amended expanded shale aggregate. Significant differences were detected in all measured physical properties. A plant growth study was conducted in a greenhouse. *Ocimum basilicum* (basil), *Sedum floriforum* (sedum), and *Carex eburnea* (bristleleaf sedge) were grown in a depth of 10 cm of all six substrates for 6 months. The greatest dry shoot masses in bristleleaf sedge and sedum were twice those of the smallest masses. The largest wet harvest of basil was four times greater than the smallest harvest. Runoff water was collected after simulated precipitation events on regular intervals during the plant growth study and analyzed for nitrate and phosphate concentrations. Ion concentrations were greatest on the first measurement date and decreased rapidly with time. Compost selection had a strong impact on initial nitrate and phosphate concentrations, but the influence of compost on concentrations diminished with time. Overall, compost selection was found to have measureable and meaningful impacts on green roof substrate performance.

Shantibala Devi Sanasam & Narayan Chandra Talukdar. (Institute of Advanced Study in Science and Technology, Paschim Boragoan, Garchuk, Gauhati, Assam, India. Correspondence: narayactalukdar@yahoo.com). Quality Compost Production from Municipality Biowaste in Mix with Rice Straw, Cow Dung, and Earthworm Eisenia fetida. Compost Science & Utilization, Volume 25, 3 (2017): 141-151

The biodegradable portion of city waste is a potential source of plant nutrients, and appropriate techniques of composting can convert it to quality compost with higher nutrient content and lower levels of pathogenic microorganisms. An amount of 68.19 tons of waste is generated in Imphal City, Manipur, India, of which 24.84 tons were biodegradable. Of the total biodegradable municipality waste (MW), 20.7 tons were produced in households and the vegetable markets of the city. The MW were found to contain pathogenic bacteria (PB), namely, *Salmonella* spp., *Shigella* spp., *Micrococcus* spp., and *Enterobacter* spp. in the range of 6.35–9.28 (log cfu/g dry biomass), and agriculturally beneficial bacteria (BB), namely, phosphate solubilizers, *Azospirillum* spp., *Azotobacter* spp., and cellulose degraders in the range of 6.25–8.83 log cfu/g dry biomass. Pre-treatment of the MW by exposure at temperatures of 27°C–50°C in a greenhouse for 5 days could not reduce the level of PB and BB, but by heating at 100°C for 8 h followed by 30°C for 16 h of a day for three consecutive days, the PB (except *Micrococcus* spp.) could be eliminated. Aerobic composting of the mixture of MW with cow dung (CD) and rice straw (RS) and by inoculation with epigeic earthworm *Eisenia fetida*, produced high quality manure as evident from more finer particle (56.6%), higher nutrient (2.19% N) content, higher population of BB (7.03–9.19 log cfu/g dry biomass), and reduced level of PB (6.87–8.09 log cfu/g dry biomass).

Housam Kanaan, Shlomit Medina & Michael Raviv. (Department of Plant Pathology and Microbiology, Robert H. Smith Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem, Rehovot, Israel; Institute of Plant Sciences, Agricultural Research Organization, Newe Ya'ar Research). The Effects of Soil Solarization and Compost on Soil Suppressiveness against Fusarium Oxysporum f. sp. Melonis. Compost Science & Utilization, Volume 25, 3 (2017): 206-210

Soil suppressiveness against Fusarium was tested using solarized and non-solarized soils combined with composts of three maturation levels, and a non-amended control. The soils were sampled on three dates: after previous year solarization but before current year solarization (0 weeks), at the end of the solarization period of the current year (4 weeks), and 4 weeks later (recovery time). Melon seedlings were inoculated with Fusarium spores and disease severity was assessed. The study showed a reduction of soil suppressiveness capacity against *Fusarium oxysporum* f. sp. *melonis* after 1 year of solarization (0 weeks). Fusarium disease severity in artificially inoculated melon plants, expressed by area under the disease progress curve, was higher in solarized soil than in non-solarized soil. Compost addition lowered the disease severity, both in the solarized and in the non-solarized soils. However, suppression was not obtained at the end of the solarization period, whereas compost beneficial effect was found at this time.

F.Mesa[a], J.Torres[b], O.Sierra[a], Francisco J.Escobedo[c]. ([a]Universidad del Rosario, Facultad de Ciencias Naturales y Matemáticas, Grupo NanoTech, Cra. 24 Nº 63C-69, Bogotá, Colombia, [b]Facultad de Ingeniería, Universidad Libre, Cra. 70 Nº 53-40, Bogotá, Colombia, [c]Universidad del Rosario, Facultad de Ciencias Naturales y Matemáticas, Grupo Ecología Funcional y Ecosistémica, Bogotá, Colombia). Enhanced production of compost from Andean wetland biomass using a bioreactor and photovoltaic system. Biomass and Bioenergy, Volume 106(2017): 21-28

Azolla filiculoides and *Typha* latifolia are invasive plants that detrimentally affect water and environmental quality in Andean wetlands. This study determined the aeration rate required to accelerate the composting process for biomass from these two plants using an enhanced semi-portable, closed, controlled bioreactor powered by a photovoltaic system. Such a system utilizing

biomass from invasive aquatic plants could be used to produce compost in rural, remote, mountainous areas with little infrastructure. The solar powered, self-gyrating fixed bed gasifier bioreactor system measured tri-daily temperature, humidity, oxygen and pH. Aeration rate and humidity curves were also developed and could be used in other composting systems in tropical mountainous areas. The autonomous, self-powered, closed system bioreactor reduced composting time from the typical 9 weeks to just 4 and period of activation from 2.6 weeks to 1.5 days. Compost pH, humidity and C:N ratios were all within the range of reported values. Physical and chemical analyses show that the final compost material was suitable for local Andean cropping systems. The system can be used to sustainably utilize excess biomass residue material from Andean wetland restoration projects.

Keywords: Fixed bed gasifier; *Azolla filiculoides; Typha latifolia;* Autonomous composting systems; Wetland vegetation biomass; Invasive aquatic plants

Biopesticides

Sawai Boukaew, Poonsuk Prasertsan, Claire Troulet, Marc Bardin. (1.College of Innovation and Management Songkhla Rajabhat University Songkhla, Thailand, 2.Department of Industrial Biotechnology, Faculty of Agro-Industry Prince of Songkla University Songkhla, Thailand, 3.Pathologie Végétale, INRA Montfavet, France). Biological control of tomato gray mold caused by *Botrytis cinerea* by using *Streptomyces* spp. BioControl, Volume 62, 6(2017):793–803

Streptomyces is a genus known for its ability to protect plants against many pathogens and various strains of this bacteria have been used as biological control agents. In this study, the efficacy of *Streptomyces philanthi* RM-1-138, *S. philanthi* RL-1-178, and *Streptomyce mycarofaciens* SS-2-243 to control various strains of *Botrytis cinerea* was evaluated both in vitro and in vivo. In vitro studies using confrontation tests on PDA plates indicated that the three strains of *Streptomyces* spp. inhibited the growth of 41 strains of *B. cinerea*. Volatile compounds produced by *Streptomyces* spp. had an influence on the growth of ten strains of *B. cinerea* while its culture filtrate at low concentration (diluted at 10^{-3}) showed a complete inhibition (100%) of spore germination of *B. cinerea* strain BC1. A significant protection efficacy of tomato against *B. cinerea* was observed on both whole plant test (57.4%) and detached leaf test (60.1%) with *S. philanti* RM-1-138. Moreover, this antagonistic strain had a preventive and a curative effect. These results indicated that *S. philanthi* RM-1-138 may have the potential to control gray mold caused by *B. cinerea* on tomato but further work is required to enhance its efficacy and its survival *in planta*.

Keywords: Botrytis; cinerea; Biological control; Durability; Sensitivity; Streptomyces spp.

Davide Ferrigo, Roberto Causin, Alessandro Raiola. (Dipartimento Territorio e Sistemi agro-forestali (TESAF) Università di Padova Legnaro, Italy). Effect of potential biocontrol agents selected among grapevine endophytes and commercial products on crown gall disease. BioControl, Volume 62(2017): 821–833

The current strategies for the control of *Agrobacterium vitis* crown gall in grape are generally unsuccessful once the pathogen has established in vineyards. Experimental trials were conducted to evaluate the effectiveness of treatments based on non-pathogenic endophytes isolated from asymptomatic grapevines growing in vineyards with high incidence of crown gall and on microorganisms isolated from commercial products. Two-year *in planta* trials conducted on rootstocks treated with endophytic isolates showed the effectiveness of two bacterial endophytes, both in the genus *Curtobacterium*, and one fungal isolate in the genus *Acremonium* in reducing crown gall development. For the commercial biological control agents, *Bacillus subtilis* SR63 and *Trichoderma asperellum* T1 were the most effective strains against *A. vitis*, indicating commercial products could be reserves to draw upon to identify useful biocontrol agents. Based on the combination of data in this work, microorganisms, both endophytes and those formulated in commercial products, were identified that can potentially be exploited for the control of grapevine crown gall disease.

Keywords: Crown gall disease; *Agrobacterium vitis; Vitis vinifera;* Grapevine endophyte; Biological control agent

Ernesto San-Blas, Mariangel Luzardo, Edgar Portillo, Yvan Fuenmayor, Brynelly Bastidas. (Laboratorio de Protección Vegetal, Centro de Estudios Botánicos y Agroforestales Instituto Venezolano de Investigaciones Científicas Maracaibo, Venezuela). ***Heterorhabditis amazonensis* for biological control of fungus gnats *Bradysia difformis* in Daisy gerberas. BioControl, Volume 62, 6 (2017): 847–855**

Fungus gnats (FG) have been reported in Venezuelan greenhouses recently. *Bradysia difformis* Frey (Diptera, Mycetophilidae) was found attacking Daisy gerbera plants [*Gerbera*sp. L. (Asterales: Asteraceae)] and many other crops in the country causing serious damages. *Heterorhabditis amazonensis* Andaló et al. (Rhabditida: Heterorhabditidae), was used to assess the mortality of larvae and adults of FG, number of invader nematodes per larvae and to compare the mortality of FG using nematodes and/or ciromazine under laboratory conditions. In a commercial flower farm, different doses of these nematodes were applied for eight weeks to control FG. The results showed 95% of mortality of the *B. difformis* larvae under laboratory conditions and performed better in the field when 50,000 nematodes were applied in every pot as a base dose to initiate a control programme. According to our results, *H. amazonensis* has the potential to become a regular organism for controlling fungus gnat larvae in tropical greenhouses.

Keywords: Floriculture, Venezuela; Biocontrol; Heterorhabditidae; Asteraceae; Mycetophilidae; Entomopathogenic; nematodes

Chengsheng Zhang, Jiaming Gao, Teng Han, Xueying Tian, Fenglong Wang. (1.Pest Integrated Management Key Laboratory of China Tobacco Tobacco Research Institute of Chinese Academy of Agricultural Sciences Qingdao China, 2.Tobacco Research Institute of Hubei Province Wuhan China, 3.Zaozhuang Special Fruit Engineering Extension Station Zaozhuang China). **Integrated control of tobacco black shank by combined use of riboflavin and *Bacillus subtilis* strain Tpb55. BioControl, Volume 62(6) (2017):835–845**

We investigated the effect of riboflavin on the biocontrol activity of *Bacillus subtilis* Tpb55 against *Phytophthora nicotianae* (*Pn*), which causes tobacco black shank. Riboflavin (0.2 mg ml^{-1}) significantly improved the biocontrol activity of Tpb55 (2.0×10^8 cfu ml^{-1}).

Riboflavin (0.02–0.5 mg ml^{-1}) alone could not significantly inhibit *Pn* growth. However, it enhanced the *B. subtilis* population, both in vitro and in tobacco roots and significantly increased the activity of defense enzymes, peroxidase, catalase, superoxide dismutase, and β-1,3-glucanase, in the roots of *B. subtilis*-treated tobacco seedlings. Our results indicate that riboflavin can stimulate the growth of *B. subtilis* Tpb55 and induce resistance to *Pn* in tobacco plants. These findings should boost the prospects for practical application of *B. subtilis* Tpb55 as a biocontrol agent against black shank of tobacco.

Keywords: Tobacco; *Phytophthora nicotianae;* Riboflavin; Biological control; Integrated control

Apostolos Kapranas, Ben Malone, Sarajane Quinn, Padraig O'Tuama, Arne Peters, Christine T. Griffin. (1.Department of BiologyMaynooth University Maynooth Ireland, 2.Coillte Forest, Hartnetts Cross Maynooth Ireland, 3.E-nema GmbH Schwentinental Germany, 4.Institute of Biology University of Neuchâtel Neuchâtel Switzerland). **Optimizing the application method of entomopathogenic nematode suspension for biological control of large pine weevil *Hylobius abietis.*BioControl, Volume 62(5) (2017): 659–667**

Entomopathogenic nematodes (EPNs) are effective against the immature stages of the large pine weevil *Hylobius abietis*. In three field trials we compared the efficacy of the application method of EPN for weevil suppression below the suggested threshold of 20 weevils per stump: applying the EPN suspension in the top edges of the stumps ('top') vs. drenching the soil around stumps ('standard'). For *Steinernema carpocapsae*, weevil suppression was below the targeted threshold only when suspension was applied in the standard way (two of the three sites). On the other hand, weevil suppression was provided in all three cases of 'top' application of *Heterorhabditis downesi* suspension, whereas suppression in 'standard' application was observed in one site. Percentage parasitism of developing weevils in relation to depth and distance help explain EPN movement post-application. Weevil suppression relative to suggested thresholds can be improved by altering the method of EPN application depending on the nematode species.

