Extended Abstract | Journal of Biotechnology and Phytochemistry | 2020 | Vol 2:2

Constructed Wetlands and their Role in Remediation of Industrial Effluents *via* Plant-Microbe Interaction – A Mini Review

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Constructed wetlands (CWs) are an alternative method for wastewater treatment and its purification. In the past decades, CW techniques were hardly used for contamination removal, although first time in early 1950s, Dr. Kathe Seidel used constructed wetland for wastewater treatment. But evolutionary period started since the 1990s, this technique is used to treat various types of wastewaters i.e., industrial effluents, municipal wastewater, and drinking waters. CWs are the engineered systems that mimics the natural processes by removing the pollutants or by reducing the level of pollutants to a dischargeable limit.

Constructed wetland treatment systems efficiently remove several kinds of pollutants from wastewater, drinking water, and industrial effluents within the controlled environment and are considered as environment-friendly. Removal of effluents, metal and waste are performed through a variety of processes i.e., by increasing sorption, hydrolysis, filtration and oxidation, precipitation, binding with iron oxide, microbial activity and uptake by plants. In response to removing pollution, constructed wetlands differ in their processes, cost effectiveness and their design and also enhance the waste removal performance by using different substrates i.e., Phosphorus (P). In the recent years, scientists have tried to remediate or clean up wastewater through phytoremediation and bioremediation. Constructed wetland treatment systems use microbes and rooted plants to remove contaminants from soil or wastewater. It takes advantage of natural wetland processes (biological, physical and chemical processes) to remove contaminants but the efficiency of all the processes (Chemical, physical and Biological) differ with water residence time.

This technology is now widely used (in America, China, Argentina, Czech Republic, Greece, Netherlands, and Europe) and tested to efficiently improve water quality. However, the industrial and environmental sector pay more attention to remove heavy metals form industrial effluents using CWs. CWs are more effective and have significantly low capital costs as compared to conventional system (ITRC 2003) and also require less labor and electricity to operated (USEPA 1988). The main objective of constructing the constructed wetland is to optimize the interaction of the substrate with microbial species and plants cells and then bioconversion into harmless products.

The haplotype plants and microbes that are used in wastewater treatment not only accumulate heavy metals but also perform the function of catalysts for purification reaction. Several factors also influence the remediation process which includes plant transpiration, and growth rates, storage, and accumulation in root and leaf cells, sedimentation, pH of media. CWs are composed of one or two chambers which are filled with the substrate that support the growth of haplotype plants and microorganisms. The substrate is both directly and indirectly involved in the remediation of pollutants, directly these substrates are involved in precipitation and filtration of suspended solids, sorption of heavy metals and organic matter and indirectly act as adhesion of microorganisms and support to root system. Nowadays an integrated technique is used to efficiently remediate the contaminants or pollutants from drinking water and industrial effluents from the soil. The main aim of this review is to evaluate and explain the role of constructed wetlands to remove industrial effluent.

Conclusion:

Phytoremediation in the past years has shown a promising evidence in case of the removal of different kinds of industrial effluents from the soils as well as the waters. Removal of contaminants discharged from the industries is essential for the better sustenance of the ecosystem and the protection of the various life forms including, humans, animals, and the microbial life forms. Removal of these contaminants discharged from the industries is of extreme importance and is the most focused area research for the environmental scientists of today because of the increase in the industrialization as well as the population of the developing and under-developed countries has made it an utter requirement for the wealthy people to establish industries and fulfill the increasing demands of the increasing world population. Phytoremediation is the cheap and the most accurate and widely adopted method to remove industrial effluents from the water as well as the contaminated soils. Plant-microbe interaction in most cases does not work efficiently as it is needed to, in that case, the scientists are making their efforts to engineer certain plant growth-promoting and contaminant degrading bacteria which would harm the environment and the plants to a neglectable level and would efficiently degrade the contaminants present in the soils and in water. Several plant species like *Lolium multiflorum* (Italian ryegrass), *Typha domingensis* (Southern cattail), *Vetiver grass*, *Lolium prenne*, *Brachaiaria mutica* etc. are known as the best for the phytoremediation which work efficiently in association with the microbes colonizing their roots. Proper plant-microbes interaction strategies and the management of the floating

wetlands could aid in the development of such wetlands that can be used to treat the greater surface area of water and remove as much contaminant s as possible that could not harm the life forms thriving in the water or in the soil which would otherwise die off due to intolerable level of pollutants in their surrounding environment.

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