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on
ENVIRONMENTAL BIOTECHNOLOGY

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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 32nd 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 June 2018. 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

Anna Maria Orani[ac], Aurélie Barats[a], Wendy Zitte[a], Christine Morrow[b], Olivier P.Thomas[b]. ([a]Université Nice Sophia Antipolis, CNRS, IRD, Observatoire de la Côte d'Azur, Géoazur, UMR 7329, 250 rue Albert Einstein, Sophia Antipolis 06560 Valbonne, France, [b]National University of Ireland Galway, Marine Biodiscovery, School of Chemistry, University Road, Galway, Ireland, [c]International Atomic Energy Agency, Environment Laboratories, 4 Quai Antoine 1er, MC 9800, Monaco). **Comparative study on the bioaccumulation and biotransformation of arsenic by some northeastern Atlantic and northwestern Mediterranean sponges. Chemosphere, Volume 201(2018): 826-839**

The bioaccumulation and biotransformation of arsenic (As) were studied in six representative marine sponges from the French Mediterranean and Irish Atlantic coasts. Methodologies were carefully optimized in one of the species on *Haliclona fulva* sponges for two critical steps: the sample mineralization for total As analysis by ICP-MS and the extraction of As species for HPLC-ICP-MS analysis. During the optimization, extractions performed with $0.6\ \mathrm{mol\ L^{-1}}$ H_3PO_4 were shown to be the most efficient. Extraction recovery of 81% was obtained which represents the best results obtained until now in sponge samples. Total As analyses and As speciation were performed on certified reference materials and allow confirming the measurement quality both during the sample preparation and analysis. Additionally, this study represents an environmental survey demonstrating a high variability of total As concentrations among the different species, probably related to different physiological or microbial features. As speciation results showed the predominance of arsenobetaine (AsB) regardless of the sponge species, as well as the occurrence of low amounts of dimethylarsinic acid (DMA), arsenate (As(+V)), and unknown As species in some samples. The process responsible for As transformation in sponges is most likely related to sponges metabolism itself or the action of symbiontorganisms. AsB is supposed to be implied in the protection against osmolytic stress. This study demonstrates the ability of sponges to accumulate and bio-transform As, proving that sponges are relevant bio-monitors for As contamination in the marine environment, and potential tools in environmental bio-remediation.

Keywords: Marine sponges; Biomonitor; Arsenic bioaccumulation; Arsenic speciation; Bioremediation.

Jianxiang Feng[a1], Yanyan Lin[a1], YaoYang[b1], Qianqian Shen[a], Jianrong Huang[a], Shugong Wang[c], XiaoshanZhu[d], Zufu Li[a]. ([a]School of Life Sciences, Sun Yat-Sen University, Guangzhou 510275, People's Republic of China, [b]College of Life Science and Oceanography, Shenzhen University, Shenzhen 518060, People's Republic of China, [c]School of Earth Sciences and Engineering, Sun Yat-Sen University, Guangzhou 510275, People's Republic of China, [d]Graduate School at Shenzhen, Tsinghua University, Shenzhen

518055, People's Republic of China). Tolerance and bioaccumulation of Cd and Cu in *Sesuvium portulacastrum*. Ecotoxicology and Environmental Safety, Volume 147(2018): 306-312

In order to investigate the tolerance and bioaccumulation of Cd and Cu in the halophyte *Sesuvium portulacastrum*, seedlings were hydroponically cultured for 30 days using the modified 1/2 Hoagland nutrient solution with different concentrations of Cd (0, 5, 10, 15, and 20 mg L^{-1}) and Cu (0, 2.5, 5, 7.5, and 10 mg L^{-1}). Afterwards, the seedling height, leaf area, biomass, and mineral element contents (Fe, Mg, Cu, and Zn) in the roots, stems and leaves were measured, and the tolerance index, bioconcentration factor (BCF), transportation index, and removal rate were calculated. The effects of salinity (0‰–30‰) on the growth and bioaccumulation ability of *S. portulacastrum* under combined Cu/Cd (5 mg L^{-1}) exposure were also determined. The results showed that, with an increasing Cd concentration, the biomass and seedling height of *S. portulacastrum* initially increased and then decreased. The highest leaf biomass and seedlings height was observed in the 10 mg L^{-1} and 5 mg L^{-1} Cd treatment group, respectively. Salinity did not affect the biomass of *S. portulacastrum* but decreased Cd concentration in roots and aboveground tissues and Cu concentration in roots of *S. portulacastrum*. Cu treatment significantly facilitated the absorption of Mg, Cu, and Zn in roots. With an increasing Cu concentration, the Mg and Fe contents increased in the leaves of *S. portulacastrum*. In comparison to the above-ground portions, the root showed a higher bioaccumulation ability of Cd and Cu, with the BCF of 341.5 and 211.9, respectively. The BCF and translocationfactor (TF) values indicated that *S. portulacastrum* was not a hyperaccumulator for Cd and Cu, but could be used as a phytostablization plant in heavy metal contaminated coastal environments.

Keywords: Bioaccumulation; Cadmium; Copper; Removal rate; *Sesuvium portulacastrum;* Salinity

Jon A.Arnot[abc], SaschaPawlowski[d], SamanthaChamp[d]. ([a]ARC Arnot Research and Consulting Inc., 36 Sproat Avenue, Toronto, ON M4M 1W4, Canada, [b]Department of Physical and Environmental Sciences, University of Toronto at Scarborough, 1265 Military Trail, Toronto, ON M1C1A4, Canada, [c]Department of Pharmacology and Toxicology, University of Toronto, 1 King's College Circle, Toronto, ON M5S 1A8, Canada, [d]BASF SE, Carl-Bosch Str. 38, 67056 Ludwigshafen, Germany). A weight-of-evidence approach for the bioaccumulation assessment of triclosan in aquatic species. Science of The Total Environment, Volume 618(2018): 1506-1518

The bioaccumulation assessment of chemicals is challenging because of various metrics and criteria, multiple lines of evidence and underlying uncertainty in the data. Measured in vivo laboratory and field bioaccumulation data are generally considered preferable; however, quantitative structure-activity relationships (QSARs), mass balance models and in vitro data can also be considered. This case study critically evaluates in vivo, in vitro and in silico data and provides new data for the bioaccumulation assessment of triclosan (TCS). The review focusses on measured fish bioconcentration factors (BCFs) because this is the most commonly used

regulatory metric. Reported measured fish BCFs range from about 20 to 8700 L/kg-ww spanning a range of possible bioaccumulation assessment outcomes, i.e. from “not bioaccumulative” to “very bioaccumulative”. Estimated biotransformation rate constants for fish obtained from in vivo, in vitro and in silico methods show general consensus fostering confidence in the selection of plausible values to confront uncertainty in the measured fish BCF tests. Other measurements (lines of evidence) from various species are also collected and reviewed. The estimated biotransformation rate constants and selected chemical property data are used to parameterize bioaccumulation models for aquatic species. Collectively the available lines of evidence are presented using a weight of evidence approach for assessing the bioaccumulation of TCS in aquatic species. Acceptable quality measured data and model predictions for TCS BCFs and bioaccumulation factors are lower than 2000 L/kg. Biomagnification factors are < 1 (kg/kg). The general consistency in the acceptable quality data is largely explained by the relatively efficient rates of TCS biotransformation in a range of species including measurements of significant in vitro activity of phase II conjugation reactions. The review demonstrates the value of combining models and measurements and, when necessary, applying multiple lines of evidence for chemical assessment.

Keywords: Biotransformation; Uncertainty; Models; In vivo; In vitro; In silico.

Mette Dalgaard Agersted[a], Eva Friis Møller[b], Kim Gustavson[b]. ([a]University of Oslo, Department of Biosciences, PO Box 1066, Blindern, 0316 Oslo, Norway, [b]Aarhus University, Arctic Research Centre, Department of Bioscience, Frederiksborgvej 399, PO Box 358, 4000 Roskilde, Denmark). **Bioaccumulation of oil compounds in the high-Arctic copepod *Calanus hyperboreus.* Aquatic Toxicology, Volume 195(2018): 8-14**

Oil and gas exploration in the Arctic will increase the risk for accidental oil spills and thereby have a potential impact on the ecosystem and the organisms inhabiting these areas. Lipid rich copepods are an important food source for higher trophic levels in Arctic marine ecosystems. However, high lipid content and a slower metabolism increase the risk for bioaccumulation in Arctic species. Here we exposed three late development stages of the lipid rich high-Arctic copepod species *Calanus hyperboreus* to two different ^{14}C-marked crude oil model compounds, the alkane dodecane ($\log K_{ow}$ 6.10) and the polycyclic aromatic hydrocarbon (PAH) phenanthrene ($\log K_{ow}$ 4.46) on a short-term scale of 4 days. Exposure was followed by a depuration phase of 3 days. We observed a difference in estimated bioaccumulation of the two model compounds between stages and found a slower depuration of dodecane than of phenanthrene in the two largest and most lipid rich stages. However, depuration of dodecane and phenanthrene was non-significant for all three stages. The results indicate that even short-term exposure may result in long-term bioaccumulation and internal exposure of oil compounds in the lipid rich high-Arctic copepods *C. hyperboreus*. Slow elimination and depuration of oil components indicate a risk for transfer of oil component up the food web to pelagic fish, seabirds and baleen whales.

Bioremediation

VirbalaSharma DeepakPant,(Department of Environmental Sciences, Central University of Himachal Pradesh, Dharamshala, Himachal Pradesh 176215, India)Structural basis for expanding the application of bioligand in metal bioremediation,Volume 252(2018): 188-197

Bioligands (BL) present in plant and microbes are primarily responsible for their use in metal decontamination. Both primary (proteins and amino acid) and secondary (proliferated) response in the form of BL is possible in plants and microbes toward metal bioremediation. Structure of these BL have specific requirement for preferential binding towards a particular metal in biomass. The aim of this review is to explore various templates from BL (as metal host) for the metal detoxification/decontamination and associated bioremediation. Mechanistic explanation for bioremediation may involve the various processes like: (*i*) electron transfer; (*ii*) translocation; and (*iii*) coordination number variation. HSAB (hard and soft acid and base) concept can act as guiding principle for many such processes. It is possible to investigate various structural homolog of BL (similar to secondary response in living stage) for the possible improvement in bioremediation process.

Keywords: Bioligand; Bioremediation; Homologous; Mechanism; π-Cloud

Marwa Eltarahony[a], SaharZaki[a], Zeinab Kheiralla[b], Desouky Abd-El-haleem[a], (a.Environmental Biotechnology Department, Genetic Engineering and Biotechnology Research Institute, City of Scientific Research and Technological Applications, 21934 Borgelarab, Alexandria, Egypt, b. Botany Department, College of Women for Arts, Science and Education, Ain Shams University, Cairo, Egypt) NAP enzyme recruitment in simultaneous bioremediation and nanoparticles synthesis, Volume: 18(2018): e00257

The periplasmic nitrate reductase enzyme (NAP) has become attractive catalyst, whose exploitation has emerged as one of the indispensable strategies toward environmentally benign applications. To achieve them efficiently and overcome the sensitivity of NAP in harsh environmental circumstances, the immobilization for denitrifying bacteria and NAP enzyme for simultaneous bioremediation and bionanoparticles synthesis was studied. NAP catalyzed NO_3^- reduction at V_{max} of 0.811 μM/min and K_m of 14.02 mM. Concurrently, the immobilized MMT cells completely removed NO_3- upon 192 h with AgNPs synthesis ranging from 23.26 to 58.14 nm as indicated by SEM. Wherase, immobilized NAP exhibited lower efficiency with 28.6% of NO_3^- elimination within 288 h and large aggregated AgNPs ranging from 94.44 nm to 172.22 nm. To the best of author knowledge, the immobilization for denitrifying bacteria and NAP enzyme for simultaneous bioremediation and bionanoparticles synthesis was not studied before.

Keywords: Immobilization; Nitrate reductase; Nanoparticles; Denitrification; Bioremediation.

RupshikhaPatowary[a] Kaustuvmani Patowary[a]Mohan ChandraKalita [b]SureshDeka [a](a.Environmental Biotechnology Laboratory, Life Sciences Division, Institute of Advanced Study in Science & Technology (IASST), Paschim Boragaon, Guwahati 781 035, Assam, India, b. Department of Biotechnology, Gauhati University, Guwahati 781014, India) **Application of biosurfactant for enhancement of bioremediation process of crude oil contaminated soil, Volume: 129(2018): 50-60.**

In the present study, a biosurfactant produced by *Pseudomonas* aeruginosa SR17 was utilized to evaluate its efficiency in enhancement of bioremediation of oil contaminated soil. The degradation of total petroleum hydrocarbon (TPH) on application of rhamnolipid biosurfactant at 1.5 g L^{-1} was found to be 86.1% and 80.5% in two soil samples containing 6800 ppm and 8500 ppm TPH respectively. The efficiency of biosurfactant was also compared with a frequently used synthetic surfactant, sodium dodecyl sulphate (SDS) that resulted in 70.8% and 68.1% degradation of TPH from the same contaminated soil samples. GC-MS based analysis showed the presence of poly aromatic hydrocarbons (PAHs) namely indene, chamazulene, naphthalene, phenanthrene, anthracene, fluorene, floranthene, benz(b)fluorene and benz(d)anthracene in the soil samples. Rhamnolipid treatment eliminated 3 PAHs namely floranthene, benz(b)fluorene, and benz(d)anthracene completely within six months and the remaining PAHs were depleted up to 60–80%, within the same period. The efficient degradation of PAHs and other components of TPH on application of the biosurfactant were attributed to enhanced heterotrophicbacterial population. It was also found that the degradation of oil contaminants led to alteration of certain vital physico-chemical properties of the soil.

Keywords: Biosurfactant; *Pseudomonas aeruginosa* SR17; Bioremediation; Oil contamination; PAHs.