Keywords: *Hylobius abietis;* Entomopathogenic nematodes; *Steinernema carpocapsae; Heterorhabditis downesi;* wood-boring insect; application method

Daniella Egli, Terence Olckers. (School of Life Sciences University of KwaZulu-Natal Scottsville, South Africa). **Establishment and impact of insect agents deployed for the biological control of invasive Asteraceae: prospects for the control of *Senecio madagascariensis.* BioControl, Volume 62(5) (2017): 681–692**

Several invasive Asteraceae have been targeted for biological control worldwide, with variable success. *Senecio madagascariensis* Poiret, which invades agricultural lands in Australia and Hawaii, is a recent target. Since several potential insect agents were recorded in the plant's native range in South Africa, we assessed biocontrol efforts against asteraceous weeds to determine those most likely to deliver success. Some 108 insect species, from five orders and 23 families, were deployed against 38 weed taxa, mostly in the mainland USA, Canada, Australia and New Zealand. Coleoptera (mainly Curculionidae and Chrysomelidae), Diptera (Tephritidae) and Lepidoptera (Tortricidae) featured the most. Despite high establishment success (73% of

releases across countries), only 37% of successful releases achieved meaningful impact. Although root-feeding and stem-feeding insects appeared to be the best candidates, neither insect family nor feeding guild significantly influenced the probability of success. This synthesis of the global contribution of different guilds of specialist herbivores to the management of invasive Asteraceae is guiding the selection of candidate agents for the biocontrol of *S. madagascariensis* in Australia.

Keywords: Agent selection; Fireweed; Insect herbivore guilds; Success rates; Weed biocontrol

Carlos Valente, Catarina Afonso, Catarina I. Gonçalves, Miguel A. Alonso-Zarazaga, Ana Reis, Manuela Branco. (1.RAIZ - Instituto de Investigação da Floresta e PapelEixo-Aveiro Portugal, 2.Departamento de Biodiversidad y Biología EvolutivaMuseo Nacional de Ciencias Naturales (CSIC)Madrid Spain, 3.Altri Florestal, S.A., Quinta do FuradouroOlho Marinho Portugal, 4.Centro de Estudos Florestais, Instituto Superior de AgronomiaUniversidade de Lisboa, Lisbon Portugal). **Environmental risk assessment of the egg parasitoid *Anaphes inexpectatus* for classical biological control of the *Eucalyptus* snout beetle, *Gonipterus platensis.* BioControl, Volume 62(4) (2017):457–468**

Classical biological control is a valuable tool against invasive pests, but concerns about non-target effects requires risk assessment studies. Potential non-target effects of *Anaphes inexpectatus* Huber and Prinsloo (Hymenoptera: Mymaridae) were assessed for a classical biological control programme against the *Eucalyptus* snout beetle, *Gonipterus platensis*(Marelli) (Coleoptera: Curculionidae). No-choice tests were conducted with 17 non-target species to assess host specificity, including 11 curculionids. In behavioural observations, *A. inexpectatus* showed no interest in any of the non-target species, but two weevil species were parasitised within five days of exposure, although at significantly lower rates than *G. platensis*. In choice tests, only one non-target, *Hypera postica* (Gyllenhal) (Coleoptera: Curculionidae), was parasitised, at a rate of 0.6%, while 50.0% of *G. platensis* eggs were parasitised. Based on the host specificity test results and the potential host fauna found in the target area, the likelihood of non-target effects resulting from the release of *A. inexpectatus* is considered to be negligible.

Keywords: Curculionidae; Mymaridae; Non-target effects; Portugal; Spain

A. Gotor-Vila, J. Usall, R. Torres, M. Abadias, N. Teixidó. (IRTA, XaRTA-Postharvest, Edifici Fruitcentre, Parc Científic i Tecnològic Agroalimentari de Lleida, Lleida Spain). **Formulation of the biocontrol agent *Bacillus amyloliquefaciens* CPA-8 using different approaches: liquid, freeze-drying and fluid-bed spray-drying. BioControl, Volume 62(4) (2017):545–555**

The present work focuses on the assessment and comparison of three different formulation technologies and the effect of protectants on cell viability, storage stability and antagonistic activity of the biocontrol agent *Bacillus amyloliquefaciens* CPA-8. Cultures were concentrated with different protective substances such as $MgSO_4$, sucrose and skimmed milk (SM) and subjected to liquid formulation, freeze-drying and fluid-bed spray-drying. Results showed that CPA-8 freeze-dried cells without protectants or amended with SM suffered the highest losses in cell viability (0.41−0.48 log). Moreover, the cell viability of the tested freeze-dried products decreased after four months of storage at both tested temperatures (4 and 22 °C). Otherwise,

liquid and fluid-bed spray-dried products were stable for four months at 4 °C and for 12 months at 22, 4 and −20 °C, respectively, and no effect of the protectants was observed. The most suitable CPA-8 products were then tested against *Monilinia* laxa and *M. fructicola*in artificially wounded nectarines and in all cases the antagonistic activity was maintained similar to fresh cells. The efficacy results revealed that the formulation process did not affect the biocontrol potential of CPA-8. This work led us to conclude that effective formulations with final concentrations ranging from 1.93×10^9–2.98×10^9 CFU ml^{-1} and from 4.76×10^9–1.03×10^{10} CFU g^{-1} were obtained for liquid and dried products, respectively. Additionally, the suitability of the fluid-bed spray drying technology should be taken into account to develop a stable and effective CPA-8 product for practical applications to control brown rot in stone fruit.

Keywords: *Bacillus* spp.; Protectants; Shelf-life; *Monilinia* spp.; Biocontrol efficacy

Richa Sharma[ab], AnkitaMagotra[ab], Ravi S.Manhas[a], AshaChaubey[ab]. ([a]CSIR-Indian Institute of Integrative Medicine, Canal Road, Jammu 180001, India, [b]Academy of Scientific & Innovative Research, New Delhi 110001, India). **Antagonistic potential of a psychrotrophic fungus: *Trichoderma velutinum* ACR-P1. Biological Control, Volume 115(2017): 12-17**

Trichoderma is a well explored genus for plethora of bioactivities due to their cosmopolitan existence, diverse metabolomics, reproductive and competitive efficacies. Mycoparasitism and antibiotics production seems to be the probable mechanisms underlying their use as biocontrol agents. The aim of this study is to investigate the antagonistic potential of a new psychrotrophic fungus *Trichoderma velutinum* ACR-P1 as a promising biocontrol agent against destructive phytopathogens with probable underlying mechanisms. Antagonistic potential of *T. velutinum* ACR-P1 against the important phytopathogens, that is, *Fusarium oxysporum*, *Verticillium dahliae*, *Alternaria alternata* and *Colletotrichum capsici* was demonstrated by the *in vitro* dual culturing experiments. Also, probable mechanism underlying antagonism was studied by investigating enzymatic cell wall hydrolytic potential of the strain and potential for production of secondary metabolites i.e. non-ribosomal peptides (NRPs). The putative strain ACR-P1 showed immense potential of inhibiting the growth of all the four test phytopathogens and its capability of producing cell wall degrading enzymes (CWDE) i.e. chitinase, cellulase and protease utilizing colloidal chitin, carboxymethyl cellulose and milk protein respectively as sole source of carbon and energy as illustrated by growth and agar well diffusion assays. Also, metabolic profiling firstly revealed the production of two groups of the NRPs by *T. velutinum*ACR-P1 as reported in our earlier study on the strain (Sharma et al., 2016). Mycoparasitism supported by NRPs and CWDEs substantiate their use as biocontrol agents. The psychrotrophic strain is endowed with immense potential to be included as a new candidate in the list of biocontrol agents (BCA). The potential antagonism against the important destructive phytopathogens signifies *T. velutinum* ACR-P1 as a BCA and can be exploited in fields to get rid of devastating impacts of these phytopathogens on the crops.

Keywords: *Trichoderma velutinum;* Phytopathogens; Antagonistic; Cell wall degrading enzymes; Non ribosomal peptides (NRPs); Biocontrol agents

Jason M.Schmidt[ab], Emily A.Pochubay[a], JosephTourtois[a], Matthew J.Grieshop[a]. ([a]Department of Entomology, Michigan State University, East Lansing, MI, United States,

[b]Department of Entomology, University of Georgia, Tifton Campus, United States). The inherent complexity of soil and foliar predators for greenhouse biological control. Biological Control, Volume 115(2017): 46-54

In greenhouse systems it is commonplace to release a suite of predators or parasitoids to combat pest populations that grow in both the vegetative portion of plants and soil. For instance, to control thrips and fly pests, a combination of *Neoseiulus cucumeris* (Oudemans 1930), a foliar predatory mite, *Stratiolaelaps miles* (Berlese 1892), a soil dwelling mite and *Dalotia coriaria* (Kraatz 1856), a soil dwelling beetle, show efficacy for controlling all life-stages. However, when introduced biological control agents overlap in their distributions and diet, there is the potential for competition or intraguild predation. Frequently studies of intraguild interactions involve isolation of one pest or prey and a host of predators, here we conducted an initially open greenhouse experiment in a marigold system and allowed communities to assemble. We measured the community responses in the soil and foliar habitat strata to a fully replicated factorial design of all combinations of three common greenhouse predators, *N. cucumeris*, *S. miles* and *D. coriaria*. Over 288,158 arthropods were recovered from this six-week experiment resulting in unique soil and foliar communities of introduced predators, greenhouse arthropods, and pest life-stages. In the foliar habitat strata, spider mite populations rapidly overwhelmed the initial focus on thrips, indicating the importance of pest interactions for determining the efficacy of biological control. Overlap of predator populations occurred in the soil strata, which led to complex intraguild interactions. Results provide further evidence that separation of introduced predators and availability of alternative prey in greenhouse systems is important for managing potential agonistic interactions.

Keywords: Above-below ground food webs; Biological control; Intraguild predation; Pest life stages; Mites; Multitrophic interactions

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Larvae of *Allograpta exotica* (Wiedemann, 1830) (Diptera: Syrphidae) are important natural enemies of common agricultural pests such as aphids (Hemiptera: Aphididae). Life history, life table and functional response of *A. exotica* were determined using the cowpea aphid *Aphis craccivora* Koch, 1854 as prey under controlled conditions of temperature, humidity and light. The average recorded duration of *A. exotica* development was 2.0, 7.4 and 5.7 days for eggs, larvae and pupae respectively, and 15.04 days from egg to adult emergence. The adult longevity was not significantly sex dependent, but imagoes lived longer than in previous studies. The offspring sex ratio was favorable to males. The mortality and survival rate were recorded on a daily basis for all immature stages and adults. The age specific survival rate was determined and the highest mortality occurred in eggs followed by mortality in 1st and 2nd instar larva. Moreover, in the present study different levels of aphid densities 10, 30, 40, 50, 60, 70, 80 and

100 were used to calculate the functional response. Based on logistic regression analyses the three instar larvae and the whole larval stage (first to third instar) exhibited a type II functional response. Handling time was shortest for the third larval instar followed by second and first instars. Potential use of *A. exotica* in augmentative biological control is discussed.

Keywords: Diptera; Syrphidae; Aphididae; Biological control; Functional response

Mujeebur Rahman Khan, Shumaila Shahid[1], Fayaz A.Mohidin[2], Uzma Mustafa. (Department of Plant Protection, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh 202002, U.P., India). **Interaction of *Fusarium oxysporum* f. sp. *gladioli* and *Meloidogyne incognita* on gladiolus cultivars and its management through corm treatment with biopesticides and pesticides. Biological Control, Volume 115(2017): 95-104**

Effects of single and concomitant (simultaneous) inoculations with *Fusarium oxysporum* f. sp. *gladioli* (Fog) and *Meloidogyne incognita* (Mi) were examined on the plant growth and flowering of five cultivars of gladiolus viz., King Lear, Her Majesty, Friendship, White Prosperity and American Beauty in earthen pots. In addition, the effectiveness of corm dressing with *Trichoderma harzianum*, *Pseudomonas fluorescens*, carbendazim and nemacur against corm rot and yellows, root-knot and Fog + Mi disease complex was tested. All cultivars were found susceptible to *F. oxysporum* f. sp. *gladioli* and *M. incognita*. However, the cvs. White Prosperity and American Beauty expressed moderate tolerance to Fog and Mi, respectively. The cvs. Her Majesty and American Beauty scored highest corm rot and yellows indices (2.9–3.2 on 0–5 scale), and exhibited 28–32% decrease in the number of florets per spike due to Fog infection. Corm dressing with *T. harzianum* or carbendazim checked the corm rot and yellows ($P \leq 0.05$) and increased the plant growth and flowering of gladioli ($P \leq 0.05$). The Mi inoculation caused maximum galling on the cv. White Prosperity (40 galls/root system) and lowest on cv. American Beauty (11 galls) and significantly reduced flowering of gladiolus cultivars (11–23%, $P \leq 0.05$) except cv. American Beauty. A treatment with nemacur or *P. fluorescens*suppressed the galling and egg mass production of *M. incognita*, and improved the plant growth and flowering variables (7–38%) compared with the inoculated control ($P \leq 0.05$). In concomitantly inoculated plants, severity of corm rot and yellows increased ($P \leq 0.05$), and significantly greater decrease in the plant growth and flowering variables occurred in all cultivars, but gall formation and egg mass production were decreased. Treatment with carbendazim-nemacur mixture or *P. fluorescens* effectively controlled the Fog + Mi disease complex leading to significant ($P \leq 0.05$) decrease in the corm rot and yellows (4–43% and 5–21%) and root-knot indices (9–33% and 4–40%). The two treatments increased in the spike length (11–15% and 9–16%), spike number (13–43% and 13–57%) and florets per spike (40–55% and 30–46%), respectively, compared with the inoculated control.

