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NYPA FRUTICANS AS A POTENTIAL LOW COST ADSORBENT TO UPTAKE HEAVY METALS FROM INDUSTRIAL WASTEWATER

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Abstract. Nypa fruticans locally known as Gol leaves (GL) was demonstrated in the present study as a potential low cost adsorbent for the removal of heavy metals, especially Cr(VI) from aqueous solution. A series of batch tests were conducted and the influence of initial metal ion concentration, contact time, pH of the solution and adsorbent dosage was investigated. The adsorbent was characterized by Fourier transform infrared (FTIR) spectroscopy and Brunauer–Emmett–Teller (BET) to confirm the mechanism of the retention of heavy metals. The adsorption process was found to be strongly pH dependent and a value of 4 was optimized for the utmost recovery. The adsorption isotherm data were fitted with Langmuir equation and the maximum adsorption capacity was found to be 76.92 mg/g. Therefore, GL can be employed as an efficient and cost-effective adsorbent for the removal of heavy metals present in industrial wastewater.

INTRODUCTION

Heavy metals, in general, do not degrade biologically into harmless end products due to complex physico-chemical properties. Chromium, for instance, enters into the environment primarily through its widespread use in industries including leather tanning, metallurgy, electroplating, paint manufacturing, mining operations, chloralkali, storage battery industries and chromate preparation industries etc. [1, 2].

Hexavalent chromium Cr(VI) is known as a toxic heavy metal due to its high oxidizing ability. Industrial effluents may contain Cr(VI), in general, at concentrations ranging from tenths to hundreds of mg/L. It has been estimated that in the chromium tanning process, the leather takes up only 60–80% of applied chromium and the rest is usually discharged into the sewage system causing serious environmental impact [3]. Discharge of heavy metal containing wastewater without proper treatment can results in numerous problems such as chemical oxygen demand (COD) by the water body. The maximum levels permitted in wastewater are 5 mg/L for trivalent chromium and maximum tolerance limit of Cr(VI) in the effluent of industrial wastewater is 0.1 mg/L [4] and the recommended limit of chromium in potable water is 0.05 mg/L [5].

The existing treatment processes for chromate-containing wastewaters involve a chemical reduction process, ion-exchange [6], detoxification process using living cells such as Bacillus sp. [7], Pseudomonas putida. [8], and Anabaena variabilis [9]. However, there are many problems related to these separation techniques such as expensive, cell death due to high toxicity of Cr(VI) and complexity in separation of the liquid treated [10]. In this respect, adsorption seems to be very meaningful alternative using naturally available low cost, eco-benign adsorbent including plant leaves, barks, roots, fruit shells, agricultural wastes etc. It is evident from the last two decades that many

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