Tsair-FuhLin[de], Liang-MingWhang[ce], Yi-TingChiu[e], Yi-HsuanChen[e], (a.School of Civil, Environmental and Geological Engineering, Mapua Institute of Technology, Manila 1002, Philippines, b. Department of Civil Engineering, Adamson University, Manila 1000, Philippines, c. Sustainable Environment Research Laboratories, National Cheng Kung University, Tainan 70955, Taiwan, d. Tainan Hydraulics Laboratories, National Cheng Kung University, Tainan 70955, Taiwan, e. Department of Environmental Engineering, National Cheng Kung University, Tainan 70101, Taiwan) **A review in the current developments of genus *Dehalococcoides*, its conseortia and kinetics for bioremediation options of contaminated groundwater, Volume: 28, Issue 4, (2018): 149-157.**

This article reviews the current developments in genus *Dehalococcoides* as key dechlorinating bacteria in chlorinated ethene contaminated sites. The presence of chlorinated ethenes in environment had been a concern for more than five decades as it represents significant threat to human and ecological health due to its extreme toxicity. This review elucidates the kinetics of *Dehalococcoides* spp. growth and compound utilization in dechlorination of chlorinated ethenes compounds. The metabolic pathways in physiology of *Dehalococcoides* spp. are

important in the transformation of chlorinated species. The potential of isolates and its reductive dehalogenase genes are seen to infer activities of *Dehalococcoides* spp. that would be used to the development of engineered systems. This system is helpful in making decision on bioremediation option to treat the contaminated groundwater. Hence, the role of *Dehalococcoides* spp. in chlorinated ethene biodegradation is controlled by kinetics in complex ways. Therefore, intensive *in-situ* characterization and understanding the microbial growth on dechlorination evaluation are essential to develop a consistent and rational engineered system. This is to achieve a successful bioremediation strategies for sites contaminated with chlorinated ethenes.

Keywords: Dechlorinating consortia; *Dehalococcoides;* Reaction kinetics.

PiaoXu[ab], CuiLai[ab], Guangming Zeng[ab], DanlianHuang[ab], MingChen[ab], BiaoSong[ab], XinPeng[c], JiaWan[ab], LiangHu[ab], AbingDuan[ab], WangwangTang[a, (b]**(a.College of Environmental Science and Engineering, Hunan University, Changsha 410082, PR China, b. Key Laboratory of Environmental Biology and Pollution Control, Ministry of Education, Hunan University, Changsha 410082, PR China, c. College of Chemistry and Chemical Engineering, Hunan Normal University, Changsha 410081, PR China)Enhanced bioremediation of 4-nonylphenol and cadmium co-contaminated sediment by composting with *Phanerochaete chrysosporium* inocula, Volume 250, February 2018, Pages 625-634.**

Composting is identified as an effective approach for solid waste disposal. The bioremediation of 4-nonylphenol (4NP) and cadmium (Cd) co-contaminated sediment was investigated by composting with *Phanerochaete chrysosporium* (*P. chrysosporium*) inocula. *P. chrysosporium* inocula and proper C/N ratios (25.51) accelerated the composting process accompanied with faster total organic carbon loss, 4NP degradation and Cd passivation. Microbiological analysis demonstrated that elevated activities of lignocellulolytic enzymes and sediment enzymes was conducive to organic chemical transformation. Bacterial community diversity results illustrated that *Firmicutes* and *Proteobacteria* were predominant species during the whole composting process. Aerobic cellulolytic bacteria and organic degrading species played significant roles. Toxicity characteristic leaching procedure (TCLP) extraction and germination indices results indicated the efficient detoxification of 4NP and Cd co-contaminated sediment after 120 days of composting. Overall, results demonstrated that *P. chrysosporium* enhanced composting was available for the bioremediation of 4NP and Cd co-contaminated sediment.

Biotransformation

Nighat Sultana. (Pharmaceutical Research Center, PCSIR Laboratories Complex, Shahrah-e-Dr. Salimuzzaman Siddiqui, Off University Road, Karachi 75280, Pakistan) **Microbial biotransformation of bioactive and clinically useful steroids andsome salient features of steroids and biotransformation. Steroids 136 (2018): 76–92.**

Steroids are perhaps one of the most widely used group of drugs in present day. Beside the established utilization as immunosuppressive, anti-inflammatory, anti-rheumatic, progestational, diuretic, sedative, anabolic and contraceptive agents, recent applications of steroid compounds include the treatment of some forms of cancer, osteoporosis, HIV infections and treatment of declared AIDS. Steroids isolated are often available in minute amounts. So biotransformation of natural products provides a powerful means in solving supply problems in clinical trials and marketing of the drug for obtaining natural products in bulk amounts. If the structure is complex, it is often an impossible task to isolate enough of the natural products for clinical trials. The microbial biotransformation of steroids yielded several novel metabolites, exhibiting different activities. The metabolites produced from pregnenolone acetate by Cunning hamella elegans and Rhizopus stolonifer were screened against tyrosinase and cholinesterase showed significant inhibitory activities than the parent compound. Diosgenin and its transformed sarsasapogenin were screened for their acetyl cholinesterase and butyryl cholinesterase inhibitory activities. Sarsasapogenin was screened for phytotoxicity, and was found to be more active than the parent compound. Diosgenin, prednisone and their derivatives were screened for their anti-leishmanial activity. All derivatives were found to be more active than the parent compound. The biotransformation of steroids have been reviewed to a little extent. This review focuses on the biotransformation and functions of selected steroids, the classification, advantages and agents of enzymatic biotransformation and examines the potential role of new enzymatically transformed steroids and their derivatives in the chemoprevention and treatment of other diseases. tyrosinase and cholinesterase inhibitory activities, severe asthma, rheumatic disorders, renal disorders and diseases of inflammatory bowel, skin, gastrointestinal tract.

Keywords: Steroid, Biotransformation, Biological significance, Bioactive cyclic compounds, Derivatives, Enzymes, Biotransformation agents, Biotransformation advantages.

Aza Kobakhidzea, Vladimir Elisashvilia, Philippe F.-X. Corvinib,c, Monika Čvančarováb,□ (a Institute of Animal Husbandry and Feed Production, Agricultural University of Georgia, 240 David Agmashenebeli Alley, 0159 Tbilisi, Georgia. Institute for Ecopreneurship, School of Life Sciences, University of Applied Sciences and Arts, Northwestern Switzerland, Gründenstrasse 40, Muttenz CH-4132, Switzerlan c State Key Laboratory of Pollution Control and Resource Reuse, School of the Environment, Nanjing University Xianlin Campus, Xianlin Avenue 163, Nanjing 210023,)China.
Biotransformation of ritalinic acid by laccase in the presence of mediator TEMPO. New Biotechnology 43 (2018): 44–52.

Methylphenidate is widely used as a medication for the treatment of attention deficit hyperactivity disorder .(ADHD) in children. Less than 1% of methylphenidate is excreted unchanged in urine, while 80% of an oral dose is excreted as ritalinic acid (which is reportedly poorly degradable). This study aims to investigate the biotransformation of ritalinic acid by free and immobilized enzymes. The influence of various laccase mediators on biotransformation

efficiency has been tested. Formation of the main transformation products has been monitored and their potential structures suggested. The effective transformation of ritalinic acid was observed only in the presence of 2,2,6,6-tetramethylpiperidine 1-oxyl mediator (TEMPO). The most effective enzyme was the laccase of T. versicolor 159. The main transformation product was an N-methyl derivative of ritalinic acid. Ritalinic acid was also reduced to aldehyde and alcohol, and a broad spectrum of intermediate complexes with oxoammonium ion of TEMPO were detected. This is the first time the biotransformation of ritalinic acid has been investigated in detail.

Keywords: Ritalinic acid, Laccase, Biotransformation, TEMPO, LC–MS.

LorenaGonzalez-Gil[a], MiguelMauricio-Iglesias[a], DenisseSerrano[ab], Juan M.Lema[a], MartaCarballa[a], (a. Department of Chemical Engineering, School of Engineering, Universidade de Santiago de Compostela, Rúa Lope Gómez de Marzoa, E-15782 Santiago de Compostela, Spain, b. Department of Water and Environmental Sciences, Instituto Tecnológico de Sonora, 5 de febrero 818 sur, Colonia Centro, 85000 Ciudad Obregón, Mexico) **Role of methanogenesis on the biotransformation of organic micropollutants during anaerobic digestion. Sci Total Environ. Vol. 622-623: 459-466**

Several studies showed that some organic micropollutants (OMPs) are biotransformed during anaerobic digestion (AD). Yet, most of them aim at reporting removal efficiencies instead of understanding the biotransformation process. Indeed, how each of the main AD stages (i.e., hydrolysis, acidogenesis, and methanogenesis) contribute to OMP biotransformation remains unknown. This study focuses on investigating the role of methanogenesis, the most characteristic step of AD, to OMP removal. More specifically, the sorption and the biotransformation of 20 OMPs by methanogenic biomass were analyzed determining their concentrations in both liquid and solid phases. Sorption onto methanogenic biomass displayed a similar behavior as reported for digested sludge. Most of the OMPs were biotransformed to a medium extent (35–70%) and only sulfamethoxazole was completely removed. Comparing these results with those reported for the complete AD process, methanogenesis was proven to play a key role, accounting for more than 50% of the OMP biotransformation (except for roxithromycin) during AD. An increase in the organic loading rate from 1 to 2 g COD/L d, typical loads employed in sewage sludge anaerobic digesters, did not exert a clear cometabolic effect on the OMPs biotransformation. It is hypothesized that biotransformation occurs in both liquid and solid phases because no link between the partition coefficient (*Kd*) and the overall biotransformation efficiency was found. These findings allow a better understanding of the OMPs fate under anaerobic conditions, which is necessary to design efficient biological mitigation strategies.

Keywords: Biotransformation; Cometabolism; Partition coefficient; Pharmaceuticals; Sewage sludge.

T.Alvarino, S.Suarez, J.Lema, F.Omil (Department of Chemical Engineering, Institute of Technology, Universidade de Santiago de Compostela, 15782 Santiago de Compostela,

Galicia, Spain) Understanding the sorption and biotransformation of organic micropollutants in innovative biological wastewater treatment technologies, Volume : 615 (2018): 297-306.

New technologies for wastewater treatment have been developed in the last years based on the combination of biological reactors operating under different redox conditions. Their efficiency in the removal of organic micropollutants (OMPs) has not been clearly assessed yet. This review paper is focussed on understanding the sorption and biotransformation of a selected group of 17 OMPs, including pharmaceuticals, hormones and personal care products, during biological wastewater treatment processes. Apart from considering the role of "classical" operational parameters, new factors such as biomass conformation and particle size, upward velocity applied or the addition of adsorbents have been considered. It has been found that the OMP removal by sorption not only depends on their physico-chemical characteristics and other parameters, such as the biomass conformation and particle size, or some operational conditions also relevant. Membrane biological reactors (MBR), have shown to enhance sorption and biotransformation of some OMPs. The same applies to technologies bases on direct addition of activated carbon in bioreactors.. The OMP biotransformation degree and pathway is mainly driven by the redox potential and the primary substrate activity. The combination of different redox potentials in hybrid reactor systems can significantly enhance the overall OMP removal efficiency. Sorption and biotransformation can be synergistically promoted in biological reactors by the addition of activated carbon. The deeper knowledge of the main parameters influencing OMP removal provided by this review will allow optimizing the biological processes in the future.

Biomarker

Margaret L. Axelroda,b, Douglas B. Johnsona, Justin M. Balkoa,b,c, a Department of Medicine, Vanderbilt University Medical Center, Nashville, TN, United States b Cancer Biology, Vanderbilt University Medical Center, Nashville, TN, United States c Breast Cancer Research Program, Vanderbilt University Medical Center, Nashville, TN, United States). Emerging biomarkers for cancer immunotherapy in melanoma. Semin Cancer Biol., 52(Pt 2)(2018): 207-215.

The treatment and prognosis of metastatic melanoma has changed substantially since the advent of novel immune checkpoint inhibitors (ICI), agents that enhance the anti-tumor immune response. Despite the success of these agents, clinically actionable biomarkers to aid patient and regimen selection are lacking. Herein, we summarize and review the evidence for candidate biomarkers of response to ICIs in melanoma. Many of these candidates can be examined as parts of a known molecular pathway of immune response, while others are clinical in nature. Due to the ability of ICIs to illicit dramatic and durable responses, well validated biomarkers that can be effectively implemented in the clinic will require strong negative predictive values that do not limit patients with who may benefit from ICI therapy.

Keywords: Melanoma, Biomarker, Checkpoint inhibitor, PD-1, CTLA-4

Celi Pietroa,d,⍰ , Verlhac Vivianeb , Pérez Calvo Estefaniab , Schmeisser Jeromeb , Kluenter Anna-Mariac (a.DSM Nutritional Products, Animal Nutrition and Health, Columbia, 21045, MD, USA ,b. DSM Nutritional Products, Animal Nutrition & Health R & D, Village-Neuf, F-68128, France , c. DSM Nutritional Products, Animal Nutrition and Health, Wurmisweg 576, 4303 Kaiseraugst, Switzerland d Faculty of Veterinary and Agricultural Sciences, The University of Melbourne, Parkville, VIC, 3010, Australia) Biomarkers of gastrointestinal functionality in animal nutrition and health. https://doi.org/10.1016/j.anifeedsci.2018.07.012. In press

Effective gastrointestinal functionality is crucial in determining animal health, welfare and performance. A new definition of gastrointestinal functionality has been recently presented and it has identified the key components that contribute to effective gastrointestinal functionality and health. These components are: diet, effective structure and function of the gastrointestinal barrier, host interaction with the gastrointestinal microbiota, effective digestion and absorption of feed, effective immune status, and neuroendocrine function of the gut. Each of these components are linked to each other by several complex mechanisms and pathways, however, having identified some key components of gastrointestinal functionality offers the opportunity to evaluate potential biomarkers that can allow us to measure the functionality of the gastrointestinal system in farm animals. Numerous and rapidly evolving methodologies are producing an ever-increasing number and types of biomarkers, each with their own distinct advantages and disadvantages. Moreover, differences in models and methodologies make it difficult to extrapolate finding across species and to make meaningful comparisons, even when studies seem quite similar. This review will highlight the intrinsic challenges in choosing what biomarker to measure, where and when to measure it. Because of the complexity of the interactions between the key components of gastrointestinal functionality, we propose that the use of a single biomarker might not be feasible, rather we propose the development of a panel of biomarkers of gastrointestinal functionality that needs to be indicative not only of effective functionality and health of the gastrointestinal tract, but also of animal performance, health and welfare.

Keywords: Gastrointestinal; functionality Biomarkers ; Inflammation; Microbiota ; Nutrition.

lF.E.Watt, Osteoarthritis. (Arthritis Research UK Centre for Osteoarthritis Pathogenesis, Kennedy Institute of Rheumatology, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Oxford, OX3 7FY, United Kingdom. Electronic address: fiona.watt@kennedy.ox.ac.uk). Biomarkers: year in review, volume 26, issue 3, (2018): 312-318

To summarise important findings from biomarker studies relevant to osteoarthritis (OA), published between April 2016 and March 2017; to consider these findings in the context of new discoveries and technologies, and clinical and scientific need in OA.

Studies were selected by PubMed search, conducted between 01/04/2016 and 01/03/2017. MeSH terms [biomarker] AND [OA] were used; the search was restricted to Human, English language and Full Text Available publications, which yielded 50 eligible publications. Any biomarker was considered, including non-proteins and other clinical measurements.