Keywords: Fungus-nematode interaction; Disease complex; Biological control; Pesticides; Gladiolus

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350002, China). Identification of a *Pseudomonas putida* as biocontrol agent for tomato bacterial wilt disease. Biological Control, Volume 114(2017): 45-50

A bacterial isolate, A1, was collected from the rhizosphere soil of cultivated peanuts. Based on its 16 S rRNA sequence, this isolate was identified as a *Pseudomonas putida* strain. On minimal medium supplemented with diverse nutrient substrates, the *P. putida* A1 strain could use fructose and fructosan, trehalose, and inositol as sole carbon resources. The ability of these four carbon resources, as well as leaf and root exudates, to stimulate cell migration in a chemotaxis assay was investigated. *P. putida* A1 was labelled with GFP to study colonization on the root surface; this strain was found to aggregate around wound sites. In addition to forming biofilms *in vitro*, A1 showed antimicrobial activity against several plant pathogenic bacteria, including *Ralstonia solanacearum*, *Xanthomonas oryzae* pv. *oryzae*, *X. o.* pv. *oryzicola*, and *X. citri* subsp. *citri*. In evaluations of biocontrol potential of tomato bacterial wilt, this isolate delayed the appearance of wilt symptoms for 4 days and reduced wilt disease severity. Overall, our results indicate that *P. putida* A1 could be an effective biocontrol agent for plant soil-borne diseases.

Keywords: *Pseudomonas putida;* Bacterial wilt; Chemotaxis; Biofilm; Biocontrol

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Many of the non-pathogenic endophytic bacteria that reside in plant roots promote plant growth as well as protection against pathogens attack. However, little is known about their mode of action in wheat. We have previously demonstrated the potential of *Paenibacillus* sp. strain B2 (PB2) to stimulate plant defense mechanisms via its paenimyxin lipo-polypeptide elicitor. Recently, we isolated the *Curtobacterium plantarum*strain EDS (EDS) from seeds of almost all wheat cultivars. In the present work, the ability of PB2 and EDS to promote wheat growth and protection against Septoria leaf blotch (SLB) was investigated. Results showed that PB2 is a general root external colonizer and cultivar-dependent endophyte. In the endophytic state and only in co-inoculation, it significantly increased the internal root colonization by EDS, resulting in an increase of root and aerial part fresh weights. qPCR analysis showed that, in the endophytic and nonendophytic states, PB2 conferred ≥59% protection against SLB by inducing systemic resistance which is characterized by the over expression of the *pr1, lox, Aos, peroxidase, oxo* and *gst* genes. Paenimyxin conferred 76% local protection characterized by the overexpression of the *glu, lox, aos, pal, chs, oxo,* and *gst*genes, and 82% systemic protection by *chs*. It was concluded that PB2 is potentially very interesting in the biocontrol of SLB and, in a mixture with EDS, in the wheat growth promoting. Genes involved in the flavonoid, salicylic

acid, jasmonic acid, reactive oxygen species and basal defense pathways seem to play an important role in the resistance against SLB.

Keywords: Wheat septoria leaf blotch; Paenimyxin; *Paenibacillus* sp. strain B2; *Curtobacterium plantarum;* Flavonoids; Salicylic acid; Jasmonic acid; Reactive oxygen species

Qiaofei Li[a1], Chaolan Li[a1], Pengxia Li[b], Hongyin Zhang[a], Xiaoyun Zhang[a], Xiangfeng Zheng[a], Qiya Yang[a], Maurice Tibiru, Apaliya[a], Nana Adwoa Serwah Boateng[a], Yiwen Sun[a]. ([a]School of Food and Biological Engineering, Jiangsu University, Zhenjiang 212013, Jiangsu, People's Republic of China, [b]Institute of Agricultural Products Processing, Jiangsu Academy of Agricultural Sciences, Nanjing 210014, Jiangsu, People's Republic of China). **The biocontrol effect of *Sporidiobolus pararoseus* Y16 against postharvest diseases in table grapes caused by *Aspergillus niger* and the possible mechanisms involved. Biological Control, Volume 113(2017): 18-25**

Fruits are vulnerable to pathogen infection caused by decay during growth and storage, which causes huge economic losses. The aim of this study was to investigate the biocontrol efficacy of the antagonistic yeast *Sporidiobolus pararoseus*Y16 in the control of *Aspergillus niger* decay, and natural decay of table grapes and the possible mechanisms involved. The results showed that *S. pararoseus* Y16 at different concentrations significantly inhibited *A. niger* decay of table grapes compared with the control. Besides, the population dynamics results showed that *S. pararoseus* Y16 could rapidly survive and proliferate in grape wounds or on grape surfaces at 20 °C. Moreover, *S. pararoseus* Y16 treatment did not impair postharvest qualities of table grapes. Results also showed that treatment with *S. pararoseus* Y16 enhanced the enzyme activities of polyphenol oxidase (PPO), catalase (CAT), phenylalanine ammonia-lyase (PAL) and ascorbate peroxidase (APX) in table grapes. Furthermore, the gene expression levels of *PPO*, *CAT*, *PAL* and *APX* were increased by gene level verification. All these results indicated that *S. pararoseus* Y16 has great potential for development of commercial formulations to control postharvest pathogens on table grapes. These findings revealed that the enhanced gene expression and enzyme activities are the mechanisms involved in the biocontrol, while the yeast outcompeted the fungus for space and nutrients.

Keywords: Biocontrol; Table grapes; *Sporidiobolus pararoseus* Y16; *Aspergillus niger;* Antagonistic activity; Gene expression level

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The invasive water hyacinth (*Eichhornia crassipes*) severely limits the ecosystem services provided by the Sacramento-San Joaquin River Delta in California, USA. As part of the biological control program in the Delta, two weevils, *Neochetina bruchi* and *N. eichhorniae* (Coleoptera: Curculionidae) and a moth, *Niphograpta albiguttalis*(Lepidoptera: Pyralidae), were released in the 1980s. Additionally, a planthopper, *Megamelus scutellaris* (Hemiptera: Delphacidae) was released in 2011. We conducted monthly surveys for one year at 16 sites throughout 1667 km^2 of the Delta to determine the resulting establishment, abundance and distribution of these introduced herbivores. Morphological identifications, and partial sequencing of the mitochondrial cytochrome oxidase subunit 1 gene determined that 96.6% of the examined weevils were *N. bruchi*. *N. eichhorniae* was only recovered from two sites in the southern Delta tributaries. Densities (larvae and adult weevils per destructively sampled plant) varied spatially and temporally. Peak mean densities (averaged across August–November) decreased with increasing distance from the original release sites. Peak mean densities ranged from 0.31 to 6.31 weevils per plant. Densities averaged across sites were the lowest in June 2015 (0.54 weevils), increasing in August to 5.35 weevils, and peaking in November at 6.22 weevils. The proportion of damaged leaf area from weevil feeding increased concomitantly with weevil densities. Although *N. albiguttalis* was not recovered, *M. scutellaris* remained established at its original release site but has not dispersed into the other surveyed regions. We propose hypotheses to explain patterns in species establishment and distribution, with potential mechanisms for improved future biological control.

Keywords: Dispersal; Establishment; Exotic; Herbivore; Insect; PCR; Post-release evaluations

M. C. Diez[13], S. Elgueta[2], O. Rubilar[13], G. R. Tortella[13], H. Schalchli[13], C. Bornhardt[13], F. Gallardo[23]. (1.Chemical Engineering Department Universidad de La Frontera Temuco Chile, 2.Chemical Science and Natural Resource Department Universidad de La Frontera Temuco Chile, 3.Biotechnological Research Center Applied to the Environment (CIBAMA-BIOREN)Universidad de La Frontera Temuco Chile). F. Gallardo). **Pesticide dissipation and microbial community changes in a biopurification system: influence of the rhizosphere. Biodegradation, Volume 28(5) (2017): 395–412**

The dissipation of atrazine, chlorpyrifos and iprodione in a biopurification system and changes in the microbial and some biological parameters influenced by the rhizosphere of *Lolium perenne* were studied in a column system packed with an organic biomixture. Three column depths were analyzed for residual pesticides, peroxidase, fluorescein diacetate activity and microbial communities. Fungal colonization was analyzed by confocal laser scanning microscopy to assess the extent of its proliferation in wheat straw. The *L. perenne* rhizosphere enhanced pesticide dissipation and negligible pesticide residues were detected at 20–30 cm column depth. Atrazine, chlorpyrifos and iprodione removal was 82, 89 and 74% respectively in the first 10 cm depth for columns with vegetal cover. The presence of *L. perenne* in contaminated columns stimulated peroxidase activity in all three column depth sections. Fluorescein diacetate activity decreased over time in all column sections with the highest values in biomixtures with vegetal cover. Microbial communities, analyzed by PCR-DGGE, were not affected by the pesticide mixture application, presenting high values of similarity (>65%) with and without vegetal cover. Microbial abundance of Actinobacteria varied according to treatment and no clear link was observed. However, bacterial abundance increased over time and was similar with and without vegetal cover. On the other hand, fungal abundance decreased in all sections of columns after 40 days, but an increase was observed in response to pesticide

application. Fungal colonization and straw degradation during pesticide dissipation were verified by monitoring the lignin autofluorescence loss.

Keywords: Pesticides; Biodegradation; Biopurification system; Rhizosphere; Microbial community

Biodegradation

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The effect of copper (added as $CuCl_2$) on the anaerobic co-digestion of *Phragmites* straw and cow dung was studied in pilot experiments by investigating the biogas properties, process stability, substrate degradation and enzyme activities at different stages of mesophilic fermentation. The results showed that 30 and 100 mg/L Cu^{2+} addition increased the cumulative biogas yields by up to 43.62 and 20.77% respectively, and brought forward the daily biogas yield peak, while 500 mg/L Cu^{2+} addition inhibited biogas production. Meanwhile, the CH_4 content in the 30 and 100 mg/L Cu^{2+}-added groups was higher than that in the control group. Higher pH values (close to pH 7) and lower oxidation–reduction potential (ORP) values in the Cu^{2+}-added groups after the 8th day indicated better process stability compared to the control group. In the presence of Cu^{2+}, the degradation of volatile fatty acids (VFAs) and other organic molecules (represented by chemical oxygen demand, COD) generated from hydrolysis was enhanced, and the ammonia nitrogen (NH_4^+-N) concentrations were more stable than in the control group. The contents of lignin and hemicellulose in the substrate declined in the Cu^{2+}-added groups while the cellulose contents did not. Neither the cellulase nor the coenzyme F_{420} activities could determine the biogas producing efficiency. Taking the whole fermentation process into account, the promoting effect of Cu^{2+} addition on biogas yields was mainly attributable to better process stability, the enhanced degradation of lignin and hemicellulose, the transformation of intermediates into VFA, and the generation of CH_4 from VFA.

Keywords: Copper addition; Process stability; Cellulase; Coenzyme F_{420} ; Biodegradation

Francisco Ríos, Manuela Lechuga , Alejandro Fernández-Arteaga, Encarnación Jurado Mercedes, Fernández-Serrano, Mercedes Fernández-Serrano. (1.Chemical Engineering Department University of Granada, Campus Fuentenueva Granada Spain). Anaerobic digestion of amine-oxide-based surfactants: biodegradation kinetics and inhibitory effects. Biodegradation, Volume 28(4) (2017): 303–312

Recently, anaerobic degradation has become a prevalent alternative for the treatment of wastewater and activated sludge. Consequently, the anaerobic biodegradability of recalcitrant compounds such as some surfactants require a thorough study to avoid their presence in the environment. In this work, the anaerobic biodegradation of amine-oxide-based surfactants,

which are toxic to several organisms, was studied by measuring of the biogas production in digested sludge. Three amine-oxide-based surfactants with structural differences in their hydrophobic alkyl chain were tested: Lauramine oxide (AO-R_{12}), Myristamine oxide (AO-R_{14}) and Cocamidopropylamine oxide (AO-cocoamido). Results show that AO-R_{12} and AO-R_{14} inhibit biogas production, inhibition percentages were around 90%. AO-cocoamido did not cause inhibition and it was biodegraded until reaching a percentage of 60.8%. Otherwise, we fitted the production of biogas to two kinetic models, to a pseudo first-order model and to a logistic model. Production of biogas during the anaerobic biodegradation of AO-cocoamido was pretty good adjusted to the logistics model. Kinetic parameters were also determined. This modelling is useful to predict their behaviour in wastewater treatment plants and under anaerobic conditions in the environment.

