Removal Of Lead By Adsorption Using Casuarina Fruit Shell

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Abstract- This work focuses on removal of lead from its prepared synthetic sample using casuarina fruit shell as Adsorbents. Effect of contact time, adsorbent dosage and pH on lead removal was found out. All the three adsorbents were found to be very effective for leadadsorption It was found that 50min contact time at pH 5 and 35mg adsorbent dosage was sufficient for approximately 83.5 % removal by casuarina fruit shell. At different contact time, dosage and pH, batch adsorption studies were conducted.

I. INTRODUCTION

Clean environment and beautiful nature is a gift of god to mankind. But due to rapid growth of industrialization, urbanization, all over the world coupled with population explosion have resulted in pollution of environment. The airs we breathe, the water we drink, the food we consume have been polluted remarkably by the heavy metals, which are the byproduct of various industries. Process waste streams from the mining operations, metal plating facilities, Basic non-ferrous metal waste foundries. Lead is frequently used in industrial processes, smelting process;E-waste, paints, lead acid batteries, coal based thermal power plants, ceramics, and bangle industry, and are usually present in high concentrations in the liquid wastes which are released directly into the environment without any pre-treatment. Lead is an essential and beneficial element for human growth. Concentration above 1mg/L can cause a bitter astringent taste in water. The lead concentration in water varies from 0.1 to 2 mg/L with a mean concentration.Lead most commonly enters the domestic water supply from deterioration of galvanized iron and dezincification of brass. Lead in water also may result from industrial waste pollution. The (Food and Agricultural Organization) FAO recommended maximum level for lead in irrigation water is 2mg/L. The (United States Environmental Protection Agency) US EPA primary drinking water standard is 0.1mg/L.

1.1 ADSORPTION Adsorption is one of the effective methods for removing heavy metals from waste water. But the standard adsorbents like silica gel etc are costly. So low cost adsorbent i.e casuarina fruit shell is easily available and can serve as an economically available alternative. Adsorption is a separation process in which the molecules of a fluid phase, i.e. gas or liquid are transferred to a solid surface. Therefore, the composition of the system is heterogeneous consisting of two or more fluid phases including the solid adsorbent. Molecules that have been adsorbed onto solid surfaces are referred to as adsorbate, and the surfaces to which they are adsorbed are referred to as the substrate or adsorbent. Adsorption takes place in the boundary between the phases called the interface.

1.2 Objective of the study To evaluate a feasible and economical low cost treatment of heavy metal. and Present in synthetic sample by casuarina fruit shell which is naturally available as an adsorbent.

The present study has been carried out according to the guidelines as follows

- Determination of physical and chemical properties of the carbon derived from casuarina fruit shell.
- Determination of lead removal by adsorbent as a function of contact time, adsorbent dosage and pH.

II. MATERIALS AND METHODOLOGY

The Physico-chemical Characteristics of the adsorbents is described in the table 1.

Table 1 physico-chemical characteristics of casuarina fruit shell

SL.NO	CHARECTERISTICS	UNITS	ACTIVATED CARBON
1	Moisture content	%	6.6
2	Ash content	mL/g	14.51
3	Decolorizing Power	----	120
4	pH	----	9.2
5	Surface Area	m^2/g	750
6	Specific Gravity	g/cc	0.82
7	Bulk Density	----	0.33

2.1 Preparation of Synthetic lead Solution

A. lead solution: dissolve 0.598g lead nitrate, Pb(NO3)2, in a minimum amount (1+1) of HNO3 and dilute to 1000mL with water 1.00 mL= 100µg Pb.

B. Equipment's All the glass wares used in the experimental work were soaked overnight in a 10mg/L of lead solution to minimize the possibility of lead being adsorbed on glass surface during the experimental work. The excess of lead is washed off with 1:3 HNO3 and distilled water prior to use. After completion of the experimental work the glassware is soaked in 1:3 HNO3 followed by distilled water for 4hrs to remove excess lead and then washed with tap water before soaking in 10mg/L of lead solution.

C. Procedure

Determining the microgram per liter of dissolved or total recoverable lead in each sample from the digital display or printer output while aspirating each sample. Dilution of sample were leadconcentration exceed the working range of the method. And multiply by the proper dilution factor. The concentration of lead present in the sample is directly displayed on computer's screen which is connected to AAS. Also, the results are compared by the calibration curve prepared.

D. Selection of Optimum Contact Time

The adsorption is strongly influenced by the contact time, for the study of effect of contact time 100mL of 10mg/L lead solutions is mixed with 1gm of adsorbents and stirred on Gyro shaker for various time intervals such as 5, 10, 15, 20, 25, 30, 35, 40, 50, 60, 90, 120 min. The samples are filtered analyzed for remaining lead concentrations.

E. Determination of Optimum Dosage

To determine the optimum dosage of adsorbent, various dosages of adsorbents are added to the conical flask containing known concentration lead solutions (10mg/L). The solution in the conical flask was subjected to stirring for optimum contact time and the dosage varies from 5, 10, 15, 20, 25, 30, 35, 40, 45, 50mg. Filtered and analyzed for residual and removal of lead concentrations. The dosage which gives minimum residual concentration is chosen as optimum dosage.

F. Determination of Optimum pH

To determine the optimum pH series of conical flasks were taken with 100 mL of 10 mg/L Zn (II) solutions. Optimum dosage of adsorbents is added to the respective flasks. The pH of the flasks is adjusted ranging from 2,3,4,5,6,7,8. The flasks were shaken for optimum contact time. After stirring, the samples are filtered and analyzed for the residual lead concentration. The flask containing lead, which gives minimum residual concentration, is selected as the optimum pH.

