REVIEW ARTICLE

PHYTOREMEDIATION PROCESS FOR HYDROPHONIC PLANT OF REFINERY WASTE WATER

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ABSTRACT

Wastewater treatment has been normally carried out by conventional systems. These systems along - with advanced technologies being employed at many places are highly dependent upon power availability,skilled,manpower and waste load characteristics. In developing countries,some of these could be critical towards efficient waste treatment. The demand of time to develop a sustainable wastewater treatment system overcoming. Phytoremediation Technology based on aquatic plant systems to solve the current runoff and wastewater quality problems. Phytoremediation depends on naturally occurring processes in which plants detoxify inorganic and organic pollutants with the help of degradation,sequestration and/or transformation. Phytoremediation is being used successfully to deal with a wide range of solid, liquid and gaseous substrates.

Keywords : Phytoremediantion, Hydrophonic plant, waste water, HPLC,

INTRODUCTION

Many of the cities in India have been provided with treatment systems but Pollution Control Boards have not been able to maintain and run the systems properly, leading to non-functionality of most of these waste treatment units. Many pollution Control Boards in the country are in poor shape in terms of finances. The need and priority, therefore, of these Pollution Control Boards are not waste treatment but to give good water supply, health care and solid waste collection. The issue of giving low priority to waste treatment and disposal of wastewater for many Pollution Control Boards is not realized either by residents or people's representatives. Majority of the Pollution Control Boards apply themselves mainly to collect wastewater and channelise them to single or multiple disposal points.

The term phytoremediation (phyto=plant and remediation=correct evil) is relatively new, coined in 1991. Phytoremediation includes variety of research areas including constructed wetlands,oil spills, and agriculture plant accumulation of heavy metals (EPA, 2000). Phytoremediation, the use of plants to remove/reduce the pollutants from the environment studies because of the advantages to its environmental studies because of the advantages of its environmental friendliness, cost effectiveness and the possibility of harvesting the plants for the extraction of absorbed contaminants such as metals that cannot be easily biodegraded for recycling among others (Maine et al, 2001, Maine et al, 2004, skinee et al, 2007; Malik, 2007).

Plants in a natural system provide a substrate (roots, stems and leaves) upon which microorganisms can grow as they break down organic materials and uptake heavy metals (McCutcheon et al 2008). However, as a result of the exponentially increasing demands of human expansion and resource exploitation, it has been recognized that natural wetland ecosystems cannot always function efficiently for desired objectives and stringent water quality standards (Wetzel, 1993). These and many other factors have led to the rapid development of "constructed wetlands" for waste (especially wastewater) treatment (Wetzel, 1993).

Phytoremediation is the utilization of plants accumulation capabilities to remove contamination from water,soil and air, the capacity of aquatic plants to remove pollutants from water is well documented (Demirezen et al, 2004).

In the last two decades, a special interest in the world is aroused by the potential of using the biological methods in the wastewater treatment, whose application as of natural and not artificial procedures of effluents provides the effluents of required quality in an economically acceptable way in the technically simple structures. Capacity of water hyacinth (*Eichhorniacrassipes* (Martius) Solma-Laubach) as a very promising plant with tremendous application in wastewater treatment is already proved (Jafari and Trivedi, 2005; Trivedi,2001).

Over the last two decades, phytoremediation has become an increasingly recognized pathway for contaminant removal from water and shallow soils and is an aesthetically pleasing, solar-driven, passive technique useful from remediation of shallow plumes with low to moderate levels of contamination (EPA, 2001).

MATERIAL AND METHODS

The recent application of phytoremediation technology by duckweed in wastewater treatment and management is quite interesting and revealing. Phytoremediation systems by duckweed are one of the options that have been widely applied for combined handling of wastewater with the nutrients used for poultry and aqua-cultural projects (Gijzen et al, 1997; Naphi et al, 2003).