Keywords: Amine-oxide-based surfactants ; Anaerobic biodegradation ; Biodegradation kinetics; Biogas production; Digested sludge; Inhibition

Chiara Perruchon, Anastasios Pantoleon, Dimitrios Veroutis, Sara Gallego-Blanco, F. Martin-Laurent, Kalliopi Liadaki, Dimitrios G. Karpouzas. (1.Laboratory of Plant and Environmental Biotechnology, Department of Biochemistry and Biotechnology University of Thessaly Larissa Greece, 2.AgroSup Dijon, INRA, Université de Bourgogne Franche Comté, UMR Agroécologie Dijon France).Characterization of the biodegradation, bioremediation and detoxification capacity of a bacterial consortium able to degrade the fungicide thiabendazole. Biodegradation, Volume 28(5–6): 383–394

Thiabendazole (TBZ) is a persistent fungicide used in the post-harvest treatment of fruits. Its application results in the production of contaminated effluents which should be treated before their environmental discharge. In the absence of efficient treatment methods in place, biological systems based on microbial inocula with specialized degrading capacities against TBZ could be a feasible treatment approach. Only recently the first bacterial consortium able to rapidly transform TBZ was isolated. This study aimed to characterize its biodegradation, bioremediation and detoxification potential. The capacity of the consortium to mineralize ^{14}C-benzyl-ring labelled TBZ was initially assessed. Subsequent tests evaluated its degradation capacity under various conditions (range of pH, temperatures and TBZ concentration levels) and relevant practical scenarios (simultaneous presence of other postharvest compounds) and its bioaugmentation potential in soils contaminated with increasing TBZ levels. Finally cytotoxicity assays explored its detoxification potential. The consortium effectively mineralized the benzoyl ring of the benzimidazole moiety of TBZ and degraded spillage level concentrations of the fungicide in aqueous cultures (750 mg L^{-1}) and in soil (500 mg kg^{-1}). It maintained its high degradation capacity in a wide range of pH (4.5–7.5) and temperatures (15–37 °C) and in the presence of other pesticides (*ortho*-phenylphenol and diphenylamine). Toxicity assays using the human liver cancer cell line HepG2 showed a progressive decrease in cytotoxicity, concomitantly with the biodegradation of TBZ, pointing to a detoxification process. Overall, the bacterial consortium showed high potential for future implementation in bioremediation and biodepuration applications.

Keywords: Thiabendazole; Agro-industrial wastewater; Bacterial consortium; Pesticide biodegradation; Mineralization; Detoxification

Haiping Huang. (1.School of Geosciences Yangtze University Wuhan People's Republic of China, 2.Department of Geoscience University of Calgary Calgary Canada). The effect of

biodegradation on gammacerane in crude oils. Biodegradation, Volume 28(4) (2017): 313–326

Gammacerane is one of the major biomarkers widely used in depositional environment diagnosis, oil family classification, and oil-source correlation. It is generally accepted that gammacerane is more resistant to biodegradation than regular hopanes. However, whether it is biodegradable as well has not been reported in literatures. In order to investigate the effect of biodegradation on gammacerane in crude oils, 69 core samples from two biodegraded petroleum accumulations were geochemically characterized by quantitative GC–MS analysis. All samples are originated from lacustrine source rocks in China and have experienced at least level 8 degree of biodegradation on the scale of Peters and Moldowan (The biomarker guide: interpreting molecular fossils in petroleum and ancient sediments, Prentice Hall, Englewood Cliffs, 1993). Both case histories showed the concentration of gammacerane decrease with increasing severity of biodegradation, indicating the destruction of gammacerane by biodegradation. A whole series of 25-norhopanes paralleling the 17α,21β-hopanes (up to C_{34}), together with C_{28} 18-α-25,30-bisnorneohopane, C_{29} 25-nordiahopane and C_{29} 25-norgammacerane, is found in the Liaohe sample suite but C_{33}, C_{34} 25-norhopane and 25-norgammacerane are almost undetectable in the Junggar case. The gammacerane in the Liaohe case study appear to be altered simultaneously with hopanes, although the rate of gammacerane alteration is slower. Its susceptibility to biodegradation is similar to 18α(H)-22,29,30-trisnorneohopane (Ts) and 17α(H)-22,29,30-trisnorhopane (Tm) but more vulnerable than 18α-30-norneohopane (C_{29} Ts), 15α-methyl-17α(H)-27-norhopane (C_{30} diahopane) and pregnanes. The gammacerane in the Junggar oils appear to be less biodegradable than the Liaohe case history. It was altered simultaneously with pregnanes and C_{29} Ts but faster than C_{30} diahopane. The present data suggest that biodegradation sequence is not universal since the relative rates of biodegradation of different compound classes depend upon specific environmental conditions. Like the case of hopane demethylation, the mechanism of gammacerane biodegradation is not straightforward. While the conversion of gammacerane to 25-norgammacerane is not quantitatively balanced in the Liaohe case history, no 25-norgammacerane has been formed from the degradation of gammacerane in the Junggar case history. The ratio of gammacerane to regular hopanes increases with biodegradation degree especially at extreme levels of degradation, gammacerane index is no longer valid for depositional environment assessment or oil-source correlation.

Keywords: Biodegradation; Gammacerane; Depositional environment; Crude oil

Biosensor

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of Medical Sciences, Mashhad, Iran, [e]Orthopedic Research Center, Mashhad University of Medical Sciences, Mashhad 9176699199, Iran, [f]Department of English, Tabaran Institute of Higher Education, Mashhad, Iran, [g]Department of Medicinal Chemistry, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran, [h]Targeted Drug Delivery Research Center, Mashhad University of Medical Sciences, Mashhad, Iran, [i]Department of Pharmaceutical Biotechnology, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran). **Ultrasensitive detection of ochratoxin A using aptasensors. Biosensors and Bioelectronics, Volume 98(2017): 168-179**

Regarding teratogenic, carcinogenic, and immunotoxic nature of ochratoxin A (OTA), selective and sensitive monitoring of this molecule in food samples is of great importance. In recent years, various methods have been introduced for detection of OTA. However, they are usually time-consuming, labor-intensive and expensive. Therefore, these parameters limited their usage. The emerging method of detection, aptasensor, has attracted more attention for OTA detection, due to distinctive advantages including high sensitivity, selectivity and simplicity. In this review, the new developed aptasensors for detection of OTA have been investigated. We also highlighted advantages and disadvantages of different types of OTA aptasensors. This review also takes into consideration the goal to find out which designs are the most rational ones for highly sensitive detection of OTA.

Keywords: Ochratoxin A; Aptasensor; Detection; Optical; Fluorescence; Electrochemical

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The term *biosensors* encompasses devices that have the potential to quantify physiological, immunological and behavioural responses of livestock and multiple animal species. Novel biosensing methodologies offer highly specialised monitoring devices for the specific measurement of individual and multiple parameters covering an animal's physiology as well as monitoring of an animal's environment. These devices are not only highly specific and sensitive for the parameters being analysed, but they are also reliable and easy to use, and can accelerate the monitoring process. Novel biosensors in livestock management provide significant benefits and applications in disease detection and isolation, health monitoring and detection of reproductive cycles, as well as monitoring physiological wellbeing of the animal via analysis of the animal's environment. With the development of integrated systems and the Internet of Things, the continuously monitoring devices are expected to become affordable. The data generated from integrated livestock monitoring is anticipated to assist farmers and the agricultural industry to improve animal productivity in the future. The data is expected to reduce the impact of the livestock industry on the environment, while at the same time driving the new wave towards the improvements of viable farming techniques. This review focusses on the emerging technological advancements in monitoring of livestock health for detailed, precise information on productivity, as well as physiology and well-being. Biosensors will contribute to the 4th revolution in agriculture by incorporating innovative technologies into cost-effective

diagnostic methods that can mitigate the potentially catastrophic effects of infectious outbreaks in farmed animals.

Keywords: Biosensing; Nanotechnology; Precision livestock farming; Disease diagnostics

Zhuang Liu, Hanyue Ma, Huihui Sun, Rui Gao, Honglei Liu, Xia Wang, Ping Xu[1], Luying Xun. (State Key Laboratory of Microbial Technology, Shandong University, Jinan 250100, PR China). Nanoporous gold-based microbial biosensor for direct determination of sulfide. Biosensors and Bioelectronics, Volume 98(2017): 29-35

Environmental pollution caused by sulfide compounds has become a major problem for public health. Hence, there is an urgent need to explore a sensitive, selective, and simple sulfide detection method for environmental monitoring and protection. Here, a novel microbial biosensor was developed using recombinant *Escherichia coli* BL21 (*E. coli* BL21) expressing sulfide:quinone oxidoreductase (SQR) for sulfide detection. As an important enzyme involved in the initial step of sulfide metabolism, SQR oxidizes sulfides to polysulfides and transfers electrons to the electron transport chain. Nanoporous gold (NPG) with its unique properties was selected for recombinant *E. coli* BL21 cells immobilization, and then glassy carbon electrode (GCE) was modified by the resulting *E. coli*/NPG biocomposites to construct an *E. coli*/NPG/GCE bioelectrode. Due to the catalytic oxidation properties of NPG for sulfide, the electrochemical reaction of the *E. coli*/NPG/GCE bioelectrode is attributed to the co-catalysis of SQR and NPG. For sulfide detection, the *E. coli*/NPG/GCE bioelectrode showed a good linear response ranging from 50 μM to 5 mM, with a high sensitivity of 18.35 μA mM^{-1} cm^{-2} and a low detection limit of 2.55 μM. The anti-interference ability of the *E. coli*/NPG/GCE bioelectrode is better than that of enzyme-based inhibitive biosensors. Further, the *E. coli*/NPG/GCE bioelectrode was successfully applied to the detection of sulfide in wastewater. These unique properties potentially make the *E. coli*/NPG/GCE bioelectrode an excellent choice for reliable sulfide detection.

Keywords: Sulfide:quinone oxidoreductase; Nanoporous gold; Recombinant *E. coli* BL21; Microbial biosensor; Sulfide

Yufang Hu, Qingqing Zhang, Zhiyong Guo, Sui Wang, Chunnuan Du, Chunyang Zhai. (Faculty of Materials Science and Chemical Engineering, Ningbo University, Ningbo 315211, PR China). In situ grown DNA nanotail-templated silver nanoclusters enabling label-free electrochemical sensing of terminal deoxynucleotidyl transferase activity. Biosensors and Bioelectronics, Volume 98(2017): 91-99

A novel label-free electrochemical strategy was established based on the unique electro-catalytic activity of graphene oxide (GO)-supported terminal deoxynucleotidyl transferase (TdT)-generated C-rich DNA nanotail-templated silver nanoclusters (DNA-AgNCs). TdT can catalyze the deoxycytidine triphosphate (dCTP) to the 3′-OH terminus of single-stranded DNA (ssDNA) with no template; then, in the presence of Ag(I), TdT-generated C-rich DNA sequence was employed for the synthetic template of AgNCs because of the formed complexes of nitrogen atoms of cytosine based with silver atoms. We proved that in situ grown DNA nanotail-templated AgNCs can be adsorbed on GO-modified electrode and possess high electro-catalytic activity to H_2O_2 reduction, presenting a good electrochemical indicator for signal readout. Under

optimal conditions, the proposed biosensor could be employed for quantitatively monitoring TdT activity and within a dynamic range from 0.4 to 90 U/mL and a low limit of detection is 0.08 U/mL. With high sensitivity and excellent selectivity, this strategy offers a facile, convenient and specific electrochemical method for TdT activity detection and its relevant inhibitors screening. It holds a promising potential in the practical application of TdT-based biochemical research, disease diagnosis and drug discovery.

Keywords: Terminal deoxynucleotidyl transferase; Silver nanoclusters; Graphene oxide; Enzyme activity; Inhibitor

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DNA methylation plays an important role in physiological and pathological processes. Several genetic diseases and most malignancies tend to be associated with aberrant DNA methylation. Among other analytical methods, electrochemical approaches have been successfully employed for characterisation of DNA methylation patterns that are essential for the diagnosis and treatment of particular diseases. This article discusses current trends in the electrochemical sensing and biosensing of DNA methylation. Particularly, it provides an overview of applied electrode materials, electrode modifications and biorecognition elements applications with an emphasis on strategies that form the core DNA methylation detection approaches. The three main strategies as (i) bisulfite treatment, (ii) cleavage by restriction endonucleases, and (iii) immuno/affinity reaction were described in greater detail. Additionally, the availability of the reviewed platforms for early cancer diagnosis and the approval of methylation inhibitors for anticancer therapy were discussed.

