REMOVAL OF HEAVY METAL LEAD (PB) FROM ELECTROCHEMICAL INDUSTRY WASTE WATER USING LOW COST ADSORBENT

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Abstract

Electrochemical industries generates a wastewater that has a potential hazard for our environment as it contains various heavy metals such as Lead, Cadmium, Nickel etc. If this wastewater left untreated, will pollute soil and water resources. Out of the above heavy metals, in this project work, only removal of Lead (Pb) from electrochemical industrial wastewater has been investigated by using low cost adsorbent such as charcoal along with coconut shell powder as a natural adsorbent. The project is a bench scale experimental type i.e. Batch mode technique and analyses have performed by using different amounts of adsorbent in solutions with different concentrations of Lead metal. Beside the effect of various amounts of adsorbent used in adsorption efficiency experiments has been investigated.

Result indicates that the maximum removal efficiency for Lead is about 94% by using 0.25 gm/L amount of activated coconut shell carbon powder (ACSCP) and charcoal powder (ACP) mixed in equal amount for particular pH and contact time.

Keywords: *Adsorption, batch mode technique, battery industry waste water, Coconut shell powder, Charcoal carbon powder, Economic, Heavy Metal.*

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1. INTRODUCTION

Toxic metals are often discharged by a number of industrial processes and this can lead in turn to the contamination of freshwater and marine environment [1]. Heavy metals are major pollutants in marine, ground, industrial and even treated wastewaters [2]. Industrial waste constitutes the major source of various kinds of metal pollution in natural waters. The important toxic metals i.e Cd, Zn, Ni, Pb finds its way to water bodies through waste waters [3]. Lead in particular has received a great deal of attention as it is one of heavy metals that can cause considerable damage to humans and aquatic life even at trace levels..The release of heavy metals into the natural environment e.g. irrigation of agricultural fields by using sewage has resulted in a number of environmental problems. And due to their non biodegradability and persistence, can accumulate in the environment elements such as food chain and thus may pose a significant danger to human and animal health [8].

Several methods are employed for the treatment of industrial effluents containing Lead. Some of the important methods are chemical precipitation, ion exchange, and electrodialysis and carbon adsorption [9]. As most available techniques for removal of heavy metal involve high investments and subsequently, are not suitable for small and medium scale industries, which dispose comparatively low volumes of wastewater. In addition this methods result in large volume of sludge, which poses disposal problems. Activated carbon adsorption is one alternative which overcomes the limitations presented by other removal methods. Adsorption is an effective purification and separation technique used in industry especially in water and waste water treatments [5]. Table 1 shows the ISI Tolerance Limit of Lead (Pb) for sewage and Industrial Effluents and that of Inland surface water

Table 1

	Tolerance Limits for Effluents discharged into-		**Tolerance limits for inland surface water, when used as raw water for public water supplies and bathing Ghats (IS 2296-1974)**
	Inland surface water (IS:2490-1974)	**Public sewers** (IS:3306-1974)	
Lead mg/L	0.1	1.0	0.1

Cost is an important parameter for comparing the sorbent materials. The cost of activated carbon prompts for use of cheaper and locally available sorbents for removal of metals from industrial wastewaters [11]. This paper reports the

results of the application of locally available coconut shell carbon and charcoal for removal of Lead from electrochemical industry effluent. The effluent was analyzed and its Lead content was determined.

2. MATERIALS AND METHOD

2.1 Materials

Activated Coconut shell carbon powder (ACSCP) and Activated charcoal powder (ACP) is used as adsorbent.

2.2 Method

Batch adsorption experiments are conducted to investigate the Lead sorption rates and adsorptive capacities by ACSCP and ACP. The 100 ml effluent of known Lead concentration is taken into jars in which different doses of coconut shell and charcoal carbon is added in equal amount and mixed at mixing rpm to keep the adsorptive material in mixing condition. The total amount of coconut shell and charcoal carbon are taken into equal amount to get 5mg, 10mg, 15mg, and 25mg respectively.