Three main areas are overviewed: 1) Studies examining highly validated biomarkers, in the FNIH OA Biomarkers Consortium and elsewhere, particularly their ongoing application and validation. Control reference intervals, work on predictive validity and other longitudinal studies examining prognostic value of biomarkers in large cohorts are reviewed. 2) Novel studies relating to biomarkers of inflammation are discussed, including complement, the performance of markers of so-called 'cold inflammation' and results from clinical trials including biomarkers. 3) Discovery studies, including whole blood RNA, proteomics and metabolomics are reviewed, with an emphasis on new technologies.

Discovery, characterisation and qualification of various biomarkers is ongoing; several novel protein and non-protein candidate biomarkers have been reported this year. Biomarkers provide us with an opportunity to better diagnose and stratify the disease, via established panels or new discovery approaches. Improving quality of sampling and testing, and measuring large numbers of markers simultaneously in large cohorts would seem likely to identify new clinically applicable biomarkers, which are still much needed in this disease.

Biofertilizer

Chenyu Du a,, Jwan J. Abdullah b, Darren Greetham a, Danni Fu c, Mengyuan Yu c,Liwei Ren c, Shuang Li d, Diannan Lu c, *. (a School of Applied Sciences, The University of Huddersfield, Queensgate, Huddersfield, HD1 3DH, UK b University of Nottingham, School of Biosciences, Sutton Bonington Campus, Loughborough, LE12 5RD, UK c Department of Chemical Engineering, Tsinghua University, 100084, Chinad Guangdong Key Laboratory of Fermentation and Enzyme Engineering, School of Bioscience and Bioengineering, South China University of Technology, Guangzhou 510006, China). Valorization of food waste into biofertiliser and its field application. Journal of Cleaner Production, Vol. 187 (2018): 273e284.**

Worldwide significant amounts of food waste are generated daily causing serious environmental issues, occupying land and requiring expenditure of resources for its treatment. A smart method for handling this food waste problem is the development of novel processes targeting the conversion of this waste into value added products. Although valorization of food waste to biofuels, biochemicals and biopolymers have been widely investigated, the utilization of food

waste streams into biofertiliser has not been intensively reviewed. Conversion of food waste, especially agriculture residues into biofertiliser would reduce its environmental impact, improve nutrition levels of the soil, decrease requirements for synthetic chemical fertiliser and have a direct benefit on food production. This paper reviews recent progress in the field regarding the production of biofertiliser from food waste, using anaerobic digestion, aerobic composting, chemical hydrolysis, in situ degradation and direct burning methods. This review also highlights the latest field applications of biofertiliser derived from various food waste streams. It confirms that the technology for the conversion of food waste to biofertilisers is viable, but the production efficiency could be improved with better process control strategies, strict quality controls, development of a smart product distribution system and adoption of advanced technologies. Field tests have indicated that biofertilisers which are obtained in proper managed AD plants are safe and could partially replace the use of chemical fertilisers in field application..

Keywords: Biofertiliser (biofertilizer) DigestateWasted food, Food processing waste, Agriculture residue.

Nelly Sophie Raymonda, Dorette Müller Stövera, Clément Peltrea, Henrik Hauggaard Nielsenb, Lars Stoumann Jensena, (a Plant and Soil Science Section, Department of Plant and Environmental Sciences, Faculty of Science, University of Copenhagen, Thorvaldsensvej 40, DK-1871 Frederiksberg C, Denmark b Roskilde University, Department of People, Denmark and Technology, Research Group for Environment, Energy, Transport – Regulation, Innovation and Climate Policy (METRIK), Universitetsvej 1, DK-4000 Roskilde) Use of Penicillium bilaiae to improve phosphorus bioavailability of thermally treated sewage sludge –A potential novel type biofertiliser. Process Biochemistry, Vol. 69 (2018): 169–177

This study explored the potential of different phosphorus (P)-rich sewage sludge biochars and ashes to be colonized and be used as a P sources for the phosphate-solubilising fungus, Penicillium bilaiae. P. bilaiae was inoculated on five different biochars and ashes supplemented with nutrient solution. Fungal colonisation, pH and water-extractable P (WEP) in the materials were determined after incubation. P. bilaiae colonised at similar rates on all materials tested, but colonisation was affected by glucose level, pH and total N content in the material. A pH decline, accompanied by an increase in WEP concentration, was observed in three materials. The amount of soluble P was significantly greater at the high glucose level and showed the largest relative increase in incineration ash (> 100-fold after 10 days). The results show a potential to use P-solubilising microorganisms to solubilise P from thermally converted sewage sludge, but the approach has to be further investigated regarding its effects in a soil/plant system.

Keywords: Bioproducts, Penicillium, Biofertiliser, P-solubilisation, Biochar, Colonisation, Sludge.

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Received 7 July 2016, Revised 16 December 2016, Accepted 27 March 2017, Available online 28 March 2017. The role of biogas solutions in sustainable biorefineries. Volume: 172, (2018): 3982-3989.

Biorefineries strive to maximise product mix and value while contributing to the bioeconomy. Circularity and waste valorisation are some important but often neglected concepts in this context. As such, biogassolutions in biorefineries could be a key technology to improve sustainability. This study has, through a literature review and investigation into three Swedish case studies, analysed this relationship between biogas solutions and biorefineries by assessing the added value and development potential to which biogas solutions may contribute. This analysis across agricultural, forest, and marine sectors indicates that biogas solutions contribute with several added values, including through making the biorefinery more sustainable and competitive. The study also shows that biogas solutions can be an enabler of biorefinery development through making the system more resilient and versatile, as well as through improving the value of the product portfolio.

Keywords: Biorefinery; Biogas; Bioeconomy; Valorisation; Anaerobic digestion; Waste management.

ThierryStadler[a], Jean-MarieChauvet[b]. (IAR The French Bioeconomy Cluster, 50-52 bd Brossolette, 02 930 Laon France Open Innovation Platform BRI, Pomacle France). **New innovative ecosystems in France to develop the Bioeconomy, Volume :40, Part A, (2018): 113-118.**

The cluster's policy initiated in France in 2005 was a formidable opportunity to boost innovation in the bioeconomy and to develop innovation platforms allowing industrial demonstration and feasibility at technology readiness level (TRL) from 5 to 9. The IAR Cluster (Industries and Agro-Resources), based in the Hauts-de-France and Grand Est regions is completely dedicated to the bioeconomy. IAR's work has contributed to build a complete innovation ecosystem on bioeconomy by opening up relationships between actors along the full value chain. It also facilitated investments in new platforms and programs through public-private partnerships. The Biorefinery of Pomacle is a good illustration of such a collective approach. The role of regional and national public partners is essential to succeed in this development which requires a long term strategy and support.

Keywords: Bioeconomy; Innovation ecosystem; Biorefinery; Industrial biotechnology; Open innovation platform; Industrial ecology.

QianWang[ab], Barry C.Kelly[a]. (a.Department of Civil and Environmental Engineering, National University of Singapore, Singapore, b. College of Marine Ecology and Environment, Shanghai Ocean University, China) **Assessing bioaccumulation behaviour of**

hydrophobic organic contaminants in a tropical urban catchment, Volume : 358, 15(2018): 366-375

The bioaccumulation behaviour of halogenated flame retardant (HFRs), synthetic musks (SMs), organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs) in plankton, invertebrates and fish was assessed in an urban catchment in Singapore which is a tropical island country highly populated. The studied contaminants ranged widely in physical-chemical properties, with K_{OW} values ranging between approximately 10^3–10^{11}. BDE-47 and dechlorane plus (DPs) were the predominant HFRs, while galaxolide (HHCB) and tonalide (AHTN) were the predominant synthetic musk compounds in biota from the studied freshwater system. Concentrations of organochlorine contaminants such as chlordanes, DDE, DDD, PCB 138 and PCB 153 were generally higher than those of the HFRs and SMs. On a wet weight basis, bioaccumulation factors (BAFs) of the current use HFRs were in some cases higher than the bioaccumulation criteria value of 5000 L/kg wet weight. Conversely, BAFs of SMs were found to be less than the 5000 L/kg guideline. Lipid adjusted BAFs (L/kg lipid) of the studied contaminants varied among the different aquatic species, which is likely due to organism trophic level and metabolic transformation capacity differences. BAFs were highly correlated with the chemical K_{OW} values. For fish, log BAFs of the studied contaminants increased with increasing log K_{OW}, between a log K_{OW} range of approximately 3–7, after which BAFs subsequently decreased. A similar relationship was observed for BAFs in the studied invertebrates. For plankton, a simple linear regression was observed between log BAF and log K_{OW} over the target analyte K_{OW} range (log K_{OW}'s between 3–11). Predicted BAF values derived from a mechanistic bioaccumulation model for hydrophobic organic contaminants were generally consistent with the observed BAFs. However, in some cases the model substantially overestimated bioaccumulation potential based on the chemical's hydrophobicity, which may be due to a high degree of biotransformation of those compounds. The study provides important information regarding bioaccumulation potential of several emerging organic contaminants of concern.

Keywords: HFRs; PPCPs; Legacy POPs; Bioaccumulation; Tropical urban catchment

Lena I.Fuldauer[ad], Brenda M.Parker[b], RokiahYaman[c], AiduanBorrion[d] (a. University of Oxford, School of Geography and the Environment, Oxford, OX1 3QY, UK, b. University College London, Department of Biochemical Engineering, London, WC1H 0AH, UK, c. Community By Design, London, BR1 5EL, UK, d. University College London, Department of Civil, Environmental and Geomatic Engineering, London, WC1E 6BT, UK)**Managing anaerobic digestate from food waste in the urban environment: Evaluating the feasibility from an interdisciplinary perspective, Volume: 185, 1 (2018): 929-940**

Anaerobic digestion of food waste within urban areas can generate decentralised renewable energy and support community enterprise activities, thereby contributing to closing the waste-energy-food loop. However, widespread uptake of small-scale, urban anaerobic digestion networks is limited by economic costs and the safe disposal of surplus digestate. This paper uses an interdisciplinary approach to assess the feasibility of anaerobic digestate management through

the installation of hydroponics or algae cultivation systems, based on a case study of a micro anaerobic digestion system in London, England. Results show that installing a dewatering sifter together with a hydroponics system is a technically and economically feasible option for digestate enhancement in the urban environment. Its installation is, however, not currently justified for the system under consideration due to cost, regulatory, spatial, and contextual constraints identified using actor-network analysis. Nevertheless, if regulatory and wider contextual issues are accommodated, and more than 30 L of digestate are produced daily, a dewatering and vertical hydroponic system could result in a profit of approximately £100,000 over 10 years. While the microalgal system was also able to upgrade digestate, at present productivity is too low and the capital cost of photobioreactor technology is prohibitively expensive. This underlines the need for technical improvements and low-cost enhancement options to achieve justifiable paybacks until regulatory reforms and the wider economic situation are more favourable to anaerobic digestion treatment within cities.

Biocomposting

Helen Pourmazaheri a, b, Gholamreza Salehi Jouzani a, *, Ebrahim Karimi a, Seyed Mojtaba Khayam Nekouei a, Meisam Tabatabaei a, b, Reza Maali Amiri (a. Microbial Biotechnology and Biosafety Department, Agricultural Biotechnology Research Institute of Iran (ABRII), Karaj, Iran,b. Biofuel Research Team (BRTeam), Karaj, Iran, c. Department of Agronomy and Plant Breeding, College of Agriculture and Natural Resources, University of Tehran, Iran) Development of a bioprocess for fast production of enriched biocompost from municipal solid wastes,volume: International Biodeterioration & Biodegradation 104 (2015): 482e489.

The objective of the present study was to develop a bioprocess for fast production of enriched biocompost from municipal solid wastes using a native microbial cocktail and cheap lignocellulosic biomass i.e. wood chips. The open-windrow composting experiments included (1) only municipal solid waste (C),(2) municipal solid waste þ wood chips at 3:1 ratio (CW), and (3) municipal solid waste þ wood chips þ a microbial cocktail (108 cells/kg), containing 11 native mesophilic and thermophilic bacterial strains (CWM).The microbial cocktail led to the fastest rise in the starting temperature (up to 73 _C after two weeks) and maximum carbon/nitrogen ratio decrease (40%) and organic matter reduction in the CWM compost. The CWM compost contained the minimum concentrations of the heavy and trace elements (i.e. zinc, copper, manganese, lead, nickel, chromium and cadmium) as well as Salmonella sp. And E. coli populations, whereas the control (C) contained the maximum contents of the heavy metals and human pathogens. . The maximum and minimum germination of the garden cress seeds were observed for the CWM (97.5%) and the control (73.3%) composts, respectively. Moreover, in comparison with the control, 60e70% increase was achieved in growth parameters i.e. wheat dry weight, wet weight, stem height and root long when 10% CWM compost was used.

Keywords: Biocompost; Microorganisms; Municipal solid waste; Wheat; Wood chips

Ayumi Shikataa, Junjarus Sermsathanaswadib, Phakhinee Thianhengc, Sirilak Barameed,Chakrit Tachaapaikoond, Rattiya Waeonukuld, Patthra Pasond, Khanok Ratanakhanokchaic, Akihiko Kosugia,e,(a. Graduate School of Life and Environmental Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8572, Japan, b. Department of Chemical Technology, Faculty of Science and Technology, Suan Dusit University, 295 Nakhon Ratchasima Road, Dusit, Bangkok, 10300, Thailand, c. Enzyme Technology Laboratory, School of Bioresources and Technology, King Mongkut's University of Technology Thonburi (KMUTT), Bangkok, 10150, Thailand, d. Pilot Plant Development and Training Institute (PDTI), King Mongkut's University of Technology Thonburi (KMUTT), Bangkok, 10150, Thailand, e. Biological Resources and Post-harvest Division, Japan International Research Center for Agricultural Sciences (JIRCAS), 1-1 Ohwashi, Tsukuba, Ibaraki 305-8686, Japan) **Characterization of an Anaerobic, Thermophilic, Alkaliphilic, High Lignocellulosic Biomass-Degrading Bacterial Community, ISHI-3, Isolated from Biocompost, volume: Enzyme and Microbial Technology 118 (2018) : 66–75**

The generation of a complex microbial consortium is a promising approach for efficient biomass decomposition. An anaerobic thermophilic alkaliphilic microbial consortium with efficient degradation ability was screened from bovine manure compost using non-pretreated milling corn stover (CS) and rice straw (RS). A stable microbial consortium ISHI-3 with high degradation ability for CS and RS was isolated by the roll tube technique. ISHI-3 comprised Herbivorax saccincola and bacteria belonging to the classes Pelotomaculum, Tepidanaerobacter,and Tepidimicrobium, as determined by DGGE of the PCR-generated 16S rRNA genes. Furthermore, metagenomics
analysis using a 16S rRNA library was carried out to determine the bacterial distribution during degradation of CS and RS. H. saccincola and bacteria belonging to Pelotomaculum were relatively abundant in the
beginning to middle periods of culture with CS and RS whereas bacteria belonging to Tepidanaerobacter andTepidimicrobium gradually increased in the population during the later stages. To understand the role of noncellulolytic bacteria in the consortium, novel strains ET1 and GL4, which were most closely related to Tepidimicrobium ferriphilum and Tepidanaerobacter acetatoxydans, were isolated from ISHI-3. Based on their carbon source usage, morphology, and phylogenetic analysis, we propose that strains ET1 and GL4 should be classified as a novel genus or species. Bacteria ET1 and GL4 can utilize different organic compounds as carbon and energy sources such as organic acids, alcohols, sugars, and amino acids, showing a preference for organic
acids and alcohols rather than sugars such as glucose and cellobiose. These results indicated that ET1 and GL4 help to accelerate efficient lignocellulose degradation of H. saccincola.