Keywords: Nucleic acids; DNA methylation; Sensor and biosensor; Electrochemistry; Cancer diagnosis

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In clinical practice, delays in obtaining culture results impact patient care and the ability to tailor antibiotic therapy. Despite the advancement of rapid molecular diagnostics, the use of plate cultures inoculated from swab samples continues to be the standard practice in clinical care. Because the inoculation culture process can take between 24 and 48 h before a positive identification test can be run, there is an unmet need to develop rapid throughput methods for bacterial identification. Previous work has shown that pyocyanin can be used as a rapid, redox-

active biomarker for identifying *Pseudomonas* aeruginosa in clinical infections. However, further validation is needed to confirm pyocyanin production occurs in all clinical strains of *P. aeruginosa*. Here, we validate this electrochemical detection strategy using clinical isolates obtained from patients with hospital-acquired infections or with cystic fibrosis. Square-wave voltammetric scans of 94 different clinical *P. aeruginosa* isolates were taken to measure the concentration of pyocyanin. The results showed that all isolates produced measureable concentrations of pyocyanin with production rates correlated with patient symptoms and comorbidity. Further bioinformatics analysis confirmed that 1649 genetically sequenced strains (99.9%) of *P. aeruginosa* possess the two genes (PhzM and PhzS) necessary to produce pyocyanin, supporting the specificity of this biomarker. Confirming the production of pyocyanin by all clinically-relevant strains of *P. aeruginosa* is a significant step towards validating this strategy for rapid, point-of-care diagnostics.

Keywords: Diagnostic; Electrochemistry; *Pseudomonas aeruginosa;* Pyocyanin

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A turn-on photoelectrochemical (PEC) biosensor based on the surface defect recognition and multiple signal amplification of metal-organic frameworks (MOFs) was proposed for highly sensitive protein kinase activity analysis and inhibitor evaluation. In this strategy, based on the phosphorylation reaction in the presence of protein kinase A (PKA), the Zr-based metal-organic frameworks (UiO-66) accommodated with $[Ru(bpy)_3]^{2+}$ photoactive dyes in the pores were linked to the phosphorylated kemptide modified TiO_2/ITO electrode through the chelation between the Zr^{4+} defects on the surface of UiO-66 and the phosphate groups in kemptide. Under visible light irradiation, the excited electrons from $[Ru(bpy)_3]^{2+}$ adsorbed in the pores of UiO-66 injected into the TiO_2 conduction band to generate photocurrent, which could be utilized for protein kinase activities detection. The large surface area and high porosities of UiO-66 facilitated a large number of $[Ru(bpy)_3]^{2+}$ that increased the photocurrent significantly, and afforded a highly sensitive PEC analysis of kinase activity. The detection limit of the as-proposed PEC biosensor was 0.0049 U mL^{-1}(S/N!=!3). The biosensor was also applied for quantitative kinase inhibitor evaluation and PKA activities detection in MCF-7 cell lysates. The developed visible-light PEC biosensor provides a simple detection procedure and a cost-effective manner for PKA activity assays, and shows great potential in clinical diagnosis and drug discoveries.

Keywords: Kinase; Metal-organic frameworks; Surface defect recognition; Signal amplification; Photoelectrochemical biosensor

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Cerium oxide nanoparticles (CNPs) contain several properties such as catalytic activity, fluorescent quencher and electrochemical, high surface area, and oxygen transfer ability, which have attracted considerable attention in developing high-sensitive biosensors. CNPs can be used as a whole sensor or a part of recognition or transducer element. However, reports have shown that applying these nanoparticles in sensor design could remarkably enhance detection sensitivity. CNP's outstanding properties in biosensors which go from high catalytic activity and surface area to oxygen transfer and fluorescent quenching capabilities are also highlighted. Herein, we discuss the advantages and disadvantages of CNPs-based biosensors that function through various detection modes including colorimetric, electrochemistry, and chemoluminescent regarding the detection of small organic chemicals, metal ions and biomarkers.

Keywords: Cerium oxide nanoparticles; Sensitivity; Electrochemical; Colorimetric; Fluorescent; Chemoluminescent

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In this work, we report a durable and sensitive H_2O_2 biosensor based on boronic acid functionalized metal-organic frameworks (denoted as MIL-100(Cr)-B) as an efficient immobilization matrix of horseradish peroxidase (HRP). MIL-100(Cr)-B features a hierarchical porous structure, extremely high surface area, and sufficient recognition sites, which can significantly increase HRP loading and prevent them from leakage and deactivation. The H_2O_2 biosensor can be easily achieved without any complex processing. Meanwhile, the immobilized HRP exhibited enhanced stability and remarkable catalytic activity towards H_2O_2 reduction. Under optimal conditions, the biosensor showed a fast response time (less than 4 s) to H_2O_2 in a wide linear range of 0.5–3000 μM with a low detection limit of 0.1 μM, as well as good anti-interference ability and long-term storage stability. These excellent performances substantially enable the proposed biosensor to be used for the real-time detection of

H_2O_2released from living cells with satisfactory results, thus showing the potential application in the study of H_2O_2-involved dynamic pathological and physiological process.

Keywords: Metal-organic frameworks; Boronic acid; Hydrogen peroxide; Horseradish peroxidase; Electrochemical biosensor

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Characterizing the role of metabolites, metals, and proteins is required to understand normal cell function, and ultimately, elucidate the mechanism of disease. Metabolite concentration and transformation results collected from cell lysates or fixed-cells conceal important dynamic information and differences between individual cells that often have profound functional consequences. Functional nucleic acid-based biosensors are emerging tools that are capable of monitoring ions and metabolites in cell populations or whole animals. Functional nucleic acids (FNAs) are a class of biomolecules that can exhibit either ligand binding or enzymatic activity. Unlike their protein analogues or the use of instrument-based analysis, FNA-based biosensors are capable of entering cells without disruption to the cellular environment and can report on the concentration, dynamics, and spatial localization of molecules in cells. Here, we review the types of FNAs that have been used as *in vivo* biosensors, and how FNAs can be coupled to transduction systems and delivered inside cells. We also provide examples from the literature that demonstrate their impact in practical applications. Finally, we comment on the critical limitations that need to be addressed to enable their use for single-cell dynamic tracking of metabolites and ions *in vivo.*

Keywords: Biosensors; Functional nucleic acids; Aptamers; DNAzymes; Riboswitches; Molecular beacons

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The unprecedented deterioration rate of the environmental quality due to rapid urbanization and industrialization causes a severe global health concern to both ecosystem and humanity. Heavy metals are ubiquitous in nature and being used extensively in industrial processes, the exposure to excessive levels could alter the biochemical cycles of living systems. Hence the environmental monitoring through rapid and specific detection of heavy metal contamination in potable water is of paramount importance. Various standard analytical techniques and sensors are used for the detection of heavy metals include spectroscopy and chromatographic methods along with electrochemical, optical waveguide and polymer based sensors. However, the mentioned techniques lack the point of care application as it demands huge capital cost as well

as the attention of expert personnel for sample preparation and operation. Recent advancements in the synergetic interaction among biotechnology and microelectronics have advocated the biosensor technology for a wide array of applications due to its characteristic features of sensitivity and selectivity. This review paper has outlined the overview of chromium toxicity, conventional analytical techniques along with a particular emphasis on electrochemical based biosensors for chromium detection in potable water. This article emphasized porous silicon as a host material for enzyme immobilization and elaborated the working principle, mechanism, kinetics of an enzyme-based biosensor for chromium detection. The significant characteristics such as pore size, thickness, and porosity make the porous silicon suitable for enzyme entrapment. Further, several schemes on porous silicon-based immobilized enzyme biosensors for the detection of chromium in potable water are proposed.

Keywords: Biosensor; Chromium; Water; Porous Silicon; Enzyme Immobilization

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Infectious plant diseases are caused by pathogenic microorganisms such as fungi, bacteria, viruses, viroids, phytoplasma and nematodes. Worldwide, plant pathogen infections are among main factors limiting crop productivity and increasing economic losses. Plant pathogen detection is important as first step to manage a plant disease in greenhouses, field conditions and at the country boarders. Current immunological techniques used to detect pathogens in plant include enzyme-linked immunosorbent assays (ELISA) and direct tissue blot immunoassays (DTBIA). DNA-based techniques such as polymerase chain reaction (PCR), real time PCR (RT-PCR) and dot blothybridization have also been proposed for pathogen identification and detection. However these methodologies are time-consuming and require complex instruments, being not suitable for in-situ analysis. Consequently, there is strong interest for developing new biosensing systems for early detection of plant diseases with high sensitivity and specificity at the point-of-care. In this context, we revise here the recent advancement in the development of advantageous biosensing systems for plant pathogen detection based on both antibody and DNA receptors. The use of different nanomaterials such as nanochannels and metallic nanoparticles for the development of innovative and sensitive biosensing systems for the detection of pathogens (i.e. bacteria and viruses) at the point-of-care is also shown. Plastic and paper-based platforms have been used for this purpose, offering cheap and easy-to-use really integrated sensing systems for rapid on-site detection. Beside devices developed at research and development level a brief revision of commercially available kits is also included in this review.

Keywords: Plant pathogen; Bacteria; Virus; Biosensor; Point-of-care; Nanomaterial; Antigen; DNA

Bioengineering

Bernd H.A.Rehm. (Institute of Fundamental Sciences, Massey University, Palmerston North, New Zealand). Bioengineering towards self-assembly of particulate vaccines. Current Opinion in Biotechnology, Volume 48(2017): 42-53

There is an unmet demand for safe and efficient vaccines for prevention of various infectious diseases. Subunit vaccines comprise selected pathogen specific antigensare a safe alternative to whole organism vaccines. However they often lack immunogenicity. Natural and synthetic self-assembling polymers and proteins will be reviewed in view their use to encapsulate and/or display antigens to serve as immunogenic antigen carriers for induction of protective immunity. Recent advances made in *in vivo* assembly of antigen-displaying polyester inclusions will be a focus. Particulate vaccines are inherently immunogenic due to enhanced uptake by antigen presenting cells which process antigens mediating adaptive immune responses. Bioengineering approaches enable the design of tailor-made particulate vaccines to fine tune immune responses towards protective immunity.

Pernille L.Forsberg[a], Ulrik Lumborg[b], Klavs Bundgaard[b], Verner B.Ernstsen[a]. ([a]Department of Geosciences and Natural Resource Management, University of Copenhagen, Øster Voldgade 10, 1350 Copenhagen K, Denmark, [b]DHI, Agern Allé 5, 2970 Hørsholm, Denmark). Impact of mussel bioengineering on fine-grained sediment dynamics in a coastal lagoon: A numerical modelling investigation. Journal of Marine Systems, Volume 176(2017): 1-12

Rødsand lagoon in southeast Denmark is a non-tidal coastal lagoon. It is home to a wide range of marine flora and fauna and part of the Natura 2000 network. An increase in turbidity through elevated levels of suspended sediment concentration (SSC) within the lagoon may affect the ecosystem health due to reduced light penetration. Increasing SSC levels within Rødsand lagoon could be caused by increasing storm intensity or by a sediment spill from dredging activities west of the lagoon in relation to the planned construction of the Fehmarnbelt fixed link between Denmark and Germany. The aim of the study was to investigate the impact of a mussel reef on sediment import and SSC in a semi-enclosed lagoon through the development of a bioengineering modelling application that makes it possible to include the filtrating effect of mussels in a numerical model of the lagoonal system. The numerical implementation of an exterior mussel reef generated a reduction in the SSC in the vicinity of the reef, through the adjacent inlet and in the western part of the lagoon. The mussel reef reduced the sediment import to Rødsand lagoon by 13–22% and reduced the SSC within Rødsand lagoon by 5–9% depending on the filtration rate and the reef length. The results suggest that the implementation of a mussel reef has the potential to relieve the pressure of increasing turbidity levels within a semi-enclosed lagoonal system. However, further assessment and development of the bioengineering application and resulting ecosystem impacts are necessary prior to actual implementation.

Keywords: Coastal lagoon; Numerical modelling; Fine-grained sediment transport; Bioengineering; Sediment spill; Coastal management

Pollen Biotechnology

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Allergic diseases are characterized by elevated allergen-specific IgE and excessive inflammatory cell responses. Among the reported plant allergens, grass pollen and grain allergens, derived from agriculturally important members of the Poaceae family such as rice, wheat and barley, are the most dominant and difficult to prevent. Although many allergen homologs have been predicted from species such as wheat and timothy grass, fundamental aspects such as the evolution and function of plant pollen allergens remain largely unclear. With the development of genetic engineering and genomics, more primary sequences, functions and structures of plant allergens have been uncovered, and molecular component-based allergen-specific immunotherapies are being developed. In this review, we aim to provide an update on (i) the distribution and importance of pollen and grain allergens of the Poaceae family, (ii) the origin and evolution, and functional aspects of plant pollen allergens, (iii) developments of allergen-specific immunotherapy for pollen allergy using biotechnology and (iv) development of less allergenic plants using gene engineering techniques. We also discuss future trends in revealing fundamental aspects of grass pollen allergens and possible biotechnological approaches to reduce the amount of pollen allergens in grasses.

