AGRIWAYS | VOLUME 1 | ISSUE 1 | JUNE, 2013 | 60-61

RESEARCH NOTE

BIOREMEDIATION: ENVIRONMENTALLY SAFE AND NATURAL APPROACH

■ Monika Singh and K. R. K. Prasad

Division of Crop Improvement, Central Soil Salinity Research Institute, Karnal (HARYANA) INDIA

Industrialization and extraction of natural resources have resulted in large scale environmental contamination and pollution. Large amounts of toxic waste have been dispersed in thousands of contaminated sites spread across the nation. Thus every one of us is being exposed to contamination from past and present industrial practices, emissions in natural resources (air, water and soil) even in the most remote regions. The risk to human and environmental health is rising and there is evidence that this cocktail of pollutants is a contributor to the global epidemic of cancer, and other degenerative diseases. The challenge is to develop innovative and cost-effective solutions to decontaminate polluted environments, to make them safe for human habitation and consumption, and to protect the functioning of the ecosystems which sustain human life. This problem has led to modern-day bioremediation. Bioremediation is the transformation or degradation of contaminants into non-hazardous or less hazardous chemicals. Bacteria are generally used for bioremediation, but fungi, algae and plants have also been used. Bioremediation is not a new technology. There has been evidence that compost piles existed as far back as 6000 BC, and in 1891 the first biological sewage treatment plant was created in Sussex, UK. However, the word "bioremediation" did not appear in peer-reviewed scientific literature until 1987.

Bioremediation is normally carried out by indigenous microorganisms whose activities can be enhanced by either supply of suitable nutrients or by increasing their population. Therefore, this process exploits such microorganisms and their enzymatic activities to effectively remove contaminants from contaminated sites.

Some of the microbes that can be used for bioremediation include Deinococcus radiodurans, Geobacter sufurreducens, Dehalococcoides ethenogenes, Thermus brockianu, Alcaligenes eutrophus and many more.

Bioremediation is a cost effective and an environmental friendly technology which operates through the principles of biogeochemical cycling. Bioremediation technologies can be broadly classified as ex situ and in situ technology. If the process occurs in the same place affected by pollution then it is called in-situ bioremediation. In contrast, deliberate relocation of the contaminated material (soil and water) to a different place to accelerate biocatalysis is referred to as *ex-situ* bioremediation. Some of the examples of *in situ* and *ex situ* bioremediation are land farming, composting ,Bioreactors, Biofilters, Bioventing, Bioaugmentation and Biostimulation.

Bioremediation is a successful technique has its application in cleaning up of soil, surface water, groundwater, sediments and ecosystem restoration. It has been unequivocally demonstrated that a number of xenobiotics including nitro- glycerine (explosive) can be cleaned up through bioremediation. Bioremediation is generally considered to include natural attenuation (little or no human action), bio-stimulation or bio-augmentation, the deliberate addition of natural or engineered micro-organisms to accelerate the desired catalytic capabilities thus bioremediation, Phytoremediation and rhizoremediation contribute significantly to the fate of hazardous waste and can be used to remove these unwanted compounds from the biosphere. As every technique has its pros and cons so bioremediation has also its limitations. Some chemicals are not amenable to biodegradation, for instance, heavy metals, radio nuclides and some chlorinated compounds. In some cases, microbial metabolism of contaminants may produce toxic metabolites.

But as bioremediation offers several advantages over conventional techniques, is often less expensive and site disruption is minimal and it eliminates waste permanently with long-term liability and has greater public acceptance, with

regulatory encouragement. Most bioremediation systems are run under aerobic conditions, but running a system under anaerobic conditions may permit microbial organisms to degrade otherwise recalcitrant molecules also.

REFERENCES

Brim H, McFarlan S C, Fredrickson J K, Minton K W, Zhai M, Wackett L P and Daly M J (2000). "Engineering Deinococcus radiodurans for metal remediation in radioactive mixed waste environments". *Nature Biotechnology*

Bender J and Phillips P (2004). Microbial mats for multiple applications in aquaculture and bioremediation. Bioresource Technology, **94**, pp. 229-238.

Cole J (1993). Controlling environmental nitrogen through microbial metabolism. Tibtechnical , **11**, pp. 368-372.

Dewitt N (2000). Mixed waste bioremediation. Nature Biotechnology, 18,lO.

Diaz E (2008). Microbial Biodegradation: Genomics and Molecular Biology (1st ed.). Caister Academic Press. ISBN 1-904455-17-4

Huang J W, Chen J, Berti W R and Cunningham S D (1997). Phytoremediation of lead- contaminated soils: role of synthetic chelates in lead phytoextraction. Envir.Sci Tech., **3 1**, pp. 800-805.

Milanese M, Chelossi E, Manconi R, Sara A, Sidri M and Pronzato R (2003). The marine sponge Chondrilla nucula Schmidt, 1862 as an elective candidate for bioremediation in integrated aquaculture. Biomolecular engineering, **20**, pp. 363-368.

****