Lemma minor known as common duckweed is a small, free floating aquatic plant fast growing, adapt easily to various aquatic conditions and play an important role in extraction and accumulation of pollutants from waters (Kaur et al, 2010). In particular, species of lemma are reported to accumulate toxic metals and therefore are being used as experimental model systems to investigate heavy metal induced responses, Bioavailability and bioaccumulation of various heavy metals in aquatic and wetland ecosystems is gaining tremendous significance globally (Greger, 1999). Aquatic macrophytes take up metals from water producing an internal concentration several fold greater than their surroundings. Many of the aquatic macrophytes found to be potential scavengers of heavy metals from aquatic environment and are being used in wastewater renovation systems (Abbasi et al, 1999, Kadlec et al, 2000). Aquatic plants have shown their efficiency in absorbing nutrients from various sources of polluted water (Cheng et al, 2002; Janjit et al, 2007).

Aquatic macrophytes have great potential for the phytoremediation of water contaminated with heavy metals (Zayed et al., 1998; Zhu et al., 1999; Wang et al., 2002; Miretzky et al., 2004; Peng et al., 2008; Rai, 2009), and several plants species (i.e., Alyssum bertolonni, Brassica juncea, Eichhorniacrassipes and Iberisintermedia) have been considered for phytomining of Ni, Co, TI, Ag and Au (Pinto et al., 1987; Robinson et al., 1997 ; Brooks et al., 1998 ; Anderson et al., 1999; Boominathan et al., 2004). However, No previous study has investigated the capacity of aquatic plants from water to accumulate in and few studies have been on Ag accumulation (Pinto et al., 1987; Harris and Bali, 2008; Xu et al., 2010), or the use of plants for combined phytoremediation and phytomining (Robinson et al., 1997).

Macrophytes have been shown to play important roles in marsh biogeochemistry through their active and passive circulation of elements. Through their action as nutrient pumps' (Odum, 1988), active uptake of elements into plant tissue, as seen in wetlands constructed for wastewater treatment (Kadlec and Knight, 1996) and in the use of wetland plants in phytoremediation. Phytoremediation is considered an effective, low cost, preferred clean-up option for moderately contaminated areas. Wetlands are often considered sinks for contaminants, and there are many cases in which wetland plants are utilized for removal of pollutants, including metals. The approach is generally one of "phytostabilization", where the plants are used to immobilize metals and store them below ground in roots and/or soil, in contrast to "phytoextraction" in which hyperaccumulators may be used to remove metals from the soil and concentrate them in aboveground tissues. These latter plants must be, in turn, harvested and disposed of to prevent recycling of accumulated metals when the plants decompose. However, with few exceptions (e.g. *Ceratophyllumdemersum*, a freshwater submerged rooted species, that accumulates arsenic with a 20,000-fold concentration factor- Reay,1972) wetland plants are generally not hyperaccumulaters and in any case ,the mechanical aspects of harvesting plants would be destructive to wetlands comprised of rooted plants. Therefore, for wetland plants, storing metals below ground is the preferable alternative. While many engineering studies of treatment wetlands use a black box approach analyzing levels in the influent and effluent (for e.g. , Chengetal., 2002), more must be known about patterns and processes of metal uptake, distribution and removal by different species of wetland plants.

The extent of uptake and how metal are distributed within plants can have important effects on the residence time of metals in plants and in wetlands, and the potential release of metals. This information is needed in order to better understand this system and to assure that the wetlands do not themselves eventually become sources of metal contamination to surrounding areas.

Currently, Phytoremediation is used for treating many classes of contaminants including petroleum hydrocarbons, chlorinated solvents, pesticides, explosives, heavy metals and radio nuclides, and landfill leachates. According to a recent report (Best et al., 1997), approximately 80% of the polluted ground waters are within 20 m of the surface. This suggests that a significant number of sites are potentially suitable for low cost phytoremediation applications.

In recent years, a number of articles have addressed the role of plants in remediating contaminated soils and ground waters (Paterson et al., 1990; Shimp et al., 1993; Schnoor et al., 1995; Simonich and Hites, 1995: Watanabe, 1997).