Keywords: Lignocellulose; microbial consortium; Herbivorax saccincola; biodegradation; corn stover; rice straw.

Pankaj Chowdhary[a], Abhay Raj[b], Ram Naresh Bharagava[a]. (a. Laboratory for Bioremediation and Metagenomics Research (LBMR), Department of Environmental Microbiology (DEM), Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Raebareli Road, Lucknow, 226 025, Uttar Pradesh, India, b. Environmental Microbiology Section, CSIR-Indian Institute of Toxicology Research (CSIR-IITR), Post Box 80, M.G. Marg, Lucknow, 226 001, Uttar Pradesh, India). **Environmental pollution and health hazards from distillery wastewater and treatment approaches to combat the environmental threats, Volume: 194 (2018): 229-246.**

Distillery industries are the key contributor to the world's economy, but these are also one of the major sources of environmental pollution due to the discharge of a huge volume of dark colored wastewater. This dark colored wastewater contains very high biological oxygen demand, chemical oxygen demand, total solids, sulfate, phosphate, phenolics and various toxic metals. Distillery wastewater also contains a mixture of organic and inorganic pollutants such as melanoidins, di-n-octyl phthalate, di-butyl phthalate, benzenepropanoic acid and 2-hydroxysocaproic acid and toxic metals, which are well reported as genotoxic, carcinogenic, mutagenic and endocrine disrupting in nature. In aquatic resources, it causes serious environmental problems by reducing the penetration power of sunlight, photosynthetic activities and dissolved oxygen content. On other hand, in agricultural land, it causes inhibition of seed germination and depletion of vegetation by reducing the soil alkalinity and manganeseavailability, if discharged without adequate treatment. Thus, this review article provides a comprehensive knowledge on the distillery wastewater pollutants, various techniques used for their analysis as well as its toxicological effects on environments, human and animal health. In addition, various physico-chemicals, biological as well as emerging treatment methods have been also discussed for the protection of environment, human and animal health.

Keywords: Melanoidins; Chemical pollutants; EDCs; Environmental problems; Health hazards; Treatment approaches

Nazneen Hussain, Subhasish Das, Linee Goswami, Pallabi Das, Banashree Sahariah, Satya Sundar Bhattacharya. (Soil and Agro Bio-engineering Lab, Department of Environmental Science, Tezpur University, Tezpur, 784 028, India) **Intensification of vermitechnology for kitchen vegetable waste and paddy straw employing earthworm consortium: Assessment of maturity time, microbial community structure, and economic benefit, Volume, 182 (2018): 414-426**

Vermicomposting is usually performed with one earthworm species. However, use of a consortium of two or more species (*Eisenia fetida*, *Eudrilus eugeniae*, and *Perionyx excavatus*) is rare. Research on optimization of vermicomposting duration is also insufficient. Three earthworm species in various combinations were fed with cowdung mixed biowaste feedstock. Organic C, C/N ratio, compost respiration, coliform count, toxic metals, and alkalinity reduced

at maturity; whereas, earthworm biomass, NPK availability, enzyme activity, microbial growth, and humic substances remarkably improved under consortium systems. Thus, the harvest quality was optimized sooner under vermicomposting (40–60 days) than composting (>100 days). Phospho-lipid fatty-acid (PLFA) analyses revealed the enriched variations in microbial communitystructure and fatty-acid profiles in consortium treated vermicomposts. Overall, the *Eisenia+Eudrilus+Perionyx* consortium produced the best quality compost in the shortest duration (40–50 days) followed by *Eisenia+Eudrilus* and *Eisenia + Perionyx*consortia .Tomato seed germination and root-shoot vigors were significantly greater in consortia mediated systems. Moreover, economic assessment confirmed the advantage of consortium mediated vermitechnology.

Biopesticides

Noor HafizahRamli[a], SuzanaYusup[a], Benjamin Wei BinKueh[a], Puteri Sarah Diba Kamarulzaman [a]Noridah Osman [a]MardyahwatiAbd.Rahim[b] Ramlan Aziz[b] SulaimanMokhtar[c]Abu BakarAhmad[c]. (a.Chemical Engineering Department, Biomass Cluster Centre of Biofuel and Biochemical Research, Institute of Sustainable Living, Universiti Teknologi PETRONAS, 32610 Seri Iskandar, Perak Darul Ridzuan, Malaysia, b. Plant Biosecurity Unit, Department of Agriculture of Perak Tengah, Simpang 3, 34200 Parit Buntar, Perak Darul Ridzuan, Malaysia, c. Bio-X Techno Sdn. Bhd., LK1-1-3A, Blok LK1, Laman Komersil ARECA, Putra Nilai, 71800 Nilai, Negeri Sembilan Darul Khusus, Malaysia). **Effectiveness of biopesticides against brown planthopper (*Nilaparvata lugens*) in paddy cultivation, Volume: 8(2018): 16-20.**

The brown planthopper (BPH) causes serious damage to rice by sucking rice sap, ovipositing in rice tissues, and transmitting a number of rice diseases during its long-distance migration that severely affect the productivity of paddy. Thus, the aim of this study is to investigate the effectiveness of biopesticides against BPH population. BV500WS is used at the early stage of paddy cultivation for growth enhancement meanwhile BV612EC is used a week after the liberation of BPH for crop protection. Three conditions were adopted as follows which are T1 where the paddy was sprayed using BV500WS and BV612EC to study the effectiveness of both types of biopesticides, T2 where the paddy was sprayed using BV500WS only and C1 where the paddy was cultivated without any pesticide application as control. BPH was released twice on day 46 and 59 of paddy cultivation. Reduction of BPH population with up to 100% mortality rate was observed with the application of two types of biopesticides at T1 resulting in the highest number of remaining tillers with 68.56%. Although severely affected by BPH, T2 was able to has comparable number of remaining tillers as C1 which was 46.24% and 49.65% respectively. These results showed that two types of biopesticides were more effective in reducing BPH compared to one type of biopesticide.

Keywords: Biopesticides; rown planthopper; Yield; Paddy cultivation.

Puteri Sarah Diba Kamarulzaman[a], SuzanaYusup[a], Noridah Osman[a], Noor HafizahRamli@Yusof[a]Benjamin Wei BinKueh[a], RaudahTalib[b](a. Biomass Processing Laboratory, Center of Biofuel and Biochemical Research, Mission Oriented Research (Green Technology), Chemical Engineering Department, Universiti Teknologi PETRONAS, 32610 Bandar Seri Iskandar, Perak, Malaysia, b. Agriculture Department of Perak Tengah, 32600 Bota, Perak, Malaysia) **Effectiveness of neem based biopesticide to enhance rice (*Oryza sativa*) productivity, Volume: 7(2018): 36-40**

Rice contributes towards food security and consumed widely by about 2 billion people in Asia. Losses because of pest and diseases are considered as the main constraints in rice production. Wide ranges of methods have been applied to control pests however conventional pesticide is the most widely practice. Biopesticide which is more environmental friendly can be the alternative for paddy cultivations. Bioactive secondary metaboliteazadirachtin compound which is present in neem (*Azadirachta indica*) could be used to produce effective biopesticide that possesses insecticidal properties. The effectiveness of the biopesticide derived from neem is assessed with its application on the actual paddy fieldand compared with conventional pesticide with niclosamide as its active ingredient. The paddy yield component and paddy yield were recorded and the traits associations are determined using statistical analysis. Descriptive data of biopesticide for range, mean and standard deviation of yield components such as number of panicle per m^2 (368.8 ± 11.4), panicle length (25.3 ± 0.19), percentage of productive spikelets per panicle (80.8 ± 1.13), 1000 grains weight (27.7 ± 0.10) and grains yield per m^2 (1151.3 ± 46.8) were notably higher than conventional pesticide. Biopesticide showed higher rice yield components at 5% level of significance as indicated by *t-test* analysis. Based on the results, the productivity of rice yield after application of biopesticide was verified to be positive interdependent with the components studied. Higher grain yield is obtained for biopesticide with higher positive association among the grain yield and yield components which offered an alternative for healthier rice cultivation.

Keywords: Biopesticide; Neem; Rice; Yield; Correlation

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Pseudomonas chlororaphis isolates are being used in agriculture as biopesticides because they provide plant protection against an array of microbial pathogens, insects and nematodes. These isolates directly control microbial pathogens, insects, and nematodes through the production of an array of metabolites. This review describes the structures, synthesis and function of the metabolites from *P. chlororaphis* isolates with biopesticide potential in the rhizosphere. Understanding the mechanisms involved in the efficacy of these metabolites will promote the

use of these chemicals as well as the microbes that synthesize these products, in formulations for agricultural practices aiming towards sustainability of soils as well as the quality and quantity of the crop.

Keywords: Antimicrobials; Biopesticide; Iron; Phenolics; Plant probiotic

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Agriculture system is one of the prerequisites to sustain human life on the planet earth and has been constantly tested in terms of yield. Crop losses due to pest attack as well as excessive use of chemical pesticides are major concerns for humanity and environmental protection. Traditional strategies like Integrated Pest Management (IPM) used in agriculture are insufficient and application of chemical pesticides like DDT has adverse effects on animals and human beings besides causing a decline in soil fertility. Biopesticides represent a novel opportunity in this area and offer several advantages over traditional chemical pesticides. They are safer compared to conventional pesticides and are more amenable to achieve targeted activity against a desired pest. Biopesticides are often effective in potent quantities thereby ensuring lower exposure. Furthermore, they decompose more rapidly, offer potentially higher crop yields, and can limit the use of conventional pesticides. However, their inability to tolerate environmental conditions like temperature, moisture, and sunlight presents a challenge to improve their performance. In addition, conventional processes in the crop protection industry such as microencapsulation and high temperature spray drying are not viable methods for processing certain microbial pesticides. Another desirable feature of pesticides is to provide sustained efficacy and reduce the number of applications to manage costs. This could be accomplished using nanotechnology which offers green and efficient alternatives for the management of pests in agriculture without being harmful to nature. By virtue of unique nature of nanostructures, their implementation in 'Agri-biotechnology' is highly predicted. Hence, conventional pest management strategies are now gradually being replaced owing to the potential of nanotechnology as an effective and viable approach to alleviate problems pertaining to pest control. The proposed chapter focuses on the growing applications of nanoengineered systems to achieve pest control with special emphasis on the use of biopesticides.

Keywords: Biopesticide; pest control; nanotechnology; DDT; integrated pest management.

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Shmona 11016, Israel, d. Department of Biosciences, University of Milano, via G Celoria 26, Milan 20133, Italy). Microbial and viral chitinases: Attractive biopesticides for integrated pest management, Biotechnol Adv. Vol. 36(3): 818 – 838.

The negative impact of the massive use of synthetic pesticides on the environment and on human health has stimulated the search for environment-friendly practices for controlling plant diseases and pests. Among them, biocontrol, which relies on using beneficial organisms or their products (bioactive molecules and/or hydrolytic enzymes), holds the greatest promise and is considered a pillar of integrated pest management. Chitinases are particularly attractive to this purpose since they have fungicidal, insecticidal, and nematicidal activities. Here, current knowledge on the biopesticidal action of microbial and viral chitinases is reviewed, together with a critical analysis of their future development as biopesticides.

Keywords: Chitinase; Chitin; Biological control; Biopesticide; Integrated pest management; Fungicide; Nematicide; Insecticide; Protein production; Metagenomics

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The overuse of synthetic pesticides to control insect pests leads to physiological resistance and adverse environmental effects, in addition to high operational cost. Insecticides of botanical origin have been reported as useful for control of agricultural and public health insect pests. This research proposed a novel method of mangrove-mediated synthesis of insecticidal silver nanoparticles (AgNP) using *Suaeda maritima,* acting as a reducing and stabilizing agent. AgNP were characterized by UV–vis spectroscopy, Fourier transform infrared (FTIR) spectroscopy, scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), and X-ray diffraction (XRD) analysis. *S. maritima* aqueous extract and mangrove-synthesized AgNP showed larvicidal and pupicidal toxicity against the dengue vector *Aedes aegypti* and the tobacco cutworm *Spodoptera litura*. In particular, LC_{50} of AgNP

ranged from 8.668 (larva I) to 17.975 ppm (pupa) for *A. aegypti*, and from 20.937 (larva I) to 46.896 ppm (pupa) for *S. litura*. In the field, the application of *S. maritima* extract and AgNP ($10 \times LC_{50}$) led to 100% mosquito larval reduction after 72 h. Smoke toxicity experiments conducted on *A. aegypti* adults showed that *S. maritima* leaf-, stem- and root-based coils evoked mortality rates comparable or higher if compared to permethrin-based positive control (62%, 52%, 42%, and 50.2 respectively). In ovicidal experiments, e*gg*hatchability was reduced by 100% after treatment with 20 ppm of AgNP and 250 ppm of *S. maritima* extract. Furthermore, low doses of the AgNP inhibited the growth of *Bacillus subtilis*, Klebsiella pneumoniae and *Salmonella typhi*. Overall, our results highlighted the potential of *S. maritima*-based herbal coils and green nanoparticles as biopesticides in the fight against the dengue vector *A. aegypti* and the tobacco cutworm *S. litura.*

Biodegradation

Miriam Ahuactzin-P erez, Saúl Tl, ecuitl-Beristain, Jorge García-D, avila, Ericka Santacruz-Ju, arez, Manuel Gonz, alez-P, erez, María Concepci, on Guti, Carmen S, anchez, errez-Ruíz.(a. Laboratory of Biotechnology, Research Centre for Biological Sciences, Universidad Autonoma de Tlaxcala, Ixtacuixtla, Tlaxcala, CP 90062, Mexico; b. Departamento de Ciencias de la Salud, Universidad Autonoma Metropolitana-Iztapalapa, CDMX, Mexico; c. Doctorado en Biología Experimental, Universidad Autonoma Metropolitana-Iztapalapa (UAM-I), Mexico; d. Facultad de Agrobiología, Universidad Autonoma de Tlaxcala, Ixtacuixtla, Tlaxcala, Mexico; e. Universidad Politecnica de Tlaxcala, San Pedro Xalcatzinco, Tepeyanco, Tlaxcala, CP 90180, Mexico; f. Universidad Popular Autonoma del Estado de Puebla, Puebla, CP 72410, Mexico) Kinetics and pathway of biodegradation of dibutyl phthalate by Pleurotus ostreatus. Fungal Biology, Volume 122 (2018) 991e997.

