ACTA SCIENTIFIC AGRICULTURE (ISSN: 2581-365X)

Volume 3 Issue 1 January 2019

Editorial

Environmental Cleanup - Safely

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Received: November 19, 2018; **Published:** November 30, 2018

Extensive mining and milling of metals, agriculture and industry have released extensive amounts of toxic compounds into the environment. Prolonged and excessive exposure to environmental pollutions comprise a serious health threat to all the living organisms. A range of chemical and physical approaches including solidification/stabilization, washing and excavation of contaminated soil have been used *in situ* and *ex situ* for the removal of metals and other organic pollutants [1]. Many of these methods have high maintenance costs and may cause secondary pollution or adversely affect biological activities, soil structure, and fertility. There is an urgent need for alternative, ecofriendly and effective techniques to clean-up the environment safely. Phytoremediation and natural zeolites are highly recommended techniques proved to be effective in environmental pollution remediation.

Phytoremediation can be defined as the efficient use of plants and the associated microorganisms to remove and detoxify environmental contaminants in soils, waters, air or sediments. The most efficient plants used for phytoremediation are those endemic to metallic-ferrous soil and can tolerate significantly higher amounts of heavy metal or trace elements than other plants, such as Indian mustard (*Brassica juncea*), corn (*Zea mays* L.), sunflower (*Helianthus annuus* L.) and alfalfa (*Medicago sativa*) [2]. Plants exhibit different mechanisms to remove pollutants from the environment including extraction (uptake, translocation and accumulation of pollutants in plants), volatilization (extraction of compounds from soil and out-gassing through leaves), degradation (degrade organic pollutants inside the plants or within the rhizosphere) and rhizofiltration (absorption or adsorption of the pollutants by roots) [3]. Phytoremediation efficiency of plants can be significantly improved using genetic engineering technology to transfer genes responsible for organic and inorganic pollutants manipulation such as those responsible for glutathione, phytochelatins and metal transporters biosynthesis.

Natural Zeolites (known as molecular sieves) are a group of highly crystalline aluminosilicates minerals, that when dehydrated, develop a porous structure that can absorb molecules with high selectivity based on their size. These surface pores are negatively charged, microscopically small in size which enables zeolites to act as a suitable solution to remove toxic cations by adsorption. There are about 50 natural zeolites species, among them clinoptilolite is the most abundant in soils and sediments and the most efficient ion exchange and ion selective material for removing and stabilizing heavy metals. Several studies proved the potentiality of natural zeolites in air, water and soil purification from heavy metals and as fertilizers for better plant growth and production by establishing better retention of nutrients. The mechanism of zeolite-induced immobilization of heavy metals can be briefly summarized by the effect of dissolved zeolites in increasing the alkalinity of the soil, which promotes the heavy metals sorption via surface complexation processes. The highly specific surface of natural zeolites play a significant role in heavy metals retention and immobilization [4]. Worth to mention that, zeolites have also many nutritional and medicinal approaches. Oral consumption of zeolites can detoxify the human body from toxic heavy metals by increasing the excretion of these metals from the body in a safe way.

The researches dealing with phytoremediation and natural zeolites have been flourish the last 20 years. In the next coming issues we will present in details the recent advances and the future of these technologies as potentially promising methods for environmental pollution remediation that gained wide acceptance from the researchers and the public.

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