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The Efficiency of Lemna minor L. in the Phytoremediation of textile dye wastewater

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Abstract

The study involved a laboratory experiment on the use of Lemna minor L. in the phytoremediation of a waste water from sanganer textiles. The physiochemical characteristics of the waste water were determined before and after the treatment. The experiment lasted for three weeks and the rate of reduction was recorded. The highest rate of mean reduction were for heavy metals accounting 99.6%, 93.3%, 99.3%, 94.3%, 100% and 95.4% of Cd, Hg, Zn, Mn, Pb and Ag respectively. Other physiochemical parameters include Total Dissolved Solids (TDS) 81.3%, Chemical Oxygen Demand (COD) 91.6%, Nitrate 93.3%, Biochemical Oxygen demand (BOD) 68%, Conductivity 50.3%, Total suspended Solids (TSS) 77.3%, Turbidity 85%, 81% Total Solids (TS) and the pH were increase from 6.29 to 7.7. Lemna minor L. is a suitable candidate for effective phytoremediation of textile dye wastewater of sanganer industries.

Introduction

Dyeing and textile printing industries of Sanganer houses about 400 small scales and one large scale industry [1]. These industries use a variety of chemicals and azo dyes (direct, reactive, rapid, mordant and premetalised etc.) during processing and finishing of raw materials. The workers in those industries are exposed to such dyes with no control over the length and frequency of exposure. Further, a huge volume of mostly untreated textile dye wastewater (10,000 - 15,000 Kl/day) is released into surface waters of Amani Shah drainage or through the drainage systems, seeps into the groundwater and adjoining water bodies flowing through Sanaganer. The untreated waste water is discharged directly into the drains that connect the industry to the main drainage network through the nullas in the town. The effluents disposed in open drains are directly used for crops cultivation which affects the nearby agricultural land also. (1,2)

Methodology

Lemna minor L. was kept on a filter paper to remove excess water and then transferred into plastic troughs having a capacity of five liters containing water from different points. Before transferring the test plant into the trough containing the water sample, the water characteristic were determined by analyzing some physiochemical parameters like TSS, TDS, BOD5, COD, Conductivity, pH, Turbidity, Nitrate and some heavy metals such (Mn, Zn, Ag, Cd, Hg). After 21 days, the water was re-analyses. The value before phytoremediation was noted as initial value while the value after phytoremediation is indicated by final value.

Results and discussion

Dye effluents studied form Sanganer dyeing and Printing industry are highly polluted with high degree of alkalinity, dissolved solids, cations and anions which are not in compliance with standard. Such waters are not only unfit for secondary human use such as swimming or irrigation but also a serious threat to ground and surface water resources.

Various methods of dye removal, including aerobic and anaerobic microbial degradation, coagulation, chemical oxidation, membrane separation, electrochemical treatment, filtration, flotation, hydrogen peroxide catalysis, and reverse osmosis, have been proposed from time to time. There are two major technologies available for dye removal, i.e., oxidation and adsorption. There are many adsorbents available in market but their use is often limited due to high cost, making them unfavourable for the needs of developing countries like India. Therefore, fly ash, a by-product of thermal power plants, is used as adsorbents for removal of dyes.(3,4)

Conclusion

Water quality study of textile dye wastewater has brought to the fore some important concerns that were muted by research works like Lekwot et al. [43], which indicated the presence of several heavy metals in high concentration to cause contamination to biotic species of flora and fauna that, abound in the wastewater stream. Other parameters monitored such as the oxygen characteristics of the water in terms of COD, BOD and DO are all indicating toxicity above the threshold that can be purified by the wastewater. These studies shows that Lemna minor L can be use in effectively in the treatment of the textile dye waste water there by reducing the toxicity on the flora and fauna since it is able to remove and degrade pollutants present in the stream to a significant level in all point.(5)

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