Dibutyl phthalate (DBP) is a plasticizer, whose presence in the environment as a pollutant has attained a great deal of attention due to its reported association with endocrine system disturbances on animals. Growth parameters, glucose uptake, percentage of removal efficiency (%E) of DBP, biodegradation constant of DBP (k) and half-life of DBP biodegradation (t 1/2) were evaluated for Pleurotus ostreatus grown on media containing glucose and different concentrations of DBP (0, 500 and 1000 mg l1/2). P. Ostreatus degraded 99.6 % and 94 % of 500 and 1000 mg of DBP l_1after 312 h and 504 h, respectively. The k was 0.0155 h _1 and 0.0043 h _1 for 500 and 1000 mg of DBP l _1 , respectively. T was 44.7 h and 161 h for 500 and 1000 mg of DBP l _1 1/2, respectively. Intermediate compounds of biodegraded DBP were identified by GC-MS and a DBP biodegradation pathway was proposed using quantum chemical calculation. DBP might be metabolized to benzene and acetyl acetate, the first would be oxidated to muconic acid and the latter would enter into the Krebs cycle. P. ostreatus has the ability to degrade DBP and utilizes it as source of carbon and energy.

Keywords: Basidiomycete; Biodegradation pathway; Constant of biodegradation; Plasticizer; Removal efficiency.

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The widespread existence of hydrophobic organic compounds (HOCs) in soil and water poses a potential health hazard to human, such as skin diseases, heart diseases, carcinogenesis, etc. Surfactant-enhanced bioremediation has been regarded as one of the most viable technologies to treat HOCs contaminated soil and groundwater. As a biosurfactant that has been intensively studied, rhamnolipids have shown to enhance biodegradation of HOCs in the environment, however, the underlying mechanisms are not fully disclosed. In this paper, properties and production of rhamnolipids are summarized. Then effects of rhamnolipids on the biodegradation of HOCs, including solubilization, altering cell affinity to HOCs, and facilitating microbial uptake are reviewed in detail. Special attention is paid to how rhamnolipids change the bioavailability of HOCs, which are crucial for understanding the mechanism of rhamnolipids-mediated biodegradation. The biodegradation and toxicity of rhamnolipids are also discussed. Finally, perspectives and future research directions are proposed. This review adds insight to rhamnolipids-enhanced biodegradation process, and helps in application of rhamnolipids in bioremediation.

Keywords: Rhamnolipids; Hydrophobic organic compounds; Microorganism; Biodegradation; Bioremediation.

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Anoxic mineralization of BTEX represents a promising alternative for their abatement from O_2-deprived emissions. However, the kinetics of anoxic BTEX biodegradation and the interactions

underlying the treatment of BTEX mixtures are still unknown. An activated sludge inoculum was used for the anoxic abatement of single, dual and quaternary BTEX mixtures, being acclimated prior performing the biodegradation kinetic tests. The Monod model and a Modified Gompertz model were then used for the estimation of the biodegradation kinetic parameters. Results showed that both toluene and ethylbenzene are readily biodegradable under anoxic conditions, whereas the accumulation of toxic metabolites resulted in partial xylene and benzene degradation when present both as single components or in mixtures. Moreover, the supplementation of an additional pollutant always resulted in an inhibitory competition, with xylene inducing the highest degree of inhibition. The Modified Gompertz model provided an accurate fitting for the experimental data for single and dual substrate experiments, satisfactorily representing the antagonistic pollutant interactions. Finally, microbial analysis suggested that the degradation of the most biodegradable compounds required a lower microbial specialization and diversity, while the presence of the recalcitrant compounds resulted in the selection of a specific group of microorganisms.

Keywords: Anoxic denitrification; Biodegradation kinetics; BTEX biodegradation; Mathematical modelling.

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This work focused on the biodegradation of three structurally related fluoroacetates (FAs), mono- (MFA), di- (DFA) and trifluoroacetate (TFA), using as microbial inocula samples collected from a site with a long history of industrial contamination and activated sludgeobtained from a municipal wastewater treatment plant. Biodegradation experiments were carried out under different modes of substrate supplementation, which included (i) FAs fed as sole carbon sources; (ii) FAs (only for DFA and TFA) fed in co-metabolism with sodiumacetate; and (iii) mixtures of MFA with DFA or TFA. Biodegradation of the target compounds was assessed through fluoride ion release. Defluorination was obtained in the cultures fed with MFA, while DFA and TFA were recalcitrant in all tested conditions. When present in mixture, DFA was shown to inhibit biodegradation of MFA, while TFA had no effect. A total of 13 bacterial isolates obtained from MFA degrading cultures were found to degrade 20 $mgL^{-1}$of this

compound, as single strains, when supplemented as a sole carbon source. Sequencing of the 16S rRNA gene indicated that among these degrading bacteria only *Delftia acidovorans* had been previously reported to be able to degrade MFA. This work shows that, despite their similar chemical structures, biodegradation of the three tested FAs is very distinct and draws attention to the unknown impacts that the accumulation of DFA and TFA may have in the environment as a result of their high recalcitrance.

Biosensor

Ahmed Salim, Sungjoon Lim(School of Electrical and Electronics Engineering, College of Engineering, Chung-Ang University, 221, Heukseok-Dong, Dongjak-Gu, Seoul 156-756, Republic of Korea). Recent advances in the metamaterial-inspired biosensors. Biosensors and Bioelectronics 117 (2018): 398–402

Metamaterials (MM)-inspired microwave biosensors are a valuable addition to the field of diagnostic approaches and prognostic tools. The fundamental principle behind these biosensors is unique dielectric signatures corresponding to healthy/diseased tissues. Relying on nonionizing radiation and offering an increased resolution with accuracy comparable to that of ultrasound devices, they are an attractive solution for noninvasive and label-free biosensing applications. High-quality-factor MM-inspired resonators are integrated with microfluidics to accelerate the lab-on-chip and point-of-care diagnostic approaches owing to the small detection volume and overall compact size of these devices. A variety of biomolecular detection, glucose detection and hyperthermia treatment using state-of-the-art MM-inspired biosensors have been discussed. Optical transduction techniques (e.g., surface plasmon resonance) which enhance the sensitivity in terms of limit-of-detection and resolution, have also been outlined. Utilization of microwave biosensors as therapeutic agents is at its initial stages owing to lack of required sensitivity and reliability in recently proposed MM-inspired biosensors.

Keywords: Metamaterials, Microwave, Biosensor, Terahertz, Dielectric, Plasmon

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In the present study, we have developed a smartphone based handheld optical biosensor for determina-tion of urea in saliva. A simple strategy was adopted by immobilization of urease enzyme along with a pHindicator on a filter paper based strip. The strip changed color upon the reaction with urea present in salivaand the color change can be estimated using our smartphone

based application based on RGB profiling.Calibration of the biosensor was carried out using spiked saliva samples and an exponentially decreas-ing calibration curve has been obtained for green pixel intensity in the broad range (10–1000 mgdL−1)with a linear detection range of 10–260 mgdL−1and a response time of 20 s. The sensitivity reportedfor the biosensor in the clinically significant range was −0.005 average pixels sec−1/mgdL−1with a LODof 10.4 mgdL−1. Studies carried out on spiked saliva samples showed a good correlation between sali-vary urea estimated using our biosensor against phenol-hypochlorite based spectroscopic procedure.Development of a smartphone based biosensor for urea estimation eliminates the need for procuring adedicated instrument as well as trained technician for daily monitoring and saves time as compared totraditional laboratory methods of analysis.

Keywords: Smartphone based biosensor, Non-invasive biosensor, Salivary urea, Optical biosensor.

Abdulazeez T.Lawal. (Department of Chemical Sciences, Fountain University Osogbo, Nigeria). Progress in utilisation of graphene for electrochemical biosensors. Biosensors and Bioelectronics, Volume: 106, (2018): 149-178.

This review discusses recent graphene (GR) electrochemical biosensor for accurate detection of biomolecules, including glucose, hydrogen peroxide, dopamine, ascorbic acid, uric acid, nicotinamide adenine dinucleotide, DNA, metals and immunosensor through effective immobilization of enzymes, including glucose oxidase, horseradish peroxidase, and haemoglobin. GR-based biosensors exhibited remarkable performance with high sensitivities, wide linear detection ranges, low detection limits, and long-term stabilities. Future challenges for the field include miniaturising biosensors and simplifying mass production are discussed.

Keywords: Biosensor; Electrochemical; Graphene; Metals; Pesticides, immunosensor.

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Point-of-care testing technique is increasingly important for healthcare management in human being's daily life. However, traditional biosensor systems for health care are relatively expensive, bulky and hard-to-handle, which largely limits their use in point of care testing. The problems mentioned above are successfully addressed with the popularization of smartphone and the development of microfluidic technology for their applications of biosensor, which integrates

smartphones, microfluidic components and sensory elements together, paving the way for wide application of smartphone-based microfluidic biomedical sensory system. According to the varieties of analytes, the most common sensing modalities of biosensor systems are divided into imaging analysis to detect cells and bacteria, biochemical analysis to detect blood sugar and blood fat, immunoassay to detect protein specifically bound to antibody, as well as molecular diagnosis to detect DNA and other biomolecules. Based on the most common analytical methods, this review article covers five types of smartphone-based microfluidic biosensor systems at the point-of-care detection, i.e., smartphone-based imaging biosensor, smartphone-based biochemical sensor, smartphone-based immune biosensor, smartphone-based hybrid biosensor with more than one sensing modality, and smartphone-based molecular sensor. We lay emphasis on reviewing the structures, analytical methods and sensing modalities about the four kinds of biosensor systems with detailed discussions on their application potentials, aiming at giving the audience an overview of the recent developments of automatic smartphone-based microfluidic biosensor systems, as well as their future prospective.

Bioengineering

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The generation of bioengineered biliary tissue could contribute to the management of some of the most impactful cholangiopathies associated with liver transplantation, such as biliary atresia or ischemic cholangiopathy. Recent advances in tissue engineering and in vitro cholangiocyte culture have made the achievement of this goal possible. Here we provide an overview of these developments and review the progress towards the generation and transplantation of bioengineered bile ducts. This article is part of a Special Issue entitled: Cholangiocytes in Health and Diseaseedited by Jesus Banales, Marco Marzioni and Peter Jansen.

Keywords: Bile duct; Tissue engineering; Bioengineering; Cholangiopathy.

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Pereyaslavskaya Str. 23, 61015 Kharkiv, Ukraine). Towards biobanking technologies for natural and bioengineered multicellular placental constructs. Biomaterials, Volume 185 (2018): 39–50.

Clinical application of a large variety of biomaterials is limited by the imperfections in storage technology. Perspective approaches utilizing low-temperature storage are especially challenging for multicellular structures, such as tissues, organs, and bioengineered constructs. Placenta, as a temporary organ, is a widely availableunique biological material, being among the most promising sources of various cells and tissues for clinical and experimental use in regenerative medicine and tissue engineering. The aim of this study was to analyse the mechanisms of cryoinjuries in different placental tissues and bioengineered constructs as well as to support the viability after low temperature storage, which would contribute to development of effcient biobanking technologies. This study shows that specificity of cryodamage depends on the structure of the studied object, intercellular bonds, as well as interaction of its components with cryoprotective agents. Remarkably, it was possible to effciently isolate cells after thawing from all of the studied tissues. While the outcome was lower in comparison to the native non-frozen samples, the phenotype and expression levels of pluripotency genes remained unaffected. Further progress in eliminating of recrystallization processes during thawing would significantly improve biobanking technologies for multicellular constructs and tissues.

Keywords: Placental tissues; Amniotic membrane; Alginate microspheres, Bioengineered constructs; Multipotent stromal cells; Biobanking.

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The generation of bioengineered biliary tissue could contribute to the management of some of the most impactful cholangiopathies associated with liver transplantation, such as biliary atresia or ischemic cholangiopathy. Recent advances in tissue engineering and *in vitro*cholangiocyte culture have made the achievement of this goal possible. Here we provide an

overview of these developments and review the progress towards the generation and transplantation of bioengineered bile ducts. This article is part of a Special Issue entitled: Cholangiocytes in Health and Diseaseedited by Jesus Banales, Marco Marzioni and Peter Jansen.

Keywords: Bile duct; Tissue engineering; Bioengineering; Cholangiopathy.

RamonFarré[abc], JordiOtero[ab], IsaacAlmendros[abc], DanielNavajas[abd] (a. Unitat Biofísica i Bioenginyeria, Facultat de Medicina i Ciències de la Salut, Universitat de Barcelona, Barcelona, Spain, b. CIBER de Enfermedades Respiratorias, Madrid, Spain, c. Institut Investigacions Biomèdiques August Pi Sunyer, Barcelona, Spain, d. Institut de Bioenginyeria de Catalunya, The Barcelona Institute of Science and Technology, Barcelona, Spain) **Bioengineered Lungs: A Challenge and An Opportunity. Arch Bronconeumol. Volume: 54, Issue 1(2018): 31-38.**

Lung biofabrication is a new tissue engineering and regenerative development aimed at providing organs for potential use in transplantation. Lung biofabrication is based on seeding cells into an acellular organ scaffold and on culturing them in an especial purpose bioreactor. The acellular lung scaffold is obtained by decellularizing a non-transplantable donor lung by means of conventional procedures based on application of physical, enzymatic and detergent agents. To avoid immune recipient's rejection of the transplanted bioengineered lung, autologous bone marrow/adipose tissue-derived mesenchymal stem cells, lung progenitor cells or induced pluripotent stem cells are used for biofabricating the bioengineered lung. The bioreactor applies circulatory perfusion and mechanical ventilation with physiological parameters to the lung during biofabrication. These physical stimuli to the organ are translated into the stem cell local microenvironment – e.g. shear stress and cyclic stretch – so that cells sense the physiological conditions in normally functioning mature lungs. After seminal proof of concept in a rodent model was published in 2010, the hypothesis that lungs can be biofabricated is accepted and intense research efforts are being devoted to the topic. The current experimental evidence obtained so far in animal tests and in *ex vivo* human bioengineered lungs suggests that the date of first clinical tests, although not immediate, is coming. Lung bioengineering is a disrupting concept that poses a challenge for improving our basic science knowledge and is also an opportunity for facilitating lung transplantation in future clinical translation.