CONCLUSION:

The study would result in state-of-the-art formulation of selected plant species for the treatment of refinery wastewater. This would also help in development of user- defined or trailer- made systems for treatment of particular pollutant of interest as well as gross wastewater parameters. The study would also reveal an understanding of the mechanisms of action and responsible of the various aquatic plant species for the treatment, which could be then efficiently utilized in various aquatic plant species for the treatment, which could be then efficiently utilized in various permutation and combinations for improved efficiency of wastewater treatment.

Acknowledgements:

The authors highly acknowledge School of Environment and Natural Resources lab for providing facility of ICP-OES analysis.

REFERENCES:

Abbasi AS and Ramasai E (1999) Biotechnological Methods of Pollution Control. p.168. Universities press, Hyderabad.

Gijzen H and Kondhker M (1997) An Overview of the Ecology, Physiology, Cultivation and apllication of Duckweed in Ception Report.Annex-1, Literaturte R Review. Duckweed Research Project (DWRP). Dhaka, Bangladesh.

Greger M (1999) Metal availability and Bioconcentration in plants . In: Prasad, M. and Hagemeyer, J. (eds.), Heavy Metal Stress in Plants from Molecules to Ecosystems, 1-27.Springer,Berlin

Jafari NG and Trivedy RK (2005) Environmental pollution control by using phytoremediation technology. *Pollution Research,* 24 (4) : 875- 884.

Kaur L, Gadgil K and Sharma S (2010) Effect of pH and Lead Concentration on Phytoremoval of Lead Contaminated Water by Lemna minor. *American- Eurasian J. Agric. and Environ. Sci*., 7(5):542-550.

Maine MA, Sue NL, Lagger SC (2004) *Water Research*, 38, 1494-1501.

Malik A (2007) *Environmental International,* 33, 122-138

McCutcheon SC, Jorgensen SE (2008) Phytoremediation. *Ecological Engineering*; 2751-2766.

Naphi I, Dalu J and Gijzen H (2003) An Evalution of Duckweed Based Pond Systems An alternative Option for Decentralization Treatment and Reuse of Wastewater in Zimbabwe. *Water Sci. Technology*, 48(11): 115-112

Schnoor JL, Licht LA, McCutcheon SC, Wolfe NL, Carreira LH (1995) Phytoremediation of organic and nutrient contaminants. *Environ. Sci.Technol*., 29, 318A-323A

Skinner K, Wright N, Porter-Goff E (2007)145:234-237

Trivedy RK (2001) Use of aquatic plants in wastewater treatment. P.164-183 In: Low Cost Wastewater Technologies. ABD publishers, Jaipur

Wang Q, Cui Y, Dong Y (2002) Phytoremediation of polluted waters:potentials and prospects of wetland plants. ActaBiotechnol.22(1-2), 199-208.

Watanabe ME (1997) Phytoremediation on the brink of commercialization.*Environ.Sci.Technol.*, 31:182A-186A.

Wetzel RG (1993) Constucted wetlands: scientific foundations are critical. In: Moshiri GA, editor. Constructed Wetlands for Water Quality Improvement, Boca Raton, Florida: Lewis Publishers;p. 3-8.

Zayed A, Gowthaman S, Terry N, (1998) Phytoremediation of trace elements by wetlands plants: 1. *Duckweed. J. Environ. Qual*., 27 (3): 715-721.

Zhu YL, Zayed AM, Qian JH, Souza MD, Terry N, (1999) Phytoaccumulation of trace elements by wetlands plants:II. *Water hyacinth. J. Environ. Qual.*, 28 (1), 339-344.

Cite this article as: Khadye Ravindra A and Patil Vivekkumar V (2013) Phytoremediation process for hydrophonic plant of refinery waste water, *Int. J. of Life Sciences,* Special Issue A (1): 93- 96.