Keywords: Poaceae; Allergy; Grain allergen; Pollen allergen; Allergen-specific immunotherapy; Allergen evolution; Allergen function; Transgenic grass; Genetic engineering

Bodhisattwa Saha, Swati Gupta Bhattacharya. (Division of Plant Biology, Bose Institute, 93/1 Acharya Prafulla Chandra Road, Kolkata 700009, India). **Charting novel allergens from date palm pollen (*Phoenix sylvestris*) using homology driven proteomics. Journal of Proteomics, Volume 165(2017): 1-10**

Pollen grains from *Phoenix sylvestris* (date palm), a commonly cultivated tree in India has been found to cause severe allergic diseases in an increasing percentage of hypersensitive individuals. To unearth its allergenic components, pollen protein were profiled by two-dimensional gel electrophoresis followed by immunoblotting with date palm pollen sensitive patient sera. Allergens were identified by MALDI-TOF/TOF employing a layered proteomic approach combining conventional database dependent search and manual *de novo* sequencing followed by homology-based search as *Phoenix sylvestris* is unsequenced. Derivatization of tryptic peptides by acetylation has been demonstrated to differentiate the ‘b’ from the ‘y’ ions facilitating efficient *de novo* sequencing. Ten allergenic proteins were identified, out of which six showed homology with known allergens while others were reported for the first time. Amongst these, isoflavone reductase, beta-conglycinin, S-adenosyl methioninesynthase, 1, 4 glucan synthase and beta-galactosidase were commonly reported as allergens from coconut

pollen and presumably responsible for cross-reactivity. One of the allergens had IgE binding epitope recognized by its glycan moiety. The allergenic potency of date palm pollen has been demonstrated using *in vitro* tests. The identified allergens can be used to develop vaccines for immunotherapy against date palm pollen allergy.

Identification of allergenic proteins from sources harboring them is essential in developing therapeutic interventions. This is the first comprehensive study on the identification of allergens from *Phoenix sylvestris* (date palm) pollen, one of the major aeroallergens in India using a proteomic approach. Proteomic methods are being increasingly used to identify allergens. However, since many of these proteins arise from species which are un-sequenced, it becomes difficult to interpret those using conventional proteomics. Date palm being an unsequenced species, the IgE-reactive proteins have been identified using a stratified proteomic workflow incorporating manual *de novo* sequencing and homology-based proteomics. This study also gives an insight into the presence of glycan nature of the IgE binding epitopes. Five proteins have been found to be common with coconut pollen allergens and presumably responsible for cross-reactivity. These can be used in diagnostics to differentiate patient cohorts allergic to both coconut and date palm pollen from true date palm pollen allergic subjects. This would also determine better specific immunotherapy regimes between the two cohorts. The allergens identified herein have potential towards vaccine development in date palm pollen allergy as well as in enriching the existing catalogue of allergenic proteins.

Keywords: Date palm; *De novo* sequencing; Pollen; Allergen; Cross-reactivity; Proteomics

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A recent study reported that *Panax ginseng* (*P. ginseng*) has a protective effect on the development of benign prostatic hyperplasia (BPH). KH053 is used as a new herbal prescription consisting of *P. ginseng* and bee-pollen. The present study aimed to investigate whether the KH053 has inhibition effects on the development of benign prostatic hyperplasia (BPH) using an animal model with testosterone induced BPH. The experiment was carried out in forty male Wistar 7 week old rats that were divided into four groups (control group, BPH group, positive group, and KH053 group). One group was used as the control and the three groups received subcutaneous injections of testosterone 20 mg/kg for 4 weeks to induce BPH. One of them received KH053 by oral gavage daily at doses of 200 mg/kg concurrently with the testosterone. The positive group received finasteride at a dose of 1 mg/kg with testosterone. After 4 weeks, all rats were sacrificed and analyzed for prostate weight, and growth factors. Results revealed that, compared to rats in the BPH group, KH053 showed that the prostate weight and

dihydrotestosterone (DHT) levels in serum were significantly decreased and the decreases in hyperplasia in prostate were also observed. In addition, immunohistochemistry (IHC) also revealed that the protein expressions of growth factors [transforming growth factor β1 (TGF-β1) and vascular endothelial growth factor (VEGF)] in prostate tissue were decreased in the KH053 group. In conclusion, these results suggest that KH053, comprising *P. ginseng* and bee-pollen, inhibits the development of BPH in Wistar rat model and might be used as functional food for BPH.

Keywords: KH053; *Panax ginseng;* Benign prostatic hyperplasia; BPH

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Prosopis, or mesquite (*Prosopis juliflora* (Sw.) DC.), was introduced in Saudi Arabia several decades ago and is heavily used in street, roadside, and park plantations. It shows great adaptation to the prevailing climatic conditions such as high temperature, severe drought, and salinity and spreads naturally in many parts of the Kingdom. This research was conducted to isolate allergen proteins and biogenic amines from the pollen grains of *P. juliflora* genotypes in Saudi Arabia from two regions, namely Al-Qassim and Eastern regions.

The results showed that 18 different allergen proteins were detected in *P. juliflora*genotypes, with molecular weight ranging from 14 to 97 kDa. Moreover, *P. juliflora*genotypes from the two studied regions contained eight biogenic amines, namely histamine, tyramine, tryptamine, β-phenylethylamine, butricine, codapherine, spermidine, and spermine. All genotypes from the Al-Qassim region were found to contain all eight amines, while in the Eastern region, histamine was absent in three genotypes, spermine was absent in six genotypes, and spermidine was absent in three genotypes. Genotypes B23, E20, and E21 had the lowest biogenic amine quantity.

All identified proteins from mesquite trees from both regions (Eastern and Al-Qassim) cause allergies in patients who are sensitive to pollen grains. Bioamines, except histamine and tyramine, were recorded at varying concentrations in different genotypes.

Keywords: Allergen proteins; Bioamine; Histamine; Pollen; Tree; Tyramine

Biotechnology Policy Issue

Elisabetta Raparelli[a], Sofia Bajocco[a], Giuseppe Scarascia Mugnozza[b]. ([a]Consiglio per la ricerca e l'analisi dell'economia agraria – Council for Agricultural Research and Economics, Research centre for Agriculture and Environment, CREA-AA, I-00184 Rome, Italy, [b]University of Viterbo, Department for Innovation in Biological, Agro-food and Forest Systems, DIBAF, I-01100 Viterbo, Italy). The perception of biotechnology in agro-

forestry: The opinion of undergraduates and researchers. Land Use Policy, Volume 66(2017): 364-373

Genetically modified organisms (GMOs) cropping promoted by different researchers, and the subsequent crisis regarding the safety of food derived from them, has resulted in strong public mistrust towards the authorities, both scientific and political. The aim of this work is to investigate the perception of Italian undergraduates and researchers towards the introduction of GMOs in agro-forestry. The factors determining attitudes towards GMOs were examined by means of 66 questions divided into three units: Knowledge, Opinon, Trust. Anagrafic and socio-cultural information were also analyzed. Data was processed through a multivariate analysis approach. The hierarchical clustering on undergraduates and researchers allowed to distinguish clusters of respondents skilled in biotechnology from those skilled in off-topic disciplines. Principal component analysis and K-means demonstrated that the positive or negative opinion toward GMOs, as for undergraduates, does not depend on their knowledge, but it is associated with the level of trust in the institutions. On the contrary, for researchers, it is related to their expertise level, without any linkage to trust in the institutions. This type of study may represent a key step for understanding the social, economic and scientific components underlying the choices of citizens, communities and society about GMOs.

Keywords: Biotechnology; Genetically modified organisms; Multivariate data analysis; Risk perception; Questionnaires

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The characteristics and impacts of scientific publications in biotechnology research referenced in standards. Technological Forecasting and Social Change, Volume 115(2017): 167-179

The integration of research papers in standards has not yet been addressed using quantitative approaches. This paper investigates the characteristics of research articles on biotechnology related to standards. The analysis is based on a study of standards produced by the standardization consortia *BioSharing*. Research, i.e. scientific articles, included in standards is more likely to lead to follow-up research and diffusion over a longer period of time than comparable scientific publications measured by the number of citations relative to most-related articles. In addition, research relying on scientific publications referenced in standards is more valuable for the research progress.

Keywords: Standardization; Standards; Research; Scientific publications; Biotechnology

Agricultural Biotechnology

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[b]Department of Agricultural-Engineering, Research Institute of Horticulture, 96-100 Skierniewice, Poland, [c]Department of Plant Genetics Breeding and Biotechnology, Warsaw University of Life Sciences (SGGW), Nowoursynowska 159, 02-776 Warsaw, Poland). **Monitoring of *Trichoderma* species in agricultural soil in response to application of biopreparations. Biological Control, Volume 113(2017): 65-72**

Strains of *Trichoderma* are used in crop plant production as plant growth promoters and biological control agents. In this study, strains of *T. atroviride* and *T. harzianum*, overgrown on organic material, were applied as biopreparations to the soil in open-field lettuce cultivation, and their population levels were monitored over time. A newly developed multiplex-PCR *Trichoderma*-identification technique was successfully used to confirm the increased abundance of *T. atroviride* and *T. harzianum* in the soil after biopreparations application, whereas these *Trichoderma* species were not detected in untreated soil. The results of multiplex-PCR were confirmed by standard plating and *Trichoderma* spp. colony counting of soil samples as well as by molecular identification of representative strains. Indigenous *Trichoderma* species were identified in field soil, however, their abundance was estimated to be relatively low 10^3 CFU, when compared to 10^5 CFU $g^{-1}$of dry soil, after biopreparations application, and these fungi persisted at this level even after two years.

Keywords: Biocontrol agent; Monitoring; Multiplex-PCR; PGPF ;Soil environment

Yi Lu, Xiaoqing Zhang, Lijuan Feng, Guangfeng Yang, Zhou Zheng, Junzhi Liu, Jun Mu. (1.Department of Environmental Science and Engineering, Zhejiang Ocean University, No.1 Haida South Road, Zhoushan, 316022, China. .2 Department of Ecology, Lishui University, No.1 Xueyuan Road, Lishui, 323000, China. 3 Department of Environmental Science and Engineering, Zhejiang Ocean University, No.1 Haida South Road, Zhoushan, 316022, China. fenglj680739@126.com). **Optimization of continuous-flow solid-phase denitrification via coupling carriers in enhancing simultaneous removal of nitrogen and organics for agricultural runoff purification. Biodegradation, Volume 28(4) (2017): 275–285**

Coupling of biodegradable corncob and plastic carrier was optimized in continuous-flow solid-phase denitrification systems for enhancing simultaneously removal of nitrogen and organics in agricultural runoff. In compared with preposition of plastic carriers and mixed distribution method, it was demonstrated that the preposition of corncobs simultaneously enhanced nitrate (6.64 ± 1.35 mg L^{-1} day $^{-1}$) and organics removal (6.33 ± 1.44 mg L^{-1} day^{-1}) at a hydraulic retention time (HRT) of 6 h. The operation performance could be further enhanced with extension of HRT to 12 h. The dominant genera found in corncob were denitrifiers for nitrate reduction (*Bosea*, *Simplicispira*, *Desulfovibrio*, *Klebsiella*, etc.) and fermentative bacteria (*Pleomorphomonas*, *Actinotalea*, *Opitutus*, *Cellulomonas*, *Bacteroides*, etc.) responsible for corncob degrading to simple organics for other denitrifiers. However, much lower and different denitrifiers abundances (*Bradyrhizobium*, *Acinetobacter*, *Bacillus*, etc.) exhibited on plastic filler than those of corncob. It well explained that the biofilm on plastic carrier was mainly related with organics removal while the biofilm on corncobs inclined to effectively remove nitrate, and simultaneous removal of nitrogen and organics could be achieved in coupling carriers system with preposition of biodegradable corncob.

Keywords: Biofilms; Solid phase denitrification; Corncobs; Denitrifiers

Stéphane Saj[a], Emmanuel Torquebiau[b], Etienne Hainzelin[c], Jacques Pages[c], Florent Maraux[c]. ([a]CIRAD, UMR System, 34398 Montpellier, France, [b]CIRAD, UR 115/University of Montpellier, 34398 Montpellier, France, [c]CIRAD, DG-DRS, 34398 Montpellier, France). **The way forward: An agroecological perspective for Climate-Smart Agriculture. Agriculture, Ecosystems & Environment, Volume 250(2017): 20-24**

The concept of Climate-Smart Agriculture (CSA) has consistently been positioned between science and policy. CSA has given rise to a lively debate in both the scientific community and civil society although it addresses the pressing need for an efficient strategy to manage agriculture and food systems facing climate change (CC). CSA formally targets the simultaneous fulfilment of three criteria: (i) CC mitigation, (ii) adaptation to CC and (iii) food security. Yet, the review of scientific literature on CSA displays a clear discrepancy between these three objectives, underlining the fact that CSA is regularly perceived as addressing only adaptation, and not mitigation and food security. On the other hand, research on agroecology (AE) reveals an extensive knowledge about food security and adaptation, often at scales which can be considered complementary to those of CSA. A better use by CSA of AE research results may help CSA focus on two currently overlooked dimensions, i.e. (i) mitigation and (ii) trade-offs and synergies between the three criteria. CSA does not have a specific blueprint for climate-smart practices and has rather a strong focus on policies, institutions and financing. Hence AE actually responds to the needs of CSA in terms of site-specificity and potential for adoption by farmers because it is strongly based on local practices. We argue that an eco- and socio-logical approach to CSA represents a *sine qua non* condition if CSA is to promote inclusive development and participate to collective efforts to manage agriculture and food systems under climate change.

