REMOVAL OF HEAVY METALS FROM DYING INDUSTRY WASTEWATER BY USING COSTLESS ABSORBENTS

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Abstract: ***The absorption of heavy metal from dying industry wastewater by charcoal from various ecofriendly natural available absorbent materials. The discharges of industrial effluents into aquatic environment cause a potential threat to the aquatic life as well as human health, which is a matter of great concern due to their toxic nature and adverse effect. The small scale dying industries generate a large amount of pollution load which in many cases is discharged into environment without any pre-treatment. The dying industries release harmful heavy metals which is 3 to 4 times higher than standard values. Heavy metals as been considered as one of the most toxic pollutants due to its carcinogenic and teratogenic nature. Several methods have been adopted for the removal of heavy metals from dying industry wastewater. These include chemical reduction, precipitation, ion exchange, electrolysis etc., but these process will contain more expensive so the small scale industries will not used those process for removal of heavy metals. In the present study, peel of jack fruit , bamboo charcoal, bark of mango are used. After activating materials are used as absorbents, the peel, charcoal, and bark are used for chromium, cadmium and lead removal process. The effect of various parameters such as dosage of absorbents for the removal of heavy metals, pH and effect of contact time, are studied. The absorbent gives the optimum results. The natural material gives 99% heavy metal removals.***

Keywords: Absorbents, Heavy metals, bark, bamboo, peel.

1. Introduction

Heavy metals is released from different industrial operations, including metallurgy, leather tanning, paint, textile industries, chemical manufacturing, pulp production, refining, dying industries etc., Many of the small scale dying industries in Tiruppur, Tamilnadu which releases the toxic wastewater directly to the river, pond the heavy metals are very dangerous to our human being and animals. It causes skin, lungs and throat cancers, increased incidences of birth and developmental defects along the children, According to the world health organization (WHO) safety level of industrial wastewater releases guidelines, the maximum recommended limit for heavy metals Cd is 0.01mg/l, Cr^{6+} is 0.05mg/l and Pb is 0.05mg/l. A natural absorbent plays a major roll to remove the heavy metals from dying industry wastewater. The main advantage of natural material used removal technology is its
effectiveness in reducing the concentration of heavy metals which present in dying industry wastewater. A number of conventional treatment technologies have been considered for treatment of wastewater contaminated with organic substances. As a result of the degree of problems caused by heavy metal pollution, removal of heavy metal from wastewater is important. Recently effort has been made to use cheap and available natural available as absorbents to remove the heavy metal from dying industry wastewater. For this research, dry powder from orange, banana, lemon was used as absorbents to remove the Cd, Cr and Pb present in dying industry wastewater. Parameters such as a pH, magnetic stirrer speed, absorbents dosage and contact time, were investigated.

The pore structure in test samples produced from various natural available materials was investigated using UV Spectrophotometer

2. Materials and Methods

2.1 Materials: Leaves & barks of mango tree, Jackfruit peel and bamboo sticks are the materials used as absorbents for the removal of heavy metals. The peel, leaves, bark and charcoal are economic alternative for the removal of heavy metal ions from dying industry wastewater. The main component of peel is cellulose, pectin, hemicelluloses and lignin which contain functional group as possible binding sites for metal ions.
and Pb bottled in a container and was taken to the laboratory for further analysis.**Analysis:** The heavy metals present in the dying industry wastewater sample, were analyzed by using the UV Spectrophotometer. It detected the concentration of Cd^{2+}, Cr^{6+}
$^{2+}$. The initial concentration of metal ions present

Mango Bark Bamboo Stick **Jackfruit peel**

2.2 Absorbent preparation: Mango tree bark, Bamboo sticks and Jackfruit peel are collected from local market in karamadai were cut into pieces and dried under sunlight for 2 weeks. Take 10g of dried bark, leaves and peel are washed several times with tap water and distilled water respectively, the leaves, bark and peel are taken in a separate conical flask, add each 50ml of H2So4 and 5ml of formaldehyde was added the final mixture was stirred and heated at 80ºC for 24 hrs. The slurry was washed with distilled water until the pH of the filter was more than 5. And the bamboo sticks were cut into 2cm size, washed, air dried and carbonized in a muffle furnance at 450ºC for 4 hrs. the carbonized bamboo sticks were grinded into powder and mixed with zinc chloride at ratio of 1:3. The resultant mixture was heated to a paste and then washed with distilled water to a pH 6 and then dried in an oven between temperature range of 110ºC for 5 hrs. Finally, all the samples are dried into the normal room temperature and then powdered passed through 250-500m standard sieves. Finally, the powders were placed in a tight container for further analysis.