The contact time of adsorptive material for Lead effluent is kept as 30minute, 60 minutes, 90 minutes, and 120 minutes.

2.3 Equipment

The Atomic Photo spectrometer is used to detect the Lead concentration.

3. PREPARATION OF ADSORBENTS

Coconut shell is used to derive powder coconut shell carbon and wood charcoal is used as low cost material which is easily available. Both these carbon has unique surface properties as adsorbent for the removal of heavy metals ion from water and waste water. Both these carbons are economical as compared to commercially available carbon. Both coconut shell carbon and wood are given treatment of drying, chiseling followed by grinding., subsequently, the material is sieved through sieves [ISI 30(0.296mm) and ISI 15 (0.151 mm)] and the material passing through on ISI 30 and retaining on ISI 15 is used for experimental studies. Later it is dried in oven at 50^0 C for 24 hrs. Then it is further processed by treating 4 parts of coconut shells with 3 part of concentrated sulphuric acid (H_2SO_4) (by weight) and then kept in a dry oven maintained in the temperature range of 140^0 C - 160^0 C for a period of 24 hrs. The carbonized material is now washed away with water again to remove free acid and dried at 105 ^{0}C – 110 ^{o} C.

4. EFFECT OF PH, ADSORPTION PERCENTAGE AND CONTACT TIME ON LEAD REMOVAL

The four waste solutions obtained were analyzed to find the Lead content and it was found to be 19.5mg/L,19mg/L,18.7mg/L,18mg/L.The pH of each waste solution was adjusted at range 5 to 7 and measured by pH meter..In each waste solution of 100ml adsorbent were added to 5mg, 10mg, 20mg, and 25mg per liter. The solutions were agitated at constant stirring speed for 30 min, 60min, 90min, and 120min.The concentration of Lead after adsorption was measured using Atomic photo spectrometer. The percentage uptake of Lead (Pb) was calculated according to the following equation:

$$\text{Percentage uptake (\%)} = \frac{Co - Ct}{Co} \times 100$$

Where Co is the initial concentration and Ct is the concentration at time *t*.

5. RESULTS AND DISCUSSION

From the limited project work it has been found that the pH, contact time and carbon dose plays an important role in adsorptions of heavy metal Lead (Pb) from waste water.

Figure.1 shows that the maximum efficiency of Lead (Pb) by using Coconut shell carbon and charcoal carbon in equal amount is found at 6 pH and for 120 minutes of contact time is found to be 94%.

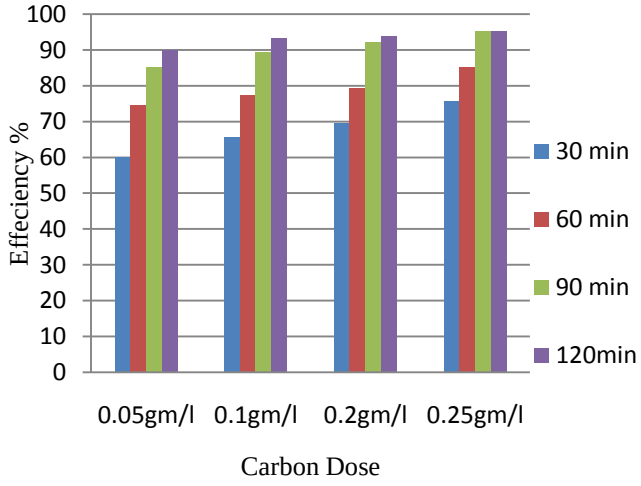

Fig 1 Effect of contact time on Adsorption of Lead at different Carbon Dose for 19 mg/L Lead concentration sample

6. CONCLUSION

From the limited experiment so far it has been found that the maximum adsorption of Lead (Pb) is up to 94%.The future scope is to analyze Adsorption Isotherm for equilibrium study for this adsorption of Lead from waste water.

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