International Journal of Innovative Research and Advanced Studies (IJIRAS)
Volume 6 Issue 11, November 2019

ISSN: 2394-4404

Comparative Study Of Waste Water Management By Phytoremediation Technique

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Abstract: ***The release of toxic and heavy metals as impurities gets dissolved in the water and environment persistently. Eventually water gets highly impure which harms life of living beings. This metals and toxic agents are non-biodegradable and hence needs to be removed in order to prevent their entrance in food chain. Various remedies have been adopted for overcoming this situation. Phytoremediation is an economical technique which offers relief and solution to this problem.***

Keywords: Toxic agents, heavy metals, Phytoremediation, Hyper accumulators.

I. INTRODUCTION

A. GENERAL INTRODUCTION

Waste water is generally formed due to industrial, human and agricultural activities. As a result, it gets released from different sources which cause pollution in environment due to which human life gets affected extremely. This is mainly because impurities dissolved in waste water which is exposed in the environment and causes depletion and deterioration. Waste water stabilization and management is a really big issue over which government has taken certain initiative and many modern techniques have been invented to treat waste water effectively. Proper treatment of waste water is part of sanitation for which different technical procedures and with modern tools &a plant has been adopted.

B. PHYTOREMEDIATION

Phytoremediation subject to the technology that use living plants to clean up soil, air, and water contaminated with hazardous contaminants. Phytoremediation is an economical plant-based approach of remediation that takes advantage of the ability of plants to concentrate elements and compounds from the environment and to metabolize various molecules in their tissues. It the natural ability of certain plants called hyper accumulators to bio accumulate, degrade, or render harmless contaminants in soils, water, or air. Toxic heavy metals and organic pollutants are the main targets for Phytoremediation. Various plants such as mustard plants, alpine pennycress, hemp, and pigweed have proven to be successful at hyper accumulating contaminants at toxic waste sites. Over the last 20 years, this technology has become increasingly popular and has been employed at sites with soils contaminated with lead, uranium, and arsenic.

II. LITERATURE REVIEW

Singh D. et. al. (2012) researched on Phytoremediation of lead from waste water using aquatic plants. Pistia statoities (water lettuce) is an aquatic plant which grows rapidly and

high biomass crop with an extensive root system that able to enhance the heavy metals removal. This plant exhibits different patterns to lead removal and although accumulated at high concentration mainly in roots. Mohd Sharel B. Bahardin (2008) found that the constructed wet land containing. They conclude that Phytoremediation is one new clean up technique that involves the use of plants to clean contaminants. The use of aquatic plant is suitable for waste water treatment. The study shows that duckweed is better lead removal than others from polluted water.

Saha P. et. al. (2017) found that the waste water at sukinde chromite mines area of Orissa (India) showed high level of toxic hexavalent chromium. A water hyacinth species Eichhornia crassipes was chosen to remediate the problem of chromium processed water of SCM in 15 days. These plants not only remove hexavalent cr, but also capable of reducing total dissolved solids, biological oxygen demand, COD and other elements of water also.

Nefdedieva E. E. et. al. (2017) found that wheat and barley were good at removing copper from waste water. In this they perform an experiment which includes wheat and barley were used as plants for phytoremediation. They were cultivated in the aqueous culture on the hellrigel nutrition medium prepared without phosphorous. The copper was dissolved in the medium in the concentration 0 mg/l, 0.5 mg/l, 1.0 mg/l, 2.5 mg/l, 5 mg/l, 10 mg/l, 20 mg/l. The concentration or the 'Cu' content were identified in solutions by the ion meter in two weeks of cultivation. Particularly it is possible for more ions or heavy metals. They conclude that Barley was more effective and tolerant then wheat. The optimal concentration of copper was 2.5 mg/l, in this variant we can get the max permissible concentration (1.0) at the end of the experiment.

Kulkarni B. V. et. al. (2017) researched on phytoremediation of textile process effluent by using water hyacinth. It has been observed that there is a reduction of 80% in COD & about 25 to 45% reduction in metals after 18 days period. They conclude that although the process is efficient it consumes more time & requires higher land area. It also produces nuisance of odor& flies. Hence phytoremediation by the use of water hyacinth is recommended as polishing treatment for the textile process effluent.

Hegazy A. K. et. al. (2012) worked on phytoremediation of industrial waste water by typha domingnesis to update heavy metals as well as its potential application for phytoremediation was assessed. This study specially focused on the capacity of typha domingenesis to absorb & accumulate aluminium, iron, zinc & lead. Rhizofilteration was found to be best mechanism to explain typha domingensis phytoremediation capability. They conclude that the concentration of Al3+, Fe3+, Zn2+7& Pb2+ in waste water ponds in the study area exceeded the upper limits indicated by the Egyptian environmental regulations. The plant which is typha domingnesis absorb & concentrate all these heavy elements.

Patel S. J. et. al. (2013) studied phytoremediation of Cu & Ld by using sunflower, Indian mustard and water hyacinth plants. They carried out experiment in the sunflower& mustard seeds were sown in tested soil. After germination of metal solution of different concentration of lead & copper where added to separate plants. The plant was allowed to grow under suitable condition like sunlight & moisture after 20 days of incubation with metals, plants were removed & subjected to digestion. They concluded that copper absorption by plants was more compare to lead. Sunflowers shows high absorption compared to other two & it was much higher with the use ofenhances like EQTA.