Activated slurry **Bamboo Powder** **Mango Powder**

Activated slurry jackfruit.

Dying industry wastewater: The wastewater sample used was collected from the effluent discharge point of dying industry in Tiruppur, Tamilnadu state. It was carefully in the wastewater are shown in table 1.

Table 1: initial concentration of metal ions present in dying industry wastewater.

Heavy metals	*Initial concentration (mg/l)*
Cd^{2+}	0.542mg/l
Cr^{6+}	0.89mg/l
Pb^{2+}	0.78mg/l

Absorbent study: Absorbent experiment was done by measuring 100ml 0f wastewater sample and poured into a 250ml

conical flask. 0.5g of test samples was added to the wastewater. The sample was placed on a jar of rotatory shaker and shook at 120 rpm at a room temperature for a period of 5min after settling the sample again it shook 80rpm of 30min to ensure equilibrium. The suspension was filtered use Whatman filtered paper 42. UV Spectrophotometer was used to analyse the concentration of the different metal ions present in the filter paper by the absorbent evaluated by using equation(1):

$q_r = (c_o - c_r)V/w$

Effect of Contact Time: The effect of contact time on removal of metal ions was studied for a period of 30min. 0.5g of the absorbents was added to different conical flask contain 100ml of wastewater, it involved in rotary shaker, and agitated at 120rpm, for each of the different contact time as been selected (20, 60, 80, 120 min). Finally it will be filtered and stored .

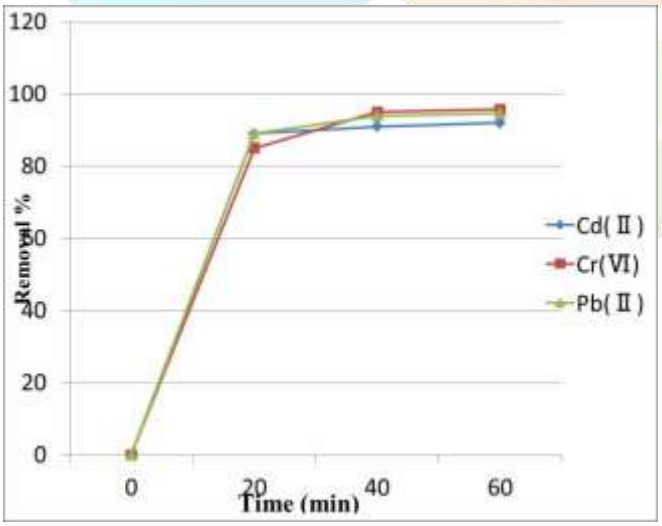
Effect of pH: Over a pH range of 2-5, the effect of pH on absorbent on metal ions was studied. 100ml wastewater sample was measured into 250ml conical flask and 1g of absorbents was added and agitated for few min. After the pH value was noted by using pH meter.

Effect of Absorbent Dosage: Different dosages of the adsorbents 0.5 to 1.6g were added in different conical flasks containing 100ml wastewater sample, it will agitated for few 5 min.

3. Results and Discussion

3.1 Effect of Contact Time

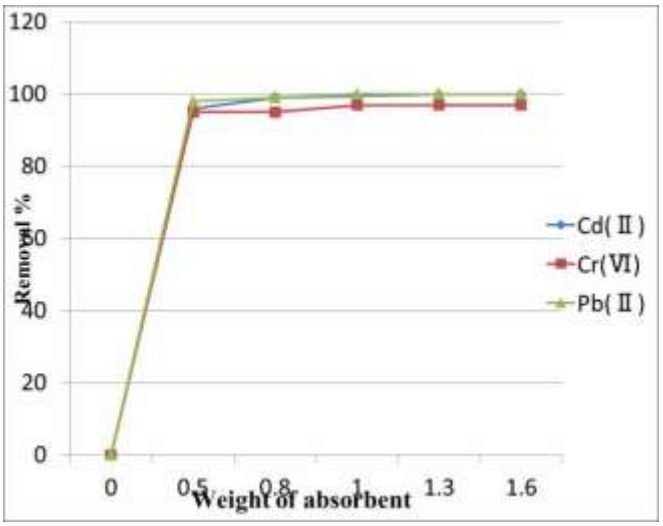
The effect of contact time was studied at a room temperature of 36ºC, at intervals of 30min. From the result, it is evident that the removal of metal ions increased as contact time increases. Cadmium, chromium and Lead were removed using the absorbents. The percentage of removal is 35 min for Pb(Ⅱ), 50min for Cd(Ⅱ), with recording Bamboo charcoal (Cd(Ⅱ) 92%), For Mango bark Cr(Ⅵ) (95.76%)and Jackfruit peel (Pb(Ⅱ) 94.6%) removal. This experimental shows that the different metal ions attained equilibrium at different times.



