

EVALUATION OF NOVEL BIO-FRIENDLY TWO-STEP PROCESS IN THE REMOVAL OF HEAVY METALS FROM THE WASTEWATER

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Abstract

Two-step treatment technique was developed for the treatment of water by *Pseudomonas aeruginosa* in a bioreactor in a first phase and then the bacterial treated water was treated with the vetiver grass, cattails and water hyacinth in second phase. Two-step process of bioremediation of 13 days was found to be satisfactory for As, Ba, Cd, Co, Cr, Cu, Hg, Ni, Pb and Zn in compared to the direct treatments with vetiver grass, cattails and water hyacinth in 20 days. As the plants cannot work or tolerate the higher concentrations of heavy metals, so with the first step on an average 52.48% reduction of heavy metals were done within 5 days. It was observed that 100% removal of Pb was found by two-step process of *Pseudomonas aeruginosa* with cattails and water hyacinth, respectively in 13 days, while 98.16% removal of Pb was found by direct plant treatment of water hyacinth in 20 days. It was clear that the two-step treatment for vetiver grass, cattails and water hyacinth were found as the most effective treatments.

Introduction

The unsustainable industrialization and the improper disposal of wastewater are the main cause behind the contamination of aquatic environment. The heavy metal, such as Cd, Cu, Cr, Fe and Ni polutan from the industrial wastewater which enter into food chain and ultimately cause the threat for lives (Singare *et al.* 2011). The addition of different chemicals from various industries the characteristics of the wastewater turned into complex in nature (Kumar *et al.* 2008). It is reported that single step phenomenon is time consuming and it is not possible to eradicate the high levels of contaminants as well as it does not give the expected feedback. Biological treatment activities are regarded as the environment friendly methods in wastewater treatment (Lofrano *et al.* 2013). Bacteria could play an effective role in eradicating pollutants specially heavy metals from wastewater (Kumaran *et al.* 2013). Nowadays, plants are being used in wastewater treatment and environmental cleansing as the secondary treatment procedure. In addition, the contaminated soil, sediment and water can be decontaminated by phytoremediation activities (Kokyo *et al.* 2014). Vetiver grass has the large rooting system, rapid growth and has been showed capability in removing contaminants especially heavy metals (Roongtanakiat *et al.* 2007). Water hyacinth (*Eichhornia crassipes*) and Cattails (*Typha latifolia*) are regarded as the best species in industrial wastewater treatments (Sukumaran 2013). The objective of the study is to evaluate the efficiency of the two-step treatment process of removal of heavy metals from the wastewater.

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