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Research Article

HEAVY METAL REMOVAL FROM TEA-WASTE

Dr. Parag Dalal

G. Prof. Ujjain Engineering College, Ujjain

Mail- paragdalal@rediffmail.com

ABSTRACT: The pure water used in industries creates wastewater which has a potential hazard to our health and environment because of introduction of various heavy metals in solid and liquid form. In this study removal of Nickel, Cadmium and Lead from industrial waste has been investigated by using tea-waste as an absorbent.This research is experimental type and the analyses are performed using different amount of absorbent in the solution with six different concentrations of each metal and its complex. Results indicate that the removal efficiency is maximum for Lead and is minimum for Cadmium. 905 of lead are removed by using 0.5g tea-waste and 100% by 1.5g tea-waste as sorbent for solutions having 5mL and 10mL concentration of lead. Whereas 1.5g tea waste can absorb 85% of 5mL nickel solution and 76% of 5mL cadmium solution.
Key Words : Tea-waste, Cadmium, Nickel, Lead

INTRODUCTION

Toxic metals are mainly discharged by industries into fresh water streams and marines. The heavy metal pollution is the biggest problem of ground water. The most important toxic metals are Cadmium, Zinc, Nickel and Lead. The release of large amount of heavy metals into the environment is done by anthropogenic activities out of which industrialization and irrigation are the main sources. Due to non-bio-degradability and persistence these heavy metals accumulate in food chain and possess a significant disaster to human health.

Adsorption is the best purification and separation techniques of heavy metal from waste water but in industries cost is very important parameter in comparison to efficiency of absorbent materials.

In this study the efficiency of tea-waste is generated in the process of removal of heavy metals and their complexes from wastewater. The major concentration in waste water is of Lead (Pb), Nickel (Ni) and Cadmium (Cd) so these three are chosen. Nickel and Cadmium are non beneficial, un-essential and unusable elements to plants and animals and Lead also highly toxic to humans.

MATERIAL AND METHODS

The tea-waste is taken, washed with distilled water and than dried. This dry tea-waste is screened and then put in sealed polyethylene for preservation so that it does not react with neighboring environment. These polyethylenes are placed in freezer so that tea-waste does not get degraded.

The individual solutions of Ni, Cd and Pb of concentrations 5mg/L, 10mg/L, 15mg/L, 30mg/L, 50mg/L and 100mg/L were taken to determine the efficiency of tea-waste. The experiments were performed using 3 different amounts 0.5g, 1.0g and 1.5g of tea-waste.

Procedure

18 flasks are taken each containing 0.5g of tea waste used as absorbent, 90ml solution with known concentration of Pb were added so that we had 3 concentrations for each experiment and result is the average of these 3 concentrations so as to find the accurate result. All these flasks were places into a shuffler with RPM 125. After shuffling for 2 hours these concentrations are filtered by waterman 40 so that turbidity does not interfere in this result. The lead concentrations were than estimated by AAS (Atomic Absorption Spectroscopy). The same procedure is been done for Ni and Cd also.

RESULTS AND DISCUSSIONS

The study depicts about efficiency of absorption of Ni, Cd and Pb by tea-waste. It is found that tea-waste is one of the best absorbent for lead and it depends mainly on time and amount of initial concentration of metal in source. By comparison of the result we conclude that the absorption efficiency is dependent on type of metal i.e. if lead is absorbed 94% than Ni is 74% and Cd 58% in same concentration.

Table 1 – Concentration of Lead in single concentration with amount of tea waste

Tea-waste	Concentration of Lead					
	5 mg/L	10 mg/L	15 mg/L	30 mg/L	50 mg/L	100 mg/L
0.5g	0.31	1.19	2.7	5.3	15.5	23.8
1.0g	0.09	0.23	0.5	1.2	1.9	3.7
1.5g	0	0	0.3	0.7	1.9	3.7

Table 2 – Concentration of Nickel in single concentration with amount of tea waste

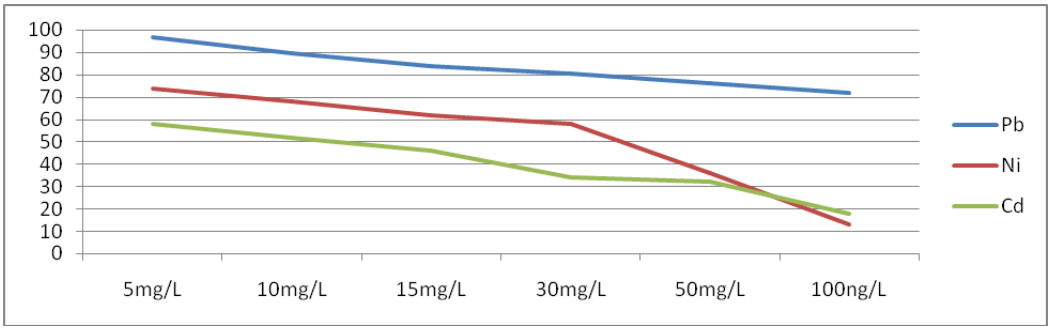
Tea-waste	Concentration of Nickel					
	5 mg/L	10 mg/L	15 mg/L	30 mg/L	50 mg/L	100 mg/L
0.5g	1.2	3.6	5.2	11.8	38.7	87.2
1.0g	0.69	2.3	3.5	10.7	21.1	42.3
1.5g	0.65	1.5	3.2	6.2	16.5	37.4