Pollen Biotechnology

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and Medical Sciences, Soochow University, Suzhou, China College of Animal Sciences, Zhejiang University, Hangzhou, China) Nutrient-rich bee pollen: A treasure trove of active natural metabolites. Journal of Functional Foods, Vol. 49 (2018): 472–484.

Bee pollen is a mixture of plant pollen pellet with nectar and honeybee secretions. Due to its active natural metabolites with extensive nutritional and therapeutic properties, it is recommended as a treasure trove of human nutrition. The nutritional components in bee pollen include carbohydrates, proteins, lipids, vitamins, minerals, polyphenols, and a small percentage of other components. Previous studies demonstrated that bee pollen exhibit antioxidant, antibacterial, anti-inflammatory, anticarcinogenic, and antiallergic properties. This comprehensive review focused on the nutritional properties and potentially active phytometabolites (polyphenolic acids and flavonoids) of bee pollen and its therapeutic health benefits. We also covered the food safety and guidelines for the consumption with future industrial challenges of bee pollen.

Keywords: Bee pollen; Phytometabolites; Nutrition; Therapeutic benefits; Food safety.

Yong Wang [a,1] , Yin Min Htwe [b,1,] Leonard Osayande Ihase [c], Peng Shi [a], Xintao Lei [a b c]. (a, Coconut Research Institute, Chinese Academy of Tropical Agricultural Sciences, Wenchang 571339, PR China b, Biotechnology Research Department, Ministry of Education, Kyaukse 100301, Myanmar c, Nigerian Institute for Oil Palm Research (NIFOR), Benin, Nigeria, Hongxing Cao). Pollen germination genes differentially expressed in different pollens from Dura. Horticulturae, Volume 235 (2018): 32–38.

Oil palm (Elaeis guineensis jacq.) is considered as the king of world's oil crops because it is the highest oil producing crop in the world. Pollination is perfectly important to increase fruits and yield because it is the first step in fruit development process. However, very few limited publications are available on the study of oil palm
pollen. In this study, Elaeis guineensis importin subunit beta-1-like, mRNA sequence (XP_010939614.2, 3314 bp in length) which showed 76% identity to rice pollen-expressed gene (rice Importin ß1), importin subunit beta-1, was downloaded to study the gene expression pattern of oil palm pollen. For gene expression analysis with real time quantitative PCR, the accuracy of the determination of target gene expression depends on the use of reliable reference gene. In order to identify suitable reference gene, we selected the most commonly used reference genes (Act, Apt, cyc and eIF) and ranked their expression stabilities using two statistical algorithms; geNorm and NormFinder. The results from both algorithms showed that Act was the most stable gene for oil palm pollen germination gene. Expression analysis of oil palm pollen gene in three diff erent fruit forms showed that the expression levels of pollen gene in Dura and Tenera fruit forms were down-regulated after germination while upregulation was observed in Pisifera. This research will be useful in future molecular genetics resource studies of gene expression in pollen germination of oil palm.

Keywords: Oil palm; Pollen; Germination; Gene; qPCR.

MarekKieliszekKami lPiwowarekAnna M.KotStanisław BłażejakAnna Chlebowska-ŚmigielI wona Wolska(Faculty of Food Sciences, Department of Biotechnology, Microbiology and Food Evaluation, Warsaw University of Life Sciences − SGGW, Nowoursynowska 159 C, 02-776 Warsaw, Poland). Pollen and bee bread as new health-oriented products. Trends in Food Science & Technology, Volume 71(2018): 170-180

An interest in substances of natural origin has been a subject that is increasing constantly-both those known for many years and recently discovered are of great interest to the researchers. This interest also applies to bee products because of their extensive nutritional and therapeutic properties; these products are known and used for several thousand years, but only recently, they became the subject of sparse documented scientific research. With the passing of time, it is difficult to determine what will be the wishes and requirements of the future consumers, what should be introduced to new technologies to ensure the demand for new products.

Recently, there has been an increasing demand for natural products, particularly the bee products. Bee bread and pollen, due to their nutritional and medicinal properties, are used for apitherapeutic purposes. These include about 200 different substances, such as free amino acids and vitamins. Special attention should be attributed to unsaturated fatty acidssuch as linoleic, linolenic, and arachidonic, which are found in pollen and bee bread.

The fashion for a healthy lifestyle leads to a situation where a number of people start taking care of their health. They search for the highest quality products, preferably with health benefits, rich in vitamins, valuable bioelements, and nutrients. Therefore, bee bread that is rich in beneficial ingredients has proved to fulfill these expectations. It constitutes a wholesome, biologically active nutrient, which can be used in the food industry.

Keywords: Bee bread; Pollen; Apitherapy; Natural products.

LinglingZhao[ad], XinwenLiang[a], LimingWu[ab], ZhongyinZhang[c], WeiCao[d], XiaofengXue (a. Institute of Apicultural Research, Chinese Academy of Agricultural Sciences, Beijing 100093, China, b. Risk Assessment Laboratory for Bee Products Quality and Safety of Ministry of Agriculture, Beijing 100093, China, c. Henan Institute of Science and Technology, Henan 453003, China, d. Institute of Analytical Science, Shaanxi Provincial Key Lab of Electroanalytical Chemistry, Northwest University, Xi'an 710069, China) Use of isoquinoline alkaloids as markers for identification of honey and pollen from *Macleaya cordata* (Willd.) R. Br. Journal of Food Composition and Analysis, Volume 66 (2018): 237-243.

Macleaya cordata (Willd.) R. Br. (McRB) is utilized in traditional medicine and is mainly distributed in North America, Europe, Japan, and China. McRB honey known as "mad honey" produced by honey bees from the nectar of McRB contains isoquinoline alkaloids that give rise to potential consumer risk. In this study, a QuEChERS (Quick, Easy, Cheap, Effective, Rugged,

Safe) extraction procedure followed by ultra-high performance liquid chromatography–quadrupole time-of-flight mass spectrometry (UHPLC–MS/MS) was developed and optimized for the determination of seven isoquinoline alkaloids in McRB bee pollen and honey. The results revealed the presence of seven alkaloids in McRB bee pollen, four of which were also detected in McRB honey. Protopine and allocryptopine were the two predominant alkaloids, with concentrations of 0.17–0.66 mg/kg and 0.068–0.19 mg/kg in McRB honey and 1.25*10^3–3.07*10^3 mg/kg and 1.12*10^3–2.52*10^3 mg/kg in McRB bee pollen, respectively. None of the seven alkaloids were detected in commercial honey (n = 130) or pollen samples (n = 30). This study shows that protopine and allocryptopine could serve as potential markers of honey and pollen specifically from McRB.

Keywords: Food analysis; Food composition

***Macleaya cordata* (Willd.) R. Br; Honey; Pollen; Alkaloid; QuEChERS; UHPLC–MS/MS.**

Chang HaParkSang UnPark(Chungnam National University, Daejeon, South Korea). **Applications of Plant Tissue Culture and Biotechnology in Buckwheat. Buckwheat Germplasm in the World : 333-341**

Two main species of buckwheat are produced worldwide. The first is common buckwheat (*Fagopyrum esculentum* Moench), which is most commonly consumed, and the second is tartary buckwheat (*Fagopyrum tataricum* Gaertn.), which is less commonly consumed because of its bitter taste. However, tartary buckwheat contains high protein, fiber, and vitamin B1, B2, and B6 contents and has more of the flavonoid rutin compared with common buckwheat. A number of studies have reported in vitro plant regeneration, plant transformation, and hairy root culture of buckwheat. In this review, we summarize previous and current information regarding the application of plant biotechnology in buckwheat cultivation and provide insights into future studies in this discipline.

Biotechnology Policy Issue

Mahaletchumy Arujanan[a], Muthu Singaram[b], (a.Malaysian Biotechnology Information Centre, The Petri Dish, 4-8-27 Monash University Sunway Campus, Jalan Lagoon Selatan, Bandar Sunway, 41650 Petaling Jaya, Selangor, Malaysia, b. VibaZone Private Limited (Malaysia), 3rd Floor, 3 Lorong Tiara 1A, Bandar Baru Klang, 41150 Klang, Selangor Darul Eshan, Malaysia) **The biotechnology and bioeconomy landscape in Malaysia. New Biotechnology, Volume : 40, Part A(2018): 52-59**

Since 1990s Malaysia aspired to make biotechnology and bioeconomy as her engines of economic growth to utlise the abundance of natural resources and biodiversity. The public sector plays an integral role in developing the sector and various incentives are in place for the private sector to be actively involved and to forge collaboration with the public sector. The country launched its National Biotechnology Policy in 2005 and later launched its National Bioeconomy Programme in 2010 to become the first country in South East Asia and second in Asia after China to have such an initiative. Malaysia is also very proactive in its biosafety law and

regulations and has most of the related legal instrument in place. A lot of success has been recorded since the inception of the National Biotechnology Policy in terms of job creation, contribution to GDP through biobusinesses and investment from foreign companies, but the sector is not spared from challenges too. Due to the nature of the discipline that is multidisciplinary and that requires huge amount of investment, expertise and political will, there are a lot of barriers before the country emerges as a bioeconomy player. This paper discusses the public policies, initiatives and funding mechanisms in place in Malaysia that drive its research, development and commercialisation in the area of biotechnology and bioeconomy. The authors also discuss the challenges faced in Malaysia in implementing the policies.

Keywords: Malaysia; Biotechnology; Bioeconomy; Bionexus; Policies; Funding; Commercialisation

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This introduction to the special issue focuses on the economics of labeling genetically modified (GM) foods and implications of GM-labeling policies and the specific contributions of papers included.

Keywords: GMOs; Biotechnology; Labeling

Arda Işıldar (IHE Delft Institute for Water Education, Delft, The Netherlands). **10 - Biotechnologies for metal recovery from electronic waste and printed circuit boards. Waste Electrical and Electronic Equipment Recycling, Woodhead Publishing Series in Electronic and Optical Materials, (2018): 241-269.**

Waste electrical and electronic equipment (WEEE) is an important secondary source of valuable metals. Recycling of end-of-life devices for metal recovery is an integral element of the environmental policy of many countries and regions. Discarded printed circuit boards (PCBs) include high amounts of copper (Cu), gold (Au), silver (Ag), aluminum (Al), zinc (Zn), and nickel (Ni). Currently, pyrometallurgical processes are used for the recovery of metals from high-grade PCBs and several former industrial mining plants operate globally. These processes, however, are deemed to be imperfect, energy-intensive, and nonselective. Biotechnologies are a promising alternative to the current industrial-scale best available technologies. In this review, the frontiers in metal recovery from WEEE using biotechnological strategies are described. These technologies encompass biologically induced leaching of metals from various matrices (bioleaching). Bioleaching of metals occurs through various mechanisms in nature and a wide variety of microorganisms are involved. This chapter gives the fundamentals on the biochemical

basis of bioleaching, and the recent research and development (R&D) applications on metal recovery from WEEE.

Keywords: Electronic waste; WEEE; metals; copper; gold; nickel; aluminum; zinc; biorecovery; bioleaching

Dipali Dhawan. **(PanGenomics International Pvt. Ltd., Ahmedabad, Gujarat, India) Chapter 23 - Biotechnology for Biomarkers: Towards Prediction, Screening, Diagnosis, Prognosis, and Therapy. Omics Technologies and Bio-Engineering, Towards Improving Quality of Life, (2018): 533-557**

Biomarkers are molecules that help in identifying the biological condition of an individual and play an important role in disease diagnosis and treatment. With the advancement in the field of biotechnology in the last two decades, a lot of research has been done in the field of biomarkers to enable better understanding of mechanisms of disease initiation, development, and progression. In the future, the integration of biomarkers identified using emerging high-throughput technologies into medical practice will enable “personalization” in treatment and disease prevention. This chapter gives an overview of well-studied biomarkers for susceptibility, diagnostics, and therapeutics in various diseases such as immune diseases, cardiovascular diseases, infectious diseases, neurological diseases, and cancer.

Keywords: Cardiology; rheumatoid arthritis; biomarkers; diagnostics; oncology

Joanna Dupont-Inglis, **Agnes Borg**. **(EuropaBio, The European Association for Bioindustries, EuropaBio, Avenue de l'Armée 6, 1040 Brussels, Belgium). Destination bioeconomy – The path towards a smarter, more sustainable future. New Biotechnology, Volume : 40, Part A(2018): 140-143.**

Five years following the publication of the EU Bioeconomy Strategy, this article discusses the state of play of the bioeconomy in Europe. Placing specific focus on Industrial Biotech, it outlines ten pragmatic recommendations from BIO-TIC [BIO-TIC, A roadmap to a thriving industrial biotechnology sector in Europe, 2015], an EU FP7 funded project completed in 2015 and coordinated by EuropaBio, comprehensively examining the hurdles to the development of a bioeconomy in Europe, enabled by industrial biotech. These include improving opportunities for feedstock producers within the bioeconomy; investigating the scope for using novel biomass; developing a workforce which can maintain Europe’s competitiveness in industrial biotechnology; introducing a long-term, stable and transparent policy and incentive framework to promote the bioeconomy; improving public perception and awareness of industrial biotechnology and bio-based products; identifying, leveraging and building upon EU capabilities for pilot and demonstration facilities; promoting the use of co-products from processing; improving the bioconversion and downstream prcessing steps; improving access to financing for large-scale biorefinery projects; doeveloping stronger relationships between conventional and non-conventional players.

Keywords: Industrial biotechnology; Bioeconomy; Circular economy; European Union; Bio-based products; Biomass

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The U.S. Preventive Services Task Force (USPSTF) provides independent, objective, and scientifically rigorous recommendations for clinical preventive services. A primary concern is to avoid even the appearance of members having special interests that might influence their ability to judge evidence and formulate unbiased recommendations. The conflicts of interest policy for the USPSTF is described, as is the formal process by which best practices were incorporated to update the policy. The USPSTF performed a literature review, conducted key informant interviews, and reviewed conflicts of interest policies of ten similar organizations. Important findings included transparency and public accessibility; full disclosure of financial relationships; disclosure of non-financial relationships (that create the potential for bias and compromise a member's objective judgment); disclosure of family members' conflicts of interests; and establishment of appropriate reporting periods. Controversies in best practices include the threshold of financial disclosures, ease of access to conflicts of interest policies and declarations, vague definition of non-financial biases, and request for family members' conflicts of interests (particularly those that are non-financial in nature). The USPSTF conflicts of interest policy includes disclosures for immediate family members, a clear non-financial conflicts of interest definition, long look-back period and application of the policy to prospective members. Conflicts of interest is solicited from all members every 4 months, formally reviewed, adjudicated, and

made publicly available. The USPSTF conflicts of interest policy is publicly available as part of the USPSTF Procedure Manual. A continuous improvement process can be applied to conflicts of interest policies to enhance public trust in members of panels, such as the USPSTF, that produce clinical guidelines and recommendations.