Baudh k. et. al. (2002) investigated that Phytoremediation is an emerging, eco- friendly and economically feasible technique for the restoration of heavy metals contaminated environment. In this investigation, five native macrophytes growing naturally in a drain receiving tannery effluent vizBacopa monnieri, Eichhornia crassipes, Hydrilla verticillata, Ipomoeaaquatica and Marsilea minuta were evaluated for their heavy metal (Cr, Cu, Ni and Pb) accumulation potentialin field conditions at Unnao, U.P., India. The results showed that metal accumulation by these macrophytes differed among species and tissue parts. The concentration of Cr, Cu, Ni and Pb in the root tissues were estimated in the range 3.38 - 45.59, 1.01 -16.85, 1.81-4.43 and 1.02 -4.24 µg g-1 d.wt., whereas the corresponding shoot values were 8.79 -48.81, 1.01-8.67, 0.84 -2.89 and 1.02 -2.84 for Cr, Cu, Ni and Pb respectively. Among the studied plants the translocation factor (TF) ranged between 1.07-2.60, 0.75-3.83, 1.44-2.57 and0.49-3.76 for Cr, Cu, Ni and Pb, respectively. Findings suggest that E. crassipes can be used for phytoremediation of Cu and Ni whereas M. minuta and H. verticillata can be applied for the removal of Cr and Pb respectively from the contaminated water bodies.

Sukhri Bin A. et. al. (2001) investigated phytoremediation of Cd, Ni, and Cr by using scindapsus pictus var argyaeus to hydroponically treat digested industrial sludge contaminated with Cr, Cd and Ni. This species was planted in hydroponic pots placed under transparent roof to stimulate the natural environment. The pots were applied with 6.05mg and 13.50 mg digested dried industrial sludge. Generally, the absorption of heavy metals of scindapus pictus var argyaeus was in the order of Ni greater than Cr and Cr is greater than Cd. The species could be able to remove about 66% of Ni, 19% of cd and 53% of Cr from the plants.

Quang T. et. al. (2014) Vietnam has been intensively studied phytoremidiation during the past decade due to its cost-effectiveness and environmental harmonies. The evaluation on ability to remove Cr, Ni in water of some plant species was done. The plant species were capable of removing Cr and Ni from contaminated water. The experiments on tolerance of 7 plant species were evaluated. Plant was washed and grown in clean water before 3 days experimental set-up. Cr and Ni concentrations in each pot were 1, 3, 5, 7 and 10 mg / l. After 14 days experiment, the investigated plants were harvested and then washed with tap water to remove dust, rinsed with deionized water, and kept for 10 hour to evaluate theplant fresh weight. The results showed that the tolerance of these species can be arranged in the following order: Vetiveria, zizanioides, Phragmites, australis, Eichhorniacrassipes, Pistiastratiotes, Ipomoea aquatic, Nypa fruticans, Enhydra fluctuans. Two plant species having hightolerance to Cr and Ni (Vetiveria zizanioides and Phragmites australis) were selected for further studies.

Charne T. et. al. (2012) observed that there is growing global concern for the environmental and health hazards due to heavy metal contaminants, especially lead in the soil and ground water. They claimed that potential for plant and animal uptake, metabolism, and propagation into food-chain poses great health risks. They evaluated the potential of using aqueous extracts of edible vegetables and fruits for the in-situ remediation of lead con-taminated water (1300 ppm). The plants used in this study include Mustard Green (Brassica juncea), Spinach (Spinacea oleracea), Collard Green (Brassica oleracea), Bitter Leaf (Vernonia amygdalina), Carrot (Daucus Carota Sativus), Red, Green, and Yellow Bell Pepper (Capsicum Annuum), Tomatoes (Lycopersiconesculentum), Red and White Grape (Vi-tis vinifera), and Lime (Citrus aurantifolia). After shaking triplicate reaction mixtures lead contaminated water and each substrate for 22 hours at room temperature, lead removal by the substrates were analyzed by EPA Method 6010, using Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES). Results suggest that the order of lead removal is Collard Green (99.8%), Spinach (98.7%), Mustard Green (98.2%), Green Bell Pepper (97.8%), and Yellow Bell Pepper (97.75%) White Grape (96.7%), Carrot (95.5%), Red Bell Pepper (94.28%), Red Grape, 93.5%, Tomatoes (84%), Bitter Leaf (61%). Their study concludes that liquid substrates such as the supernatants from pureed edible tuberous, leafy, and fruity vegetables can effectively remove lead from contaminated water.

III. CONCLUSION

After reviewing and surveying various literature papers, the following conclusions were drawn:

- ✓ Aquatic plants which grow rapidly can remove heavy metals efficiently.
- ✓ Plants are capable of reducing total dissolved solid, BOD, COD.
- ✓ Concentrations like Al3+, Fe 3+, Zn 2+, Pb 2+ can be removed by using typha domingensis.
- ✓ Plants species like G. Penelliana is the best species for phytoextraction, with BCF range 11 to 22.
- ✓ Roots of the species play vital role in accumulating heavy chemicals and maintaining shoot-root quotient.
- ✓ Usage of media like Yeast Mannitol Agar (YEMA) for profilteration of Agrobacterium Rhizogenes is good to enhance root's biomas.
- ✓ Absorption capacity varies with plant's organs like root greater than stem, and stem is greater than leaves.
- ✓ Some edible plants along with wheat and barley also act as hyperaccumulators, serving in reduction of harmful content.

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