Bioremediation

Title	**Emerging pollutants in the environment: present and future challenges in biomonitoring, ecological risks and bioremediation**
Author Name	Maria Gavrilescu Kateřina Demnerová, Jens Aamand, SpirosAgathos, Fabio Fava
Journal Name	New Biotechnology
Year	2015
Volume and Issue	32 (1)
Pages	147-56
Abstracts	Emerging pollutants reach the environment from various anthropogenic sources and are distributed throughout environmental matrices. Although great advances have been made in the detection and analysis of trace pollutants during recent decades, due to the continued development and refinement of specific techniques, a wide array of undetected contaminants of emerging environmental concern need to be identified and quantified in various environmental components and biological tissues. These pollutants may be mobile and persistent in air, water, soil, sediments and ecological receptors even at low concentrations. Robust data on their fate and behaviour in the environment, as well as on threats to ecological and human health, are still lacking. Moreover, the ecotoxicological significance of some emerging micropollutants remains largely unknown, because satisfactory data to determine their risk often do not exist. This paper discusses the fate, behaviour, (bio)monitoring, environmental and health risks associated with emerging chemical (pharmaceuticals, endocrine disruptors, hormones, toxins, among others) and biological (bacteria, viruses) micropollutants in soils, sediments, groundwater, industrial and municipal wastewaters, aquaculture effluents, and freshwater and marine ecosystems, and highlights new horizons for their (bio)removal. Our study aims to demonstrate the imperative need to boost research and innovation for new and cost-effective treatment technologies, in line with the uptake, mode of action and consequences of each emerging contaminant. We also address the topic of innovative tools for the evaluation of the effects of toxicity on human health and for the prediction of microbial availability and degradation in the environment. Additionally, we consider the development of (bio)sensors to perform environmental monitoring in real-time mode. This needs to address multiple species, along with a more effective exploitation of specialised microbes or enzymes capable of degrading endocrine disruptors and other micropollutants. In practical terms, the outcomes of these activities will build up the knowledge base and develop solutions to fill the significant innovation gap faced worldwide.
Keywords	Anthropogenic sources, Micropollutants, Biomonitoring, Biosensors, Speciallised microbes

Title	**Secondary plant metabolites and root exudates: guiding tools for polychlorinated biphenyl biodegradation.**
Author Name	P. Jha, J. Panwar, P. N. Jha
Journal Name	Int. J. Environ. Sci. Technol
Year	2015

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Pages	789-802
Abstracts	Synthetic organic compounds are hallmark of modern society. They are ubiquitous ranging from home, workplace to agriculture industry, which leads to their nonjudicious dispensing into environment. Unfortunately most of them, especially polychlorinated biphenyls (PCBs), are deemed as persistent organic pollutants posing serious health risks to human. Hence, there is an alarming need of phasing out these chemicals and remediating contaminated sites in eco-friendly manner. Phytoremediation has emerged as a highly promising approach which capitalizes on plants and their associated microorganisms for removal of pollutants from targeted sites. Plant root exudations and secondary metabolites efficiently orchestrate selective recruitment of potential PCB-degrading microbial consortia within the rhizosphere and inside plant tissues. Structural analogy between organic contaminants and secondary plant metabolites (SPMEs) renders possible uptake and subsequent degradation of pollutants by microorganisms. Present review is focused on potential role of plant root exudates and SPMEs in structuring and orchestrating remediation of PCBs within rhizosphere and inside plant tissues. Also, recent developments in tools and techniques to study remediation of organic contaminants with special reference to PCBs are addressed.
Keywords	Secondary plant metabolites, Persistent organic pollutants, Polychlorinated biphenyls, Biosensor, Rhizoengineering