Agricultural Biotechnology

Matthew S. Dahabieha,b, Stefanie Bröringc, Elicia Mainea,(a. Beedie School of Business, Simon Fraser University, Vancouver, Canada, b. Renaissance BioScience Corp., Vancouver, Canada, c. Institute for Food and Resource Economics, University of Bonn, Bonn, Germany)Overcoming barriers to innovation in food and agricultural biotechnology. Trends in Food Science & Technology, Volume 79 (2018): 204–213.

The food and agricultural biotechnology (FAB) sector is poised to respond to some of society's most pressing challenges, including food security, climate change, population growth, and resource limitation. However, to realize this promise, substantial barriers to innovation must be overcome. Here, we draw upon industry experience and innovation management literature to analyze FAB innovation challenges, as well relevant frameworks for their resolution. In doing so, we identify two major FAB innovation challenges: specialized adoption
uncertainty, and complex product-market fit across convergent value chains. We propose that these innovation challenges may be overcome by 1) prioritizing the establishment of organizational and social technology legitimacy, and 2) leveraging technology-market matching methods and open innovation practices.

Keywords: Food and agricultural biotechnology; Innovation management; Adoption barriers; Uncertainty analysis; Technology-market matching; Convergence-driven value chains; Open innovation; Product-market fit.

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During the 40th Annual Meeting of The Toxicology Forum, the current and potential future science, regulations, and politics of agricultural biotechnology were presented and discussed. The meeting session described herein focused on the technology of RNA interference (RNAi) in

agriculture. The general process by which RNAi works, currently registered RNAi-based plant traits, example RNAi-based traits in development, potential use of double stranded RNA (dsRNA) as topically applied pesticide active ingredients, research related to the safety of RNAi, biological barriers to ingested dsRNA, recent regulatory RNAi science reviews, and regulatory considerations related to the use of RNAi in agriculture were discussed. Participants generally agreed that the current regulatory framework is robust and appropriate for evaluating the safety of RNAi employed in agricultural biotechnology and were also supportive of the use of RNAi to develop improved crop traits. However, as with any emerging technology, the potential range of future products, potential future regulatory frameworks, and public acceptance of the technology will continue to evolve. As such, continuing dialogue was encouraged to promote education of consumers and science-based regulations.

Keywords: Agriculture; Biotechnology; dsRNA; GMO; RNAi; Toxicology Forum.

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This paper addresses recent government initiatives in biotechnology and various federal and regional initiatives. It presents an overview of the most visible industrial biotechnology projects under implementation and highlights changes in legislation affecting development of the bioeconomy in the Russian Federation.

Keywords: Russian Federation; Bioeconomy; Industrial biotechnology; Agrobiotechnology; Legislation

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A prime driver for a bioeconomy is the need to ensure the availability of sufficient biomass feedstock for food, feed, energy and industrial uses. This demand must be properly managed in the face of several challenges, including environmental changes and abrupt climate shifts. Plant breeding and breeding innovation is the cornerstone for sustainable supply of biomass. Not only does research and development in this sector aim at providing high yielding crops in order to

maximize production, but R&D in this field will also allow to obtain highly specialized plant varieties with new or improved traits that fit to specific applications. At the same time, there is little awareness among the general public of the fact that state-of-the-art R&D is a prerequisite for the production of sufficient biomass of the right quality in a sustainable manner. Plant breeders in the EU have to grapple with a rather challenging policy and regulatory framework. An important way forward to overcome the existing impasse would be to ensure transparent and trustworthy communication with the general public.

Kathleen L.Hefferon.(Cornell University, Ithaca, NY, United States). Chapter 16 - Crops With Improved Nutritional Content Though Agricultural Biotechnology. Plant Micronutrient Use Efficiency, Molecular and Genomic Perspectives in Crop Plants, (2018): 279-294

Malnutrition, resulting from micronutrient deficiencies such as vitamin A, folate, and iron, is and will continue to be, one of the greatest challenges of our world for the next century. One way to address this challenge is the development of food crops through the use of agricultural biotechnology that are rich in vitamins and minerals. The following chapter explores the use of genetic engineering strategies, including transgenesis, RNA interference, and genome editing to create the next generation of biotech crops that can improve the nutritional status of the rural poor in developing countries. The chapter provides a series of examples of crops that have been biofortified through biotechnology, including rice, banana, potato, cassava, and sorghum. Nutritionally enhanced food crops, including tomato, false flax, and Brassica species are also discussed. The chapter ends with a discussion of the potential of biotechnology to provide a more nutritionally secure world.

Bioenergy

Zheng Sun[1,2,3], Xiao-peng Fang[1,2,3], Xiao-yang Li[1,2,3], Zhi-gang Zhou[1,2,3] (1.Key Laboratory of Exploration and Utilization of Aquatic Genetic Resources, Ministry of EducationShanghai Ocean UniversityShanghai China, 2.National Demonstration Center for Experimental Fisheries Science Education Shanghai Ocean University Shanghai China, 3.International Research Center for Marine Biosciences, Ministry of Science and Technology Shanghai Ocean University Shanghai China). Oleaginous Microalgae from Dairy Farm Wastewater for Biodiesel Production: Isolation, Characterization and Mass Cultivation. Applied Biochemistry and Biotechnology, Volume 184(2) (2018): 524–537

Producing biodiesel from microalgae grown in wastewater is environment-friendly and cost-effective. The present study investigated the algae found in wastewater of a local dairy farm for their potential as biodiesel feedstocks. Thirteen native algal strains were isolated. On the basis of morphology and 16S/18S rRNA gene sequences, one strain was identified to be a member of cyanobacteria, while other 12 strains belong to green algae. After screening, two *Scenedesmus* strains out of the 13 microalgae isolates demonstrated superiority in growth rate, lipid productivity, and sedimentation properties, and therefore were selected for further scale-up

outdoor cultivation. Both *Scenedesmus* strains quickly adapted to the outdoor conditions, exhibiting reasonably good growth and strong anti-contamination capabilities. In flat-plate photobioreactors (PBRs), algal cells accumulated predominantly neutral lipids that accounted for over 60% of total lipids with almost 70% being triacylglycerol. In addition, *Scenedesmus obliquus* had a high content of monounsaturated fatty acids, of which the amount of oleic acid (*C*18:1) was up to 27.11%. Based on these findings, the dairy farm wastewater-isolated *Scenedesmus* strains represent promising sources of low-cost, high-quality oil for biofuel production.

Keywords: Wastewater; 16S/18S rRNA ; Screening ; Lipids ; Outdoor PBRs

Ting-Ting Wang [1], Zhao-Yong Sun[1], Yu-Lian Huang[1], Li Tan[1,2], Yue-Qin Tang[1], Kenji Kida[1] . (1.College of Architecture and Environment Sichuan University Chengdu China, 2.Key Laboratory of Environmental and Applied Microbiology Chengdu Institute of Biology, Chinese Academy of Sciences Chengdu China). **Biogas Production from Distilled Grain Waste by Thermophilic Dry Anaerobic Digestion: Pretreatment of Feedstock and Dynamics of Microbial Community. Applied Biochemistry and Biotechnology, Volume 184(2) (2018): 685–702**

Distilled grain waste (DGW) eluted from the Chinese liquor making process poses potential serious environmental problems. The objective of this study is to evaluate the feasibility of converting DGW to biogas by thermophilic dry anaerobic digestion. To improve biogas production, the effects of dilute H_2SO_4 and thermal pretreatment on DGW were evaluated by biochemical methane potential (BMP) tests. The results indicate that 90 °C thermal pretreatment provided the highest methane production at 212.7 mL/g-VTS_{add}. The long-term thermophilic dry anaerobic digestion process was conducted in a 5-L separable flask for more than 3 years at a volatile total solid (VTS) loading rate of 1 g/kg-sludge/d, using synthetic waste, untreated and 90 °C thermal pretreated DGW as the feedstock, respectively. A higher methane production, 451.6 mL/g-VTS_{add}, was obtained when synthetic waste was used; the methane production decreased to 139.4 mL/g-VTS_{add} when the untreated DGW was used. The 90 °C thermal pretreated DGW increased the methane production to 190.5 mL/g-VTS_{add}, showing an increase of 36.7% in methane production compared with that using untreated DGW. The microbial community structure analysis indicates that the microbial community in the thermophilic dry anaerobic digestion system maintained a similar structure when untreated or pretreated DGW was used, whereas the structure differed significantly when synthetic waste was used as the feedstock.

Keywords: Distilled grain waste; Thermophilic dry anaerobic digestion; Biogas; Biochemical methane potentialS; Thermal pretreatment; Microbial community

Bruno G.Fonseca[ac], SoledadMateo[b], Alberto J.Moya[b], Inês C.Roberto[c]. ([a]Curso de Farmácia, Centro Universitário Teresa D'Ávila (UNIFATEA), 12.606-580, Lorena, São Paulo, Brazil, [b]Department of Chemical, Environmental and Materials Engineering, University of Jaén, 23071, Jaén, Spain, [c]Department of Biotechnology, College of Chemical Engineering of Lorena, P.O. Box 116, Lorena, São Paulo, Brazil) **Biotreatment optimization of rice straw hydrolyzates for ethanolic fermentation with *Scheffersomyces stipitis.* Biomass and Bioenergy, Volume 112(2018): 19-28**

In the current study, the potential application of baker's yeast as biological agent for the detoxification of rice straw hemicellulosic hydrolyzate containing high initial D-xylose content has been evaluated with the goal of improving ethanol production by *Scheffersomyces stipitis*. As required, various biodetoxification conditions in terms of treatment time, cell density and pH were assessed by measuring ethanol yield (YP/S) and ethanol volumetric productivity (Q_P) when the treated hydrolyzate was fermented by *S. stipitis*. Our results showed that baker's yeast is able to reduce the toxicity of hydrolyzate with only 6 h biotreatment. Interestingly, the maximum ethanol production from biotreated hydrolyzate was not correlated with the complete removal of furan and phenolic compounds, but when acetic acid was reduced from the medium. Under selected biotreatment conditions (5.0 g dm^{-3} baker's yeast concentration at pH 3.0 for 6 h), the fermentative performance of *S. stipitis* was noticeably favored in bench top bioreactor, i.e., fermentable sugars were completely consumed with production of 23.0 g dm^{-3} ethanol after 44 h (YP/S $= 0.24$ g g^{-1} and $Q_P = 0.52$ g dm^{-3} h^{-1}). Based on our results, baker's yeast may be considered a promising detoxification method for application in biorefineries, especially because its failure to consume D-xylose, which is the major sugar in these media, besides it is recognized as safe (GRAS status) and largely available commercially. Certainly, this bioprocess could be an important step toward processing lignocellulosic biomass for the development of second-generation ethanol production.

Keywords: Rice straw hemicellulosic hydrolyzate; Biotreatment; Baker's yeast; *Scheffersomyces stipitis;* Ethanol; Bench-top bioreactor

Killian Chary[ab], JoëlAubin[cd], Loïc Guindé[a], Jorge Sierra[a], Jean-MarcBlazy[a]. ([a]INRA, UR1321 ASTRO Agrosystèmes Tropicaux, F-97170 Petit-Bourg (Guadeloupe), France, [b]Ifremer, UMR 9190 MARBEC (IRD - Ifremer - Univ. Montpellier - CNRS), Station Ifremer, Route de Maguelone, F-34250 Palavas-les-Flots, France, [c]INRA, UMR 1069 Sol Agro et Hydrosystème Spatialisation, F-35000 Rennes, France, [d]Agrocampus Ouest, F-35000 Rennes, France). **Cultivating biomass locally or importing it? LCA of biomass provision scenarios for cleaner electricity production in a small tropical island. Biomass and Bioenergy, Volume 110(2018): 1-12**

Biomass is a promising renewable alternative to decarbonize and to secure energy production on small islands, as most insular power generation systems rely heavily on imported fossil fuels. Feedstock procurement is a key aspect of bioenergy chain sustainability, and local resources as well as imported biomass can be considered if the electricity generated presents environmental

benefits. We used Life Cycle Assessment (LCA) to evaluate the environmental impacts of 1 kWh of electricity produced in Guadeloupe from the combustion of locally grown energy cane and imported wood pellets. The energy cane agricultural supply was simulated using a bio-economic model to elaborate and analyze five scenarios involving different biomass mixes and geographical areas of production. Our results show that electricity produced from energy cane reduced the impacts of ABIOTIC DEPLETION, ACIDIFICATION and PHOTOCHEMICAL OXIDATION by 29% compared with pellet-based electricity. The environmental impacts of the energy cane cultivation stage varied by a factor of 1.5–3.7 among regional areas of cultivation because of differences in yields, soil emissions and land conversion for energy crop farming. The substitution of 5% of fossil energy by biomass in the island electricity mix can reduce GLOBAL WARMING and ABIOTIC DEPLETION impact by 4.5%. However, this change requires 3.5 to 5.2 times higher LAND OCCUPATION per unit of energy produced. Given the limited land availability on small islands, this latter point confirms that the combination of locally grown energy crops with imported biomass will be a suitable strategy to develop sustainable bioenergy for small islands.

Keywords: LCA; Electricity; Energy cane; Wood pellet; Islands; *Saccharum* sp.