III. RESULTS AND DISCUSSION

Lead removal study has been carried out with respect to the following parameters

a) Effect of contact time

b) Effect of dosage

c) Effect of pH

a) Effect of Contact time

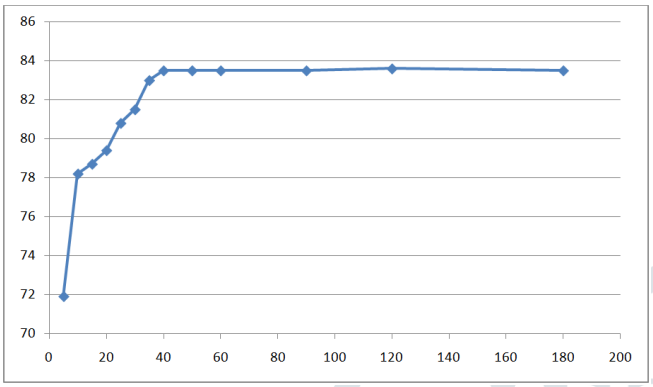
Contact time has greater role in the adsorption process. The effect of contact time on removal of lead from the synthetic sample using casuarina fruit shell. The model values are shown in tables 3.1. From this tables it is observed that contact time for adsorbent. The adsorption curves are characterizedby sharp rise in initial stage and decreases near equilibrium. This is mainly due to the large available surface area and the adsorption sites on the surface area that are open and active in the initial stage and later the adsorbent gets saturated and the removal efficiency decreases near equilibrium. Percentage of lead removal versus time is plotted as shown in the figure 3.1.

After equilibrium further increase in time, adsorption is not changing. Hence the removal efficiency of lead by casuarina fruit shell was found to be 83.5%. and optimum contact time of 50 minutes.

2. Response spectrum method

In this method linear dynamic analysis of the frame models are performed, the maximum response of the building is

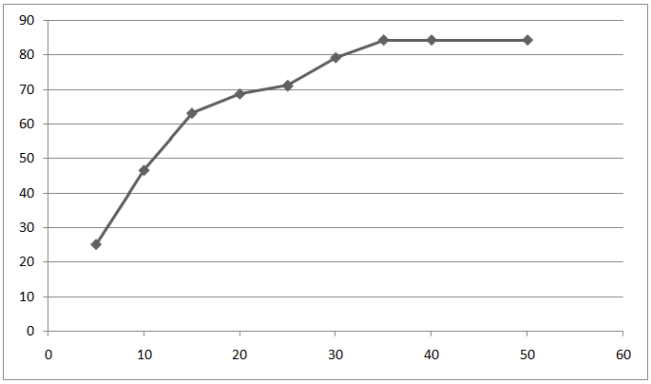
estimated directly from elastic or inelastic design spectrum characterizing the design earthquake for the site and considering the performance criteria of the building. The software solves the Eigen value problem of the model and calculates the fundamental natural period values. Hence the total earthquake loads are generated and its distribution along the height corresponds to the mass and stiffness distribution. The modeling and analysis is done using ETABS.



b) Effect of Adsorbent Dosage

Adsorption is a process in which continuous transfer of solute from solution to adsorbent occurs, until residual concentration of solution maintains equilibrium with what adsorbed by the surface of adsorbent at constant contact time. Effect of adsorbent dosages studied and percentage of lead removal versus dosage are plotted as shown in fig 3.2.

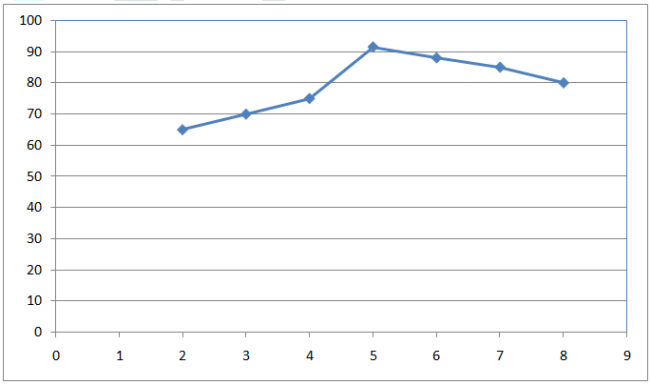
From the graph it is observed that, as dosage of adsorbents increases, the amount of lead present in the samples decreases sharply in the beginning and attains maximum later. This is mainly due to the large surface area and adsorption sites available for adsorption. Later the adsorbents get saturated and the removal efficiency of adsorbents decreases. The dosage, at which the maximum removal is attained, is taken as optimum dosage. After this not much change is observed even after increase in the adsorbent dosage. The optimum dosage for lead removal by casuarina fruit shell is 35mg with the removal efficiency of 84.30%.the respected graph are shown in figure 3.2.



c) Effect of pH

The pH of solution has influence on the extent of adsorption removal efficiencies of lead by naturally available adsorbents at different pH values are shown in table 4.3. The amount of lead removal not only depends on the surface area, optimum time and optimum dosage but also depends on pH the respected graphs are shown in the figure 3.3.

From the above-mentioned figures, it is observed that lead are removed more effectively in acidic range. The removal efficiency of lead by using casuarina fruit shell was found to be 91.5%.



IV. CONCLUSION

Based on the experimental study following conclusions can be drawn

1) The Experimental result shows good removal efficiency of lead from the synthetic solutions by using casuarina fruit shell as adsorbent.

2) The adsorption of lead is mainly pH dependent. The removal efficiency of adsorbent increases with decrease in pH value. It has been observed that maximum adsorption takes place in the acidic medium around pH 5.

3) The result of experiment on optimization of dosage of adsorbent reveals that, increase in amount of dosage added, increases the removal of lead from the solution and almost becomes constant after saturation dose.

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