Graph 1: Effect of Contact time of heavy metals by Mango bark(Cr(Ⅵ)), jackfruit peel(Pb(Ⅱ)), bamboo stick(Cd(Ⅱ)).

3.2 Effect of Absorbent Dosage

The absorbent dosage was varied from 0.5 to 1.6, under the specific conditions (pH of 2, contact time 30 min, 120rpm and room temperature 36ºC). the removal of Pb(Ⅱ) attained maximum removal even at a absorbent dosage of (Jackfruit peel of 0.8g with 99.8%, (Cr(Ⅵ) Mango bark of 1.2g with 97%,and (Cd(Ⅱ)) Bamboo stick of 1.6g with 99.9%) removal, increase in absorbent dosage, also increased the percentage removal of respectively, after increasing the absorbent dosage leads to result of overlapping due to overcrowding of absorbent materials. Hence, 1.1g was chosen as the optimum absorbent dosage for removal of metal ions.



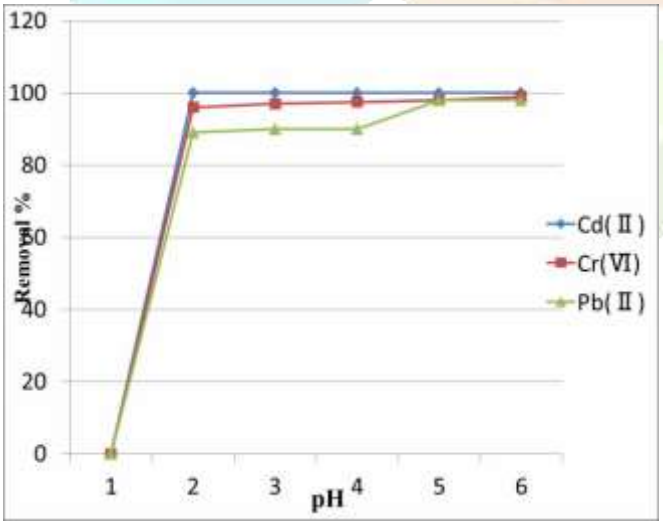
Graph 2: Effect of Absorbent Dosage of heavy metals by Mango bark(Cr(Ⅵ)),jackfruitpeel(Pb(Ⅱ)), bamboo stick(Cd(Ⅱ)).

3.3 Effect of pH

The pH of the wastewater sample is one of the important factors absorbent of the metal ions. The pH range was studied from a range 2 to 6 under such condition(at optimum contact time of 30 min, 120rpm speed, with 0.5 g of the absorbents) the test samples are used as a absorbent, it was observed that with increase in the wastewater, the removal percentage of metal ions all increased up to pH 6. In Mango

bark the pH 6, maximum removal of Cr(Ⅵ), 99%. For jackfruit peel (Pb(Ⅱ), 98%, Bamboo stick (Cd(Ⅱ), 100% .

The percentage removal of the metal ions may explain by the pH at higher concentration of the absorbent surface is negatively charged.



Graph 3: Effect of pH of heavy metals by Mango bark(Cr(Ⅵ)), jackfruit peel(Pb(Ⅱ)),bamboostick(Cd(Ⅱ)).

Conclusion

In this work, experiments were studied under laboratory conditions. From the experimental data of absorbent of Pb(Ⅱ), Cd(Ⅱ), Cr(Ⅵ) ions into Mango bark, Jackfruit peel, Bamboo charcoal powder, the following points can be concluded, the absorbent capacity of metal ions was found dependent on contact time, pH, absorbent amount and metal ion concentration of heavy metal. The obtained maximum absorbent capacity of peel samples for removal of selected

heavy metals was 99% for Pb(Ⅱ), 100% for Cd(Ⅱ) and Cr(Ⅵ) for 99% of removal. Since, it is effective low cost,

abundant and can be obtained locally. The reducing of heavy metals from waste water environmental pollution can be lowered.

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