J.Md Khudzari[a], J.Kurian[a], Y.Gariépy[a], B.Tartakovsky[ab], G.S.V.Raghavan[a]. ([a]Department of Bioresource Engineering, Macdonald Campus, McGill University, 21111 Lakeshore Road, Sainte-Anne-de-Bellevue, Québec H9X 3V9, Canada, [b]National Research Council of Canada, 6100 Royalmount Avenue, Montreal, Québec H4P 2R2, Canada). **Effects of salinity, growing media, and photoperiod on bioelectricity production in plant microbial fuel cells with weeping alkaligrass. Biomass and Bioenergy, Volume 109(2018): 1-9**

This study investigated the potential for bioelectricity production of a salt-tolerant plant, the weeping alkaligrass (*Puccinellia distans*), in a plant microbial fuel cell (MFC). Air-cathode MFCs with a carbon felt anode were assembled in a cylindrical vessel. The MFCs were operated using growing media of different dry organic matter (OM) mass fractions: potting mix (OM: 89%) and sandy loam (OM: 8%), and treated with different NaCl concentrations of 0, 6, and 12 kg m^{-3}. MFC performance was best at a salinity of 6 kg m^{-3}. Over 114 days, the highest power output was obtained from plant MFC (PMFC) in potting mix at 83.7 mW m^{-2} cathode area with an average power of 12.78 mW m^{-2}, followed by PMFC in sandy loam (maximum: 8.59 mW m^{-2}, average: 8.35 mW m^{-2}). The total biomass production of alkaligrass was 5–25% higher in the potting mix, when compared to the sandy loam. The presence of alkaligrass in PMFC increased the bioelectricity production by 14-fold compared to that of soil MFC (SMFC). In addition to the standard photoperiod of 16/8 h (light/dark), the MFCs were also operated under 24/0 h, 9/15 h, and 0/24 h photoperiods. Power outputs of 9/15 and 0/24 h were clearly decreased due to the effect of photoperiod, while the power outputs of 24/0 and 16/8 h were similar with some evidence of light-related inhibition. Frequent changes in the photoperiod test

affected bioelectricity production and thus, a longer recovery time is recommended to reduce the adverse impact of the changes.

Keywords: Plant microbial fuel cells; Fults weeping alkaligrass; Bioelectricity; Salinity; Photoperiod

Francesco Ometto[a], Kristine B.Steinhovden[b], HanaKuci[c], Johan Lunnbäck[a], Andreas Berg[a]; Anna Karlsson[a]; Aleksander Handå[b]; Håvard Wollan[d], Jörgen Ejlertsson[ac]. ([a]Scandinavian Biogas Fuels AB, Research and Development Dept., Holländargatan 21A, SE-111 60, Stockholm, Sweden, [b]SINTEF Fisheries and Aquaculture, Brattorkaia 17c, 7010 Trondheim, Norway, [c]Linköping University, Dept. of Thematic Studies – Environmental Changes, SE-58 183, Linköping, Sweden, [d]Biokraft AS, Postboks 8869, Nedre Elvehavn, 7481, Trondheim, Norway). Seasonal variation of elements composition and biomethane in brown macroalgae. Biomass and Bioenergy, Volume 109(2018): 31-38

To investigate the effect of seasonal variation on macroalgae biomass characteristics and its related energy content, four different algae species, two from the Fucales order (*Fucus vesiculosus* and *Ascophyllum nodosum*), and two from the Laminarialesorder (*Saccharina latissima* and *Alaria esculenta*), were harvested during spring, summer, autumn and winter over one year. The biomethane potential and the elemental composition were determined for all samples. Both Fucales species showed low biodegradability (<30%) with methane yields consistently below 20 Nm^3per wet tonne. Laminariales species, however, allowed up to 80% biodegradation efficiency, with methane yields varying between 20 and 70 Nm^3 per wet tonne depending on the harvesting season. For each of the four algae the biomass concentrations of potassium, phosphorus, calcium, magnesium, sodium, sulphur, aluminium and iron was higher during spring/summer compared to autumn/winter. For heavy metals, variation was seen mainly for arsenic with higher values during autumn/winter. The highest values were observed for Laminariales (30–120 mg/kg total solids). Modelling the co-digestion of each algae with municipal wastewater sludge showed Laminariales species having the greatest potential as a profitable substrate for additional biomethane production generating up to 0.38 million Euro. However, seasonal variation could affect this expected income over 60% due to fluctuation in biomethane yields and biodegradability efficiency. Furthermore, the additional loading of cadmium and arsenic into the AD process suggested possible limitation for digestate utilisation in arable lands.

Keywords: Seaweed; Algae composition; Biofuels; Anaerobic digestion

Matthias Garbs, Jutta Geldermann. (University of Göttingen, Platz der Göttinger Sieben 3, 37073 Göttingen, Germany). Analysis of selected economic and environmental impacts of long distance manure transports to biogas plants. Biomass and Bioenergy, Volume 109(2018): 71-84

In regions with high livestock density, manure supply often exceeds demand and complete local deployment would lead to severe environmental damage due to over-nutrification. One solution

is to use the surplus in other regions, which have lower nutrient-levels. To decrease costs associated with transport the manure can first be used in biogas plants of those regions. To date, however, the economic and ecological consequences of this solution are unclear. Here, we develop a model of the consequences from the perspective of a biogas plant owner and apply it to a case study in Lower-Saxony, Germany. The model determines the maximal profitable manure transport distance from a financial point of view. Furthermore, it examines selected environmental impacts for various scenarios with an assumed transport range of 150 km, a typical distance. For dry poultry manure transport distances up to 700 km and more can be financially advantageous. Emission reductions occurred in all scenarios in the impact categories *Greenhouse Gas* and *Acidification*. The model can support decision-makers in the livestock and biogas industries in determining whether to transport manure and, if so, how far.

Keywords: Biogas; Manure transport; Decision support

Wesley Michaels, Hanyu Zhang, William L. Luyben, Jonas Baltrusaitis. (Department of Chemical and Biomolecular Engineering, Lehigh University, 111 Research Drive, Bethlehem, PA 18015, USA). Design of a separation section in an ethanol-to-butanol process. Biomass and Bioenergy, Volume 109(2018): 231-23

A complete separation scheme has been designed for the effluent of a high-pressure ethanol-to-butanol catalytic reactor, producing 250,000 tonnes of n-butanol per year. The effluent contains water, hydrogen and a diverse range of C2-C4 oxygenates: unconverted ethanol, n-butanol, acetaldehyde, ethyl acetate, and acetal. Fundamental phase equilibrium relationships suggested use of conventional, extractive, and heterogeneous azeotropic distillation units to perform the separations. All reactor effluent species exit the separation process at mole purities of at least 99%. Separation costs are estimated to range from 9.0 to 10.6 MJ/kg n-butanol, which is comparable with the separation costs of n-butanol obtained from established acetone-butanol-ethanol (ABE) separation process.

Nano Biotechnology

Mostafa R. Zaher[1], Hanaa A. Ahmed[1], Kareem E. Z. Hamada[2], Reham H. Tammam[3]. (1.Genome Research Unit Animal Health Research Institute Giza Egypt, 2.Veterinary Serum and Vaccine Research Institute Giza Egypt, 3.Chemistry Department, Faculty of Science Cairo University Giza Egypt). Colorimetric Detection of Unamplified Rift Valley Fever Virus Genetic Material Using Unmodified Gold Nanoparticles. Applied Biochemistry and Biotechnology, Volume 184(3) (2018): 898–908

Rift Valley fever virus (RVFV) is considered an enzootic virus in Africa. RVFV has caused several outbreaks in Egypt, sub-Saharan Africa and the Arabian Peninsula and is responsible for

high mortality in ruminants and haemorrhagic fever in severe human cases. Although there are several molecular and serological diagnostic techniques used to detect this arthropod-borne virus with high sensitivity and efficiency, there is a need for a fast and reliable field screening test for rapid outbreak recording and containment. In this study, we developed a prototype point-of-care diagnostic test specific for RVFV detection using unmodified gold nanoparticles (AuNPs) that change colour in the presence of RVFV RNA, resulting in a simple but sensitive assay. The nanogold assay provides qualitative results showing the presence of the RVFV RNA in different sample types. The assay showed high accuracy and specificity, with a detection limit of 10 RNA copies/reaction, comparable with quantitative reverse transcription polymerase chain reaction. The assay result could be determined within 30 min with no need for specific detection instruments. To our knowledge, this is the first field test prototype to directly detect the RNA of RVFV without amplification using AuNPs.

Keywords: Rift Valley fever virus; Gold nanoparticles; Point of care; Diagnosis; Colorimetric

Xinyu Jin, Saisai Li, Nengbing Long, Ruifeng Zhang. (1.Faculty of Materials Science and Chemical Engineering Ningbo University Zhejiang People's Republic of China). Improved Biodegradation of Synthetic Azo Dye by Anionic Cross-Linking of Chloroperoxidase on ZnO/SiO_2 Nanocomposite Support. Applied Biochemistry and Biotechnology, Volume 184(3) (2018): 1009–1023

A novel ZnO nanowire/macroporous SiO_2 composite was used as a support to immobilize chloroperoxidase (CPO) by in situ cross-linking method. An anionic bi-epoxy compound was synthesized and used as a long-chained anionic cross-linker, and it was adsorbed on the surface of ZnO nanowires through static interaction before reaction with CPO, creating a new approach to change the structure, property, and catalytic performance of the produced cross-linking enzyme aggregates (CLEAs) of CPO. The immobilized CPO showed high activity in the decolorization of three azo dyes. The effect of various conditions such as the loading amount of CPO, solution pH, temperature, and dye concentration was optimized on the decolorization. Under optimized conditions, the decolorization percentage of Acid Blue 113, Direct Black 38, and Acid Black 10 BX reached as high as 95.4, 92.3, and 89.1%, respectively. The immobilized CPO exhibited much better thermostability and resistance to pH inactivation than free CPO. The storage stability and reusability were greatly improved through the immobilization. It was found from the decolorization of Acid Blue 113 that 83.6% of initial activity retained after incubation at 4 °C for 60 days and that 80.9% of decolorization efficiency retained after 12 cycles of reuses.

Keywords: Chloroperoxidase; Nanocomposites support; Anionic cross-linking; Azo dye; Decolorization

Greet Smets, Patrick Rüdelsheim. (Perseus bvba, Kortrijksesteenweg 127, B-9830 Sint-Martens-Latem, Belgium). Biotechnologically produced chitosan for nanoscale products. A legal analysis. New Biotechnology, Volume 42(2018): 42-47

Conventionally, chitosans are derived from shrimp and other crustacean shells. Biotechnology offers an alternative route to produce chitosans and more importantly, specific chitosan structures tailored to the needs of a diversity of industries. However, for biotech chitosans and products thereof to be commercialised, legislation should not create a burden. Here, the requirements of the EU regulatory framework have been analysed for the entire chain from research to development and production of several potential applications including nanomaterials. The animal or biotechnological origin leads to specific requirements in production of the raw material. No EU legislation dedicated to nanomaterials has been adopted. Instead, products are governed under the respective existing product legislation subject to extra requirements for safety assessment. While a knowledge gap exists on hazards related to nanomaterials in general, there is a need to establish realistic regulatory study designs to assess the safety of specific products. Furthermore, as many of the existing chitosan applications are not considered nanomaterials, it would be discriminatory to treat biotechnology derived products differently.

Keywords: Chitosan; Nanomaterial; Biotechnology; Regulatory analysis

Hindumathi R.[a], Jagannatham M.[b], Prathap Haridoss[b], Chandra P.Sharma[c]. ([a]Department of Biotechnology, Indian Institute of Technology Madras, Chennai - 600036, India, [b]Department of Metallurgical and Materials Engineering, Indian Institute of Technology Madras, Chennai - 600036, India, [c]Biomedical Technology Wing, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Satelmond Palace, Poojappura, Trivandrum - 695012, India). **Novel nano-cocoon like structures of polyethylene glycol–multiwalled carbon nanotubes for biomedical applications. Nano-Structures & Nano-Objects, Volume 13(2018): 30-35**

In this article, we report the synthesis and use of a novel drug delivery particle, based on bio-compatible polymer polyethylene glycol (PEG-400) and multi-walled carbon nanotubes (MWCNTs). MWCNTs in PEG-400 were broken into small tubes by vortex mixing with tungsten-carbide balls for about 15 h. Length separation of MWCNTs was then done using differential centrifugation with various concentrations of PEG-400. The separated MWCNTs in PEG solution were further pelletized using high speed centrifugation and re-dispersed in water. Novel cocoon like oval nanoparticles of about 100–200 nm size was observed in one of the centrifuged fractions. TEM shows that the cocoons primarily have PEG enclosing few MWCNTs. However, similar structures were not found when differential centrifugation was done without MWCNTs. These nano-cocoons are hemo-compatible, non-toxic to mice fibroblast cell lines (L929), have great potential to be used as nano biomaterials and they could be loaded with naturally anti-cancerous drug curcumin. The cocoon–curcumin complex is dispersible in saline and could be internalized by brain cancer cells (C6 glioma) while free curcumin dispersed in saline could not enter C6 glioma cells.

Keywords: PEG-MWCNT; Nano-cocoon; Nano biomaterial; Polymer nanocomposite

Jeotikanta Mohapatra[a1], Balakrishna Ananthoju[bc1], VishnuNair[d], ArijitMitra[c], D.Bahadur[ae], N.V.Medhekar[f], M.Aslam[abcg]. ([a]Centre for Research in Nanotechnology and Science (CRNTS), Indian Institute of Technology Bombay, Powai, Mumbai 400076, India, [b]IITB-Monash Research Academy, Indian Institute of Technology Bombay, Powai, Mumbai 400076, India, [c]Department of Physics, Indian Institute of Technology Bombay, Powai, Mumbai 400076, India, [d]Department of Chemistry, Indian Institute of Technology Bombay, Powai, Mumbai 400076, India, [e]Department of Metallurgical Engineering and Materials Science, Indian Institute of Technology Bombay, Powai, Mumbai 400076, India, [f]Department of Materials Engineering, Monash University, Clayton, VIC 3800, Australia, [g]National Centre for Photovoltaic Research and Education, Indian Institute of Technology Bombay, Powai, Mumbai 400076, India). **Enzymatic and non-enzymatic electrochemical glucose sensor based on carbon nano-onions. Applied Surface Science, Volume 442(2018): 332-341**

A high sensitive glucose sensing characteristic has been realized in carbon nano-onions (CNOs). The CNOs of mean size 30 nm were synthesized by an energy-efficient, simple and inexpensive combustion technique. These as-synthesized CNOs could be employed as an electrochemical sensor by covalently immobilizing the glucose oxidase enzyme on them via carbodiimide chemistry. The sensitivity achieved by such a sensor is 26.5 $\mu A\ mM^{-1}\ cm^{-2}$ with a linear response in the range of 1–10 mM glucose. Further to improve the catalytic activity of the CNOs and also to make them enzyme free, platinum nanoparticles of average size 2.5 nm are decorated on CNOs. This sensor fabricated using Pt-decorated CNOs (Pt@CNOs) nanostructure has shown an enhanced sensitivity of 21.6 $\mu A\ mM^{-1}\ cm^{-2}$ with an extended linear response in the range of 2–28 mM glucose. Through these attempts we demonstrate CNOs as a versatile biosensing platform.

Keywords: Carbon onions; Carbon materials; Flame synthesis; Glucose sensor

Name of Journals

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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
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63. Indian Biologist
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66. Indian Journal of Biotechnology
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