Keyswords: Adaptation; Agroecology; Climate-Smart-Agriculture; Food security; Mitigation

Oscar Pérez-García, Rafael F.del Castillo. (Instituto Politécnico Nacional, CIIDIR Oaxaca, Hornos 1003, Santa Cruz Xoxocotlán, Oaxaca 71230, Mexico). **Shifts in swidden agriculture alter the diversity of young fallows: Is the regeneration of cloud forest at stake in southern Mexico? Agriculture, Ecosystems & Environment, Volume 248(2017): 162-174**

For centuries, the *milpa* shifting cultivation, a maize-bean-squash polyculture in itinerant fields has been an essential component of the landscape (MS), in tropical montane cloud forest (TMCF) areas managed by Mesoamerican indigenous communities. At present, *milpas* are being replaced by a maize based semi-permanent system (SP) characterized by tillage, fire suppression, application of synthetic fertilizers, and short fallow periods. The effects of this substitution on post-cultivation fallows are unknown, but may have critical consequences for biodiversity and forest regeneration. In the TMCF area of Sierra Norte, Oaxaca, Mexico, the fallowed areas resulting from both cultivation systems are intermixed across the landscape. We compared the composition, richness, and diversity of vascular plant species in 2–3-year-old MS and SP fallows in this area, and explored the possible role of the adjoining forested areas on fallow plant species richness and density. Tree and herb species composition in the fallows separated into two clusters, one belonging to MS and the other to SP. Pioneer and late-successional TMCF tree species were distinctive of MS fallows, whereas native perennial grass and forb species were distinctive of SP fallows. The composition of other life forms could not be distinguished based on cultivation system. The species richness and diversity of trees, tree

seedlings, shrubs, and vines were higher in MS fallows, whereas herb species richness and diversity was similar in both fallow types. In MS and SP fallows, the tree seedling species richness increased with the proportion of adjoining forested areas that were >20 years old, but not with forests younger than that age. Tree seedling density increased with the proportion of adjoining forested areas >20 years old in SP fallows but not in MS fallows. The density of trees and shrubs were significantly higher in MS fallows than in SP fallows, whereas herb density was significantly higher in SP fallows than in MS. We concluded that the replacement of MS by SP on the one hand, reduces plant diversity in early fallows and the fallow potential for TMCF regeneration; on the other hand, increases the dependence on adjoining >20-year-old forests as propagule sources.

Keywords: Forest restoration; Land-sharing; Land-sparing; *Milpa* shifting cultivation; Secondary succession; Weeds

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Cadmium (Cd) is a toxic metal which has accumulated in New Zealand agricultural soils due to phosphate fertilizer application. Understanding the contribution of plant uptake or leaching of Cd to observed Cd losses from soil is important. The concentration and distribution of Cd in irrigated and unirrigated soils with the same phosphate fertilizer history were investigated. Twenty-two pairs of soil samples from four depths (0–0.1, 0.1–0.2, 0.2–0.3 and 0.3–0.4 m) were taken from irrigated and unirrigated areas in the same field on dairy farms in three regions of New Zealand. The mean concentration of Cd at depths of 0–0.1 m and 0.1–0.2 m, as well as the cumulative masses of Cd (0–0.2, 0–0.3 and 0–0.4 m) in unirrigated soils were significantly higher ($P < 0.05$) than in irrigated soils. The concentration of phosphorus (P) at all depths (except for 0.2–0.3 m), as well as the cumulative mass of P in all depths of unirrigated soils, was also significantly higher ($P < 0.05$) than irrigated soils. However, no significant difference was detected in the concentrations of uranium (U) between irrigated and unirrigated soils. Irrigation induced a ∼7% Cd loss from topsoil (0–0.1 m), with the average rate of Cd loss from the top 0.1 m (due to irrigation) being 2.3 g ha^{-1} yr^{-1}. This study therefore confirms that irrigation can enhance Cd mobilization, however Cd is mainly adsorbed to the surface soil.

Keywords: Cadmium; Agriculture; Irrigation; Fertilizer

Thomas A.Fox[a], Jeanine M.Rhemtulla[a1], NavinRamankutty[a2], CoreyLesk[a3], TheraesaCoyle[a4], T.K.Kunhamu[b]. ([a]Department of Geography, McGill University, 845 Rue Sherbrooke O, Montréal, QC, H3A 0G4, Canada, [b]Department of Silviculture and Agroforestry, College of Forestry, Kerala Agricultural University, KAU P.O. Vellanikkara, National Highway 47, Thrissur, Kerala 680656, India). **Agricultural land-use change in Kerala, India: Perspectives from above and below the canopy. Agriculture, Ecosystems & Environment, Volume 245(2017): 1-10**

Despite the availability of a wide range of tools, measuring and explaining changes in land cover and land use in tropical regions can be extremely challenging. Kerala, India, is a biodiversity hotspot with a high population density and a long history of complex agricultural land-use patterns. Some reports suggest that agriculture in Kerala, which historically is rice paddy-wetland and agroforestry-based, is on the decline. However, the evidence is often anecdotal, especially with regards to smallholding homegarden agriculture. In this study we employ mixed methods, including remote sensing, quantitative household surveys, and semi-structured interviews, to unravel the complex land-cover and land-use changes occurring in Kerala.

Results indicate that, from a land-cover change perspective, agroforests are in dynamic equilibrium with other land covers, being cleared for roads and new buildings, but offset by the expansion of younger, less diverse agroforests into paddy wetlands. Yet beneath the canopy, agroforests are undergoing rapid land-use change not discernible using remote sensing. These changes include a reported decrease in the cultivation of 80% of Kerala's primary crop species during 2003–2013, alongside a dramatic decline in chickens (from 12.5 to 2.6 per homestead on average) and cows (from 1.7 to 0.8). Over this period, no crop increased in cultivation. According to farmers, the primary drivers of this shift were declining profitability of agriculture in Kerala, labour shortages, unreliable weather, unfamiliar pests and diseases, and government policy.

Despite the undeniable move away from agricultural activity in homegardens, we conclude that these ecologically and culturally important systems are not disappearing, but rather evolving to meet the needs of a less agricultural Kerala. Our research highlights the value of using mixed methods for characterizing land-use and land-cover histories in tropical regions.

Keywords: Homegarden; Land-use management; Tropical agriculture; Mixed methods; Agroforestry

Bioenergy

Maie El-Gammal[a], Reda Abou-Shanab[b], Irini Angelidaki[c], Basma Omar[ac], Per Viktor Sveding[c], Dimitar Borisov, Karakashev[c], Yifeng Zhang[c]. ([a]Department of Environmental Sciences, Faculty of Science, Damietta University, 34517 Damietta, Egypt, [b]Department of Environmental Biotechnology, City of Scientific Research and Technology Applications, Alexandria, 21934, Egypt, [c]Department of Environmental Engineering, Building 113, Technical University of Denmark, DK-2800 Lyngby, Denmark. **High efficient ethanol and VFA production from gas fermentation: Effect of acetate, gas and inoculum microbial composition. Biomass and Bioenergy, Volume 105(2017): 32-40**

In bioindustry, syngas fermentation is a promising technology for biofuel production without the use of plant biomass as sugar-based feedstock. The aim of this study was to identify optimal conditions for high efficient ethanol and volatile fatty acids (VFA) production from synthetic gas fermentation. Therefore, the effect of different gases (pure CO, H_2, and a synthetic syngas mixture), media (acetate medium and acetate-free medium), and biocatalyst (pure and mixed culture) were studied. Acetate was the most dominant product independent on inoculum type.

The maximum concentration of volatile fatty acids and ethanol was achieved by the pure culture (*Clostridium ragsdalei*). Depending on the headspace gas composition, VFA concentrations were up to 300% higher after fermentation with *Clostridium ragsdalei* compared to fermentation with mixed culture. The preferred gas composition with respect to highest VFA concentration was pure CO (100%) regardless of microbial composition of the inoculum and media composition. The addition of acetate had a negative impact on the VFA formation which was depending on the initial gas composition in head space.

Keywords: Syngas fermentation, Acetate, Ethanol, *Clostridium ragsdalei*, Gas compositions, Microbial culture

Hema Rughoonundun, Mark T.Holtzapple. (Department of Chemical Engineering, Texas A&M University, College Station, TX 77843-3122, USA). Converting wastewater sludge and lime-treated sugarcane bagasse to mixed carboxylic acids – a potential pathway to ethanol biofuel production. Biomass and Bioenergy, Volume 105(2017): 73-82

Sludge is the solids recovered from wastewater treatment. Its high content of organic matter makes it a potential biomass resource for renewable energy production. In this study, batch and continuous countercurrent fermentations were performed with a 60:40 mixture (dry weight basis) of lime-treated bagasse:sludge. This combination provides an optimal C/N ratio and therefore enhances yield. Two trains of continuous fermentations were performed using different volatile solids loading rates (VSLR) and liquid retention times (LRT). The highest total carboxylic acids concentration obtained was 60.8 g L^{-1} with a total acid yield of 420 g kg^{-1} of VS added and an acid productivity of 2.31 g L^{-1} d^{-1}. In studies on co-fermentation of lignocellulosic biomass, this acid concentration is the highest reported in MixAlco™ (a patented process that converts biomass to a mixture of alcohols). This study shows that wastewater sludge is a valuable resource for liquid transportation fuels, and provides an attractive replacement for fossil fuels.

Keywords: Wastwater sludge; Mixed-acid fermentation; Carboxylic acids; Ethanol; Biofuel

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Production of biofuels from cellulosic sources, such as switchgrass, is being encouraged through mandates, incentives, and subsidies. However, uncertainty in future prices coupled with large establishment costs often inhibit their cultivation. Owing to their inability to incorporate uncertainty and dynamic decision-making, standard discounted cash flow techniques are ineffective for analyzing such investments. We formulate a discrete-time binomial framework to model output prices, allowing us to incorporate price uncertainty, stand age, and variable crop yields into the analytical framework. We analyze the feasibility of investments in switchgrass

cultivation under varying price transition paths, evaluate the relationship between risk and profitability, and estimate the value of flexible decision-making options wherein the farmer can alter cultivation choices. We find that switchgrass cultivation is only 32% likely to be profitable in the base model and infer that on-farm management could play an important role in entry and exit decisions. We also find that subsidies are important for project viability and policymakers could consider incorporating payments for ecosystem services to encourage adoption.

Keywords: Switchgrass; Bioenergy; Uncertainty; Profitability; Cellulosic

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Biogas is a renewable energy source with many different production pathways and various excellent opportunities to use, for example as vehicle fuel (biomethane). Reliable analytical methodologies for assessing the quality of the gas are critical to ensure that the gas can technically and safely be used. An essential part of any procedure aiming to determine the quality is the sampling and the transfer to the laboratory. One of the greatest challenges is then to ensure that the composition of the sample collected does not change between the time of sampling and the analysis. The choice of the sampling vessel to be used must be made only after fully assessing its short-term stability. In this paper, the results from short-term stability studies in different vessels (cylinders, bags and sorbents) are presented for siloxanes, BTEX, halogenated hydrocarbons and sulfur compounds. Storage of dry gas at high pressure (> 6 MPa) appears to be a good alternative however it is currently challenging to find an optimal treatment of the cylinders for all species to be assessed in biogas/biomethane. At lower pressure, adsorption effects on the inner surface of the cylinders have been observed. The use of bags and sorbent tubes also shows limitation. No existing sorbent tubes are sufficiently universal as to trap all possible impurities and high boiling compounds may adsorbed on the inner surface of the bags walls. Moreover, the presence of water when storing biogas most certainly impacts the storage stability of compounds in most vessels. Using at least two sampling methods for a given compound and comparing results will allow taking into account the eventual effects of water vapour, and adsorption on the inner surface of the vessels.