Title	**Bioremediation of Heavy Metals from Soil and Aquatic Environment: An Overview of Principles and Criteria of Fundamental Processes**
Author Name	Ruchita Dixit, Wasiullah, Deepti Malaviya, Kuppusamy Pandiyan, Udai B. Singh, Asha Sahu, Renu Shukla, Bhanu P. Singh, Jai P. Rai, Pawan Kumar Sharma, Harshad Lade, and Diby Paul.
Journal Name	Sustainability
Year	2015
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Pages	2189-2212
Abstracts	Heavy metals are natural constituents of the environment, but indiscriminate use for human purposes has altered their geochemical cycles and biochemical balance. This results in excess release of heavy metals such as cadmium, copper, lead, nickel, zinc etc. into natural resources like the soil and aquatic environments. Prolonged exposure and higher accumulation of such heavy metals can have deleterious health effects on human life and aquatic biota. The role of microorganisms and plants in biotransformation of heavy metals into nontoxic forms is well-documented, and understanding the molecular mechanism of metal accumulation has numerous biotechnological implications for bioremediation of metal-contaminated sites. In view of this, the present review investigates the abilities of microorganisms and plants in terms of tolerance and degradation of heavy metals. Also, advances in bioremediation technologies and strategies to explore these immense and valuable biological resources for bioremediation are discussed. An assessment of the current status of technology deployment and suggestions for future bioremediation research has also been included. Finally, there is a discussion of the genetic and molecular basis of metal tolerance in microbes, with special reference to the genomics of heavy metal accumulator plants and the identification of functional genes involved in tolerance and detoxification.
Keywords	Heavy metals, Toxicity, Biodegradation, Bioremediation, Phytoremediation

Title	**Phytoremediation And Plant-Assisted Bioremediation In Soil And Treatment Wetlands: A Review**
Author Name	Jaak Truua, Marika Truu, Mikk Espenberg, Hiie Nõlvak, Jaanis Juhanson
Journal Name	The Open Biotechnology Journal
Year	2015
Volume and Issue	9
Pages	77-92
Abstracts	Phytoremediation is a technology that is based on the combined action of plants and their associated microbial communities to degrade, remove, transform, or immobilize toxic compounds located in soils, sediments, and more recentlyin polluted ground water andwastewater in treatment wetlands. Phytoremediation could be used to treat different types of contaminants including petroleum hydrocarbons, chlorinated solvents, pesticides, explosives, heavy metals and radionuclides in soil and water. The advantages of phytoremediation compared to conventional techniques are lower cost, low disruptiveness to the environment, public acceptance, and potentiality to remediate various pollutants. The use of plants in conjunction with plant associated bacteria (rhizosphere or endophytic) offers greater potential for bioremediation of organic compounds,and in some cases inorganic pollutants than using plants alone in bioremediation. The implementation of treatment wetlands for phytoremediation of wastewater or polluted water originating from various sources allows removing organic and inorganic pollutants from water in an environmentally friendly and economically feasible way. Presently, different processes of phytoremediation in treatment wetlands are less studied compared to phytoremediation of polluted soils. Further research is needed to advance the understanding of the pollutant removal mechanisms in treatment wetlands with vegetation, and how based on this information improve treatment wetland design and operational parameters to achieve more efficient treatment processes.This review covers basic processes of phytoremediation with special emphasis on rhizoremediation and plant-microbe interactions in plant–assisted biodegradation in soil and treatment wetlands.
Keywords	Rhizoremediation, Phytoremediation, Treatment wetlands

Title	**Restoration of a Mediterranean forest after a fire: bioremediation and rhizoremediation field-scale trial**
Author Name	Paloma Pizarro-Tobías, Matilde Fernández, José Luis Niqui, Jennifer Solano, Estrella Duque, Juan-Luis Ramos and Amalia Roca
Journal Name	Microbial Biotechology
Year	2015
Volume and Issue	8
Pages	77-92
Abstracts	Forest fires pose a serious threat to countries in the Mediterranean basin, often razing large areas of land each year. After fires, soils are more likely to erode and resilience is inhibited in part by the toxic aromatic hydrocarbons produced during the combustion of cellulose and lignins. In this study, we explored the use of bioremediation and rhizoremediation techniques for soil restoration in a field-scale trial in a protected Mediterranean ecosystem after a controlled fire. Our bioremediation strategy combined the use of Pseudomonas

	putida strains, indigenous culturable microbes and annual grasses. After 8 months of monitoring soil quality parameters, including the removal of monoaromatic and polycyclic aromatic hydrocarbons as well as vegetation cover, we found that the site had returned to pre-fire status. Microbial population analysis revealed that fires induced changes in the indigenous microbiota and that rhizoremediation favours the recovery of soil microbiota in time. The results obtained in this study indicate that the rhizoremediation strategy could be presented as a viable and cost-effective alternative for the treatment of ecosystems affected by fires.
Keywords	Forest fires, Rhizoremediation, Indigenous Culturable Microbes, Microbiota