Table 3 – Concentration of Cadmium in single concentration with amount of tea waste

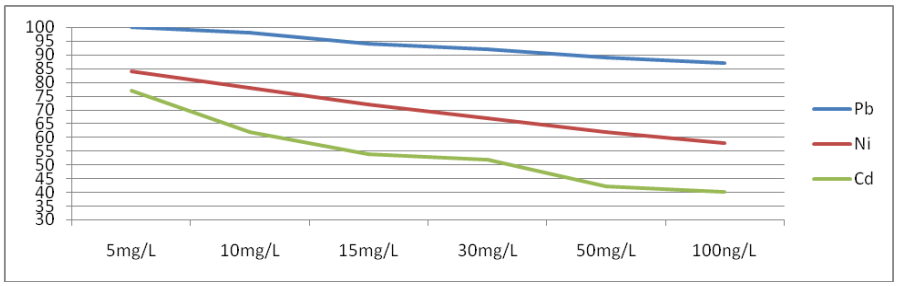
Tea-waste	Concentration of Cadmium					
	5 mg/L	10 mg/L	15 mg/L	30 mg/L	50 mg/L	100 mg/L
0.5g	1.9	5.1	8.7	21.3	41.7	75.2
1.0g	1.3	4.1	7.7	16.4	36.0	62.8
1.5g	0.94	2.7	5.5	12.0	30.0	56.7

Table 4 – Concentration of all metals in mixed concentration

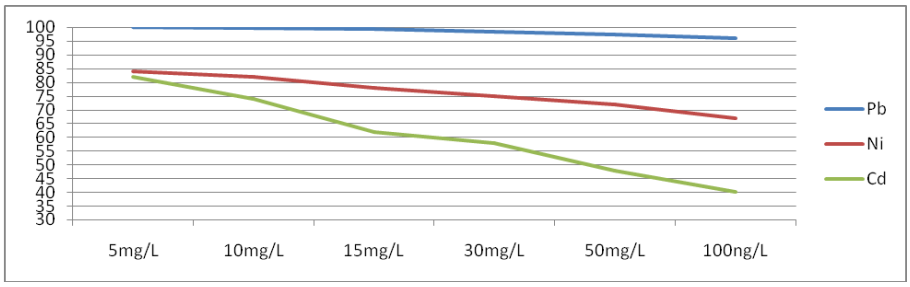
Metals	Concentration in 0.5g tea waste					
	5 mg/L	10 mg/L	15 mg/L	30 mg/L	50 mg/L	100 mg/L
Nickel	1.76	3.87	7.49	17.23	40.4	89.4
Lead	0.48	1.83	3.15	9.58	19.9	37.9
Cadmium	2.36	5.32	8.95	21.6	46.7	90.2



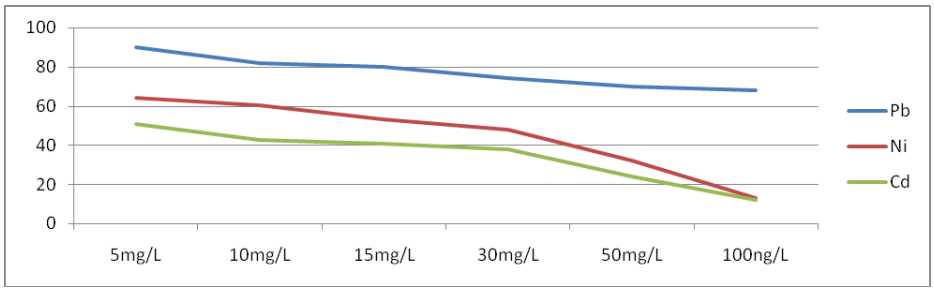
Graph 1. Efficiency for 0.5g teawaste



Graph 2. For efficiency of 1.0g Tea waste



Graph 3. For efficiency of 1.5g tea waste



Graph 4. For mix concentration

CONCLUSION

The analysis of this study indicates that tea-waste is one of the best natural absorbent of heavy metals as it cost low and has efficiency of 100% absorption also. Tea-waste is a cheap material so is convenient to use in industrial plants as absorbent.

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