Keywords: Biogas, Composition, Impurities, Vessels, Sampling

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Bucaramanga-Piedecuesta Kilómetro 7, Piedecuesta, Colombia). Hydrotreatment of vegetable oils: A review of the technologies and its developments for jet biofuel production. Biomass and Bioenergy, Volume 105(2017): 197-206

Hydroprocessing of oils and fats has been a subject of extended research works and discussions over time. It has proved to be an effective pathway for processing vegetable oils into biofuels, especially in the aviation industry. This study presents an evaluated review of recent literature about development, conversion routes, and role of processing conditions to maximize the production of renewable jet fuel. Reaction temperature and acidic strength of the catalyst had greater influence on the composition of final products. Decarboxylation and decarbonylation reactions are dominant during the production of aviation biofuel, because they are preferred over technological alternatives at higher temperatures. Nickel immobilized on a moderately acidic support and palladium on activated carbon catalysts has shown better yields of kerosene, under mild conditions. Continued and systematic efforts need to be made mainly over catalyst design to establish optimum and effective hydrotreating and hydrocracking processing alternative. Wide ranges of feedstocks have been studied for the production to jet biofuel. Jatropha and Camelina are promising options because they are crops for degraded soils; having in mind that in addition to sustainability and availability, costs is a main driver, and feedstock represents from 60 to 75% of final cost. Current initiatives and companies boosting jet biofuels production are also discussed.

Keywords: Hydroprocessing; Hydrotreating catalysts; Vegetable oils; Aviation biofuel

Matthew W.Smith[ab], BrennanPecha[ab], GregHelms[c], LouisScudiero[d], Manuel Garcia-Perez[a]. ([a]Department of Biological Systems Engineering, Washington State University, Pullman, WA 99164, USA, [b]Gene and Linda Voiland School of Chemical Engineering and Bioengineering, Pullman, WA 99164, USA, [c]Center for Nuclear Magnetic Resonance Spectroscopy, Washington State University, Pullman, WA 99164, USA, [d]Department of Chemistry and Materials Science and Engineering Program, Washington State University, Pullman, WA 99164, USA). **Chemical and morphological evaluation of chars produced from primary biomass constituents: Cellulose, xylan, and lignin. Biomass and Bioenergy, Volume 104(2017): 17-35**

The effect of pyrolysis temperature on the morphology, bulk and surface chemistry of cellulose, xylan and lignin chars has been examined. Chars were produced between 300 and 700 °C. Raman, X-ray photoelectron, nuclear magnetic resonance spectroscopic techniques, scanning electron microscopy and surface area analysis were used to characterize each sample. Formation of polyaromatic structures were found to be prevalent at 400 °C for both cellulose and lignin chars, and showed development at 300 °C for Xylan. The low A bands identified in the lignin char produced at 400 °C indicate that crosslinking at low temperatures preferentially forms hexagonal or larger rings. Aromatic condensation increased until 500 °C, and remained stable up to 700 °C. The sharp drop in oxygen content as temperature is increased up to 500 °C and the formation of ether (C-O-C) groups indicates that oxygen is a primary reaction component for crosslinking and polycondensation. Despite the considerable increase in ring size for char produced at 700 °C compared to 500 °C, only very mild loss of oxygen is identified, suggesting that C-C bonds are forming with minimal oxygen mediation The increased broadness of the NMR peak and the Raman G band suggest that at these temperatures the increase in ring size occurs largely in a 3 dimensional manner rather than planar with contributions from non-hexagonal rings and out-of-plane distortion. By comparing the NMR dephasing data to the

I(D)/I(G) ratio an approximate relation between this Raman data and cluster size has also been derived.

Keywords: Char; Biochar; Pyrolysis; NMR; Raman; XPS

Nurul Nadia Ramli, Francis M.Epplin. (Department of Agricultural Economics, Oklahoma State University, Stillwater, OK 74078, USA). Cost to produce liquid biofuel from invasive eastern redcedar biomass. Biomass and Bioenergy, Volume 104(2017): 45-52

Biomass harvested from invasive plant species has been proposed for use as lignocellulosic feedstock for the production of advanced biofuels as a way to mitigate the indirect land use issues associated with the production of dedicated energy crops. Encroachment of eastern redcedar (*Juniperus virginiana* L.) has reduced the forage productivity of North American Great Plains grasslands ranging from Texas in the South to Alberta in the North. The objective of this study is to develop and demonstrate a modeling system that can be used to determine the minimum selling price of biofuel. A fast pyrolysis process that exclusively uses eastern redcedar biomass to produce gasoline and diesel blend stock is assumed. A mixed integer mathematical programming model is constructed and applied to a 15 county case study region from which eastern redcedar may be collected. The modeling system considers the growth rate of unharvested trees to determine the optimal biorefinery location, the optimal harvest locations for each of 20 years, and the minimum selling biofuel price. To fulfill 2 Gg d^{-1} feedstock requirements for the expected life of the biorefinery, 73% of the trees growing in year zero in the case study region would be required. For a 313 dm^3 Mg^{-1} conversion rate, and with biorefinery ownership, operating and maintenance cost of 630 \$ m^{-3}, the expected cost to deliver feedstock is estimated to be 61 \$ Mg^{-1}, and the estimated minimum selling biofuel price is 830 \$ m^{-3}.

Keywords: Minimum selling price; Biofuel; Biomass; Eastern redcedar; *Juniperus virginiana* L.; Feedstock; Invasive species; Mathematical programming; Pyrolysis

Nano Biotechnology

Selvaraj Mohana Roopan. (Chemistry of Heterocycles & Natural Product Research Laboratory, Department of Chemistry, School of Advanced Sciences; VIT University, Vellore 632 014, India). An overview of natural renewable bio-polymer lignin towards nano and biotechnological applications. International Journal of Biological Macromolecules, Volume 103(2017): 508-514

Lignin were said to be major bio-polymer next to cellulose which is an abundant biopolymer. This type of lignin was mostly isolated from woods which were named after their physical, morphological appearances and majorly on extracting sources. Still now there are very few reports on isolation, identification of pure lignin and isolating pathways are also not well defined. Molecular weight of lignin varies from thousands to ten thousands which are not explored accurately. Even-though lignins were surrounded by these many hurdles it has various application studies which were studied and reported. Nowadays researchers focused on synthesizing lignin nanoparticles which were subjected for various application studies in day

today life. This lignin contains wide range of applications in several fields like medicinal, industrial, pharmaceuticals, etc., Most of the researcher are focused on applications like anti-oxidant and microbicidal agents. So this review will comprises of outlook of bioprocessing lignin and its application focused on nanoparticles synthesis, anti-oxidant and microbicidal agents. This was the first review on renewable bio-polymer lignin with its bio-pharmaceutical and nanobiotechnological applications.

Keywords: Lignin; Bio-polymer; Nanoparticles; Anti-microbial; Anti-oxidant

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This review paper discussed on the nano materials in concrete. Nowadays, the application of nano materials has received numerous attentions to enhance the conventional concrete properties. Eventually, the introduction of nano materials in concrete is to increase its strength and durability. Nano material is defined as material that contains particle size which less than 200 nm. For the purpose of concrete study, the application of nano materials must be at least 500 nm in size. The addition of ultrafine nano material will help to reduce the cement content by partially replacing cement on weight basis to improve the binding effect. The ultrafine particles of nano material will also help reduce the formation of micro pores by acting as a filler agent, producing a very dense concrete and automatically reduce the growth of micro pores in the UHPC structures. Moreover, this paper presents on the advantages and benefits to enhance the concrete by utilizing nano materials.

Keywords: Nano material; Nano silica; Nano alumina; Nano kaolin; Nano clay

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In a couple of decades, nanotechnology has become a trending technology owing to its integrated science collection that incorporates variety of fields such as chemistry, physics, medicine, catalytic processes, food processing industries, electronics and energy sectors. One of the emerging fields of nanotechnology that has gained momentous admiration is nano-biotechnology. Nano-biotechnology is an integrated combination of biology with nanotechnology that encompasses the tailoring, and synthesis of small particles that are less than 100 nm in size and subsequent exploitation of these particles for their biological applications. Though the variety of physical techniques and chemical procedures are known for the nanoparticlessynthesis, biological approach is considered to be the preferred one. Environmental hazards and concerns associated with the physical and chemical approaches

of nanoparticles synthesis has added impetus and zenith to the biological approach involving the use of plants and microorganisms. The current review article is focused on the synthesis of plant-derived (phytochemical) gold nanoparticles alongside their scope in biomedical applications.

Keywords: Nano-biotechnology; Gold nanoparticles; Phytochemical; Biomedical applications

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Over the past ten years, the global biopharmaceutical market has remarkably grown, with ten over the top twenty worldwide high performance medical treatment sales being biologics. Thus, biotech R&D (research and development) sector is becoming a key leading branch, with expanding revenues. Biotechnology offers considerable advantages compared to traditional therapeutic approaches, such as reducing side effects, specific treatments, higher patient compliance and therefore more effective treatments leading to lower healthcare costs. Within this sector, smart nanotechnology and colloidal self-assembling systems represent pivotal tools able to modulate the delivery of therapeutics. A comprehensive understanding of the processes involved in the self-assembly of the colloidal structures discussed therein is essential for the development of relevant biomedical applications.

In this review we report the most promising and best performing platforms for specific classes of bioactive molecules and related target, spanning from siRNAs, gene/plasmids, proteins/growth factors, small synthetic therapeutics and bioimaging probes.

Keywords: Bioactive molecule delivery; Micro/nanocarriers; Hydrogels; Liposomes; Carbon nano materials

Biomimicry

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Johanesburg, South Africa). Biomimicry principles as evaluation criteria of sustainability in the construction industry. Energy Procedia, Volume 142(2017): 2491-2497

The construction industry is known to have significant and adverse impact on the environment such as pollution, high energy consumptions, amongst others. Sustainability has now become a necessity in order to lower these impacts and to achieve social and economic benefits. Globally, the quest for sustainable solutions to human challenges has intensified, impelling scientists, engineers, architects, designers and innovators to now consult and learn from nature's experience. Hence, biomimicry, the study and emulation of nature's forms, functions and strategies to proffer sustainable solutions to human challenges. The purpose of this research is to examine biomimicry principles as critical success criteria of sustainability in the industry. Quantitative research method was adopted and an online questionnaire was used for data collection. Findings from the study revealed twenty-three (23) variables in their order of importance. The implication of this is that, assessing and aligning the activities of the construction industry with the identified biomimicry principles has the potential of achieving the goal of sustainability in the industry.

Keywords: Biomimicry; construction industry; environment; nature; sustainability

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High energy use, consumption and depletion of natural resources, and environmental degradation and pollution are few of the numerous impacts of the construction industry. These are traceable to the unsustainable construction practices employed by most of the construction industry globally. Hence, the need for effective energy management and sustainability. With biomimicry, the study and emulation of nature's entirety to offer sustainable solutions to human challenges, an era of novel and eco-friendly source of inspiration is heralded. This study sets out to examine the biomimetic energy management and sustainability for the reinvention of the construction industry. Literature review was conducted on nature-inspired ways and strategies of energy management and sustainability. Findings from the study revealed technology, policy, and education as major areas where biomimicry seeks to sustainably address energy challenges. The adoption and application of biomimetic strategies is important, as it offers much potential in energy management and sustainability.

Keywords: Nature-inspired; bimimicry; energy; construction industry

Name of Journals

1. Acta Biotechnologica
2. Aerobiologia
3. Annual Review-Plant Pathology
4. Annual Review- Ecology and Systematics
5. Annual Review-Biochemistry
6. Annual Review-Biomedical Engineering
7. Annual Review-Biophysics and Biomolecular Structure
8. Annual Review-Microbiology
9. Annual Review-Pharmacology and Toxicology
10. Annual Review-Phytopathology
11. Annual Review-Physiology
12. Annual Review-Plant Physiology
13. Annual Review-Public Health
14. African Journal of Biotechnology
15. Applied and Environmental Microbiology
16. Applied Microbiology & Biotechnology
17. Aquaculture
18. Allergy
19. Australian Journal of Plant Physiology
20. Biocatalysis and Transformation
21. Biocontrol
22. Biocontrol Potential and its exploitation in sustainable Agriculture
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24. Biodeterioration & Biodegradation
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31. Bioscience, Biotechnology and Biochemistry
32. Biosensors-and –Bioelectronics
33. Bioseperation
34. Biotechnolgy Letters
35. Biotechnology Advances

36. Biotechnology and Applied Biochemistry
37. Biotechnology and Bioengineering
38. Botanical Review
39. Canadian Journal of Microbiology
40. Cell & Tissue Banking
41. Clinical Microbiology Reviews
42. Critical Reviews in Biotechnology
43. Crop Research Hisar
44. Current Microbiology
45. Current Opinion in Biotechnology
46. Current Science
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48. Ecology and Environmental Corner
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52. Environmental Research
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56. Environmental Imapct Assessment Review
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58. Food & Agricultural Immunology
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64. Indian Farming
65. Indian Journal of Agricultural Science
66. Indian Journal of Biotechnology
67. Indian Journal of Ecology
68. Indian Journal of Experimental Biology
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71. Indian Journal of Plant Physiology
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73. International Journal of Biotechnology
74. International Journal of Phytoremediation
75. Journal of Applied Sciences and Environmental Management
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77. Journal Biological Control

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94. Nature Biotechnology
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96. Perspectives-in-Biotechnology
97. Pesticide research Journal
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114. Nano Biotechnology

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