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Adsorption of Heavy Metals from Waste Water using Neem Palm and Indian Beech Trees

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Abstract : Environmental pollution from hazardous metals and minerals can arise from natural as well as anthropogenic sources. Most of the industrial discharged wastewater contains heavy metals like copper, zinc and cadmium causing adverse effects on human population on consumption. In the present work, experimental investigation has been carried out on the adsorption of heavy metals such as copper, zinc and cadmium using adsorbents as barks of Neem, Palm and Indian beech trees .and studies have been carried out using analytical and spectroscopic studies. The present study is eco-friendly and cost effective compared to other methods available.
Keywords : Heavy metals, copper, zinc, cadmium.

Introduction

Metal toxicity or metal poisoning is the toxic effect of certain metals in certain forms on life. Some metals are toxic when they form poisonous soluble compounds. In the case of lead, any measurable amount may have negative health effects. Zinc is an essential requirement for a healthy body, excess zinc can be harmful, and cause zinc toxicity. Such toxicity levels have been seen to occur at ingestion of greater than 225 mg of Zinc. The free zinc ion in solution is higher toxic to bacteria, plants, invertebrates and even vertebrate fish. Ingestion of any significant amount of cadmium causes immediate poisoning and damage to the liver and the kidneys. Compounds containing cadmium are also carcinogenic in nature.

Results and Discussion

Effect of Contact Time: Zinc-Neem tree

About 1 gram of Neem bark powder adsorbent was mixed with waste water sample, mixed thoroughly using a mechanical shaker and the concentration of zinc ion at varioustime intervals was estimated by volumetric analysis (EDTA method) and the results are shown.

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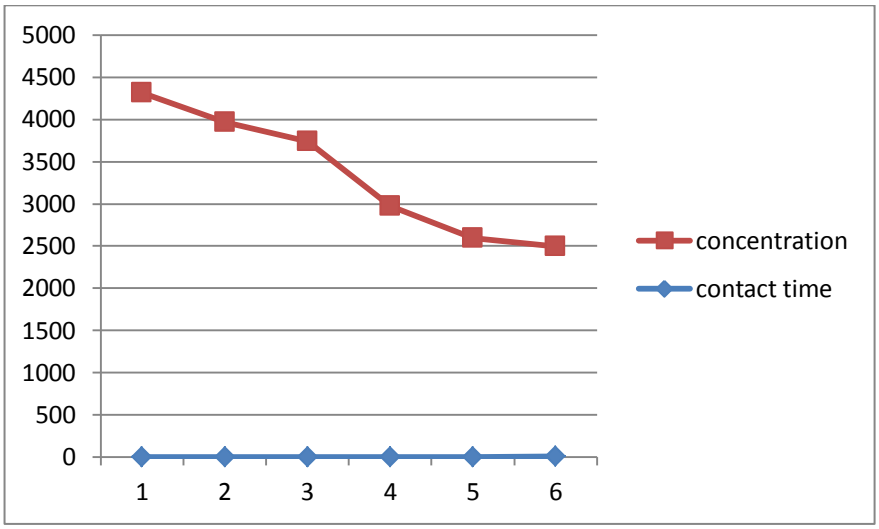
Amount of zinc ion present in Neem tree adsorbent

S.No	Contact time (in hours)	Amount of Zinc ion removed (mg/L)- Volumetric analysis
1	0	4313
2	1	3968
3	2	3738
4	3	2972
5	4	2587
6	24	2487



Graphical representation of zinc ion concentration

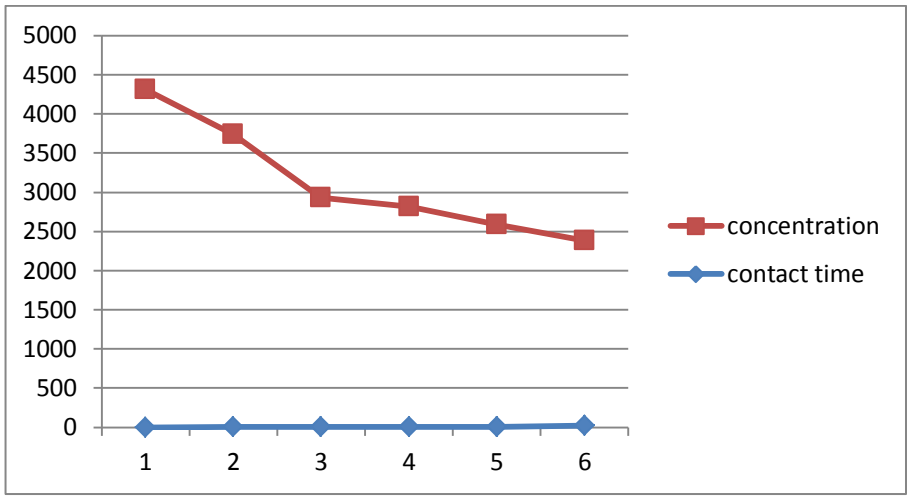
The graph shows the gradual decrease in the concentration of zinc metal ion with respect to time and on 24hrs of treating the concentration of adsorbent to the zinc solution is nearly42%.

Zinc-Palm tree

About 1 gram of palm tree bark powder adsorbent is mixed with waste water sample, mixed thoroughly using a mechanical shaker and the concentration of zinc ion at various time intervals is estimated by volumetric analysis (EDTA method) and the results are shown.

Amount of zinc ion present in Palm tree adsorbent

S.No	Contact time (in hours)	Amount of Zincion removed (mg/L)- Volumetric analysis
1	0	4313
2	1	3738
3	2	2932
4	3	2817
5	4	2587
6	24	2357



Graphical representation of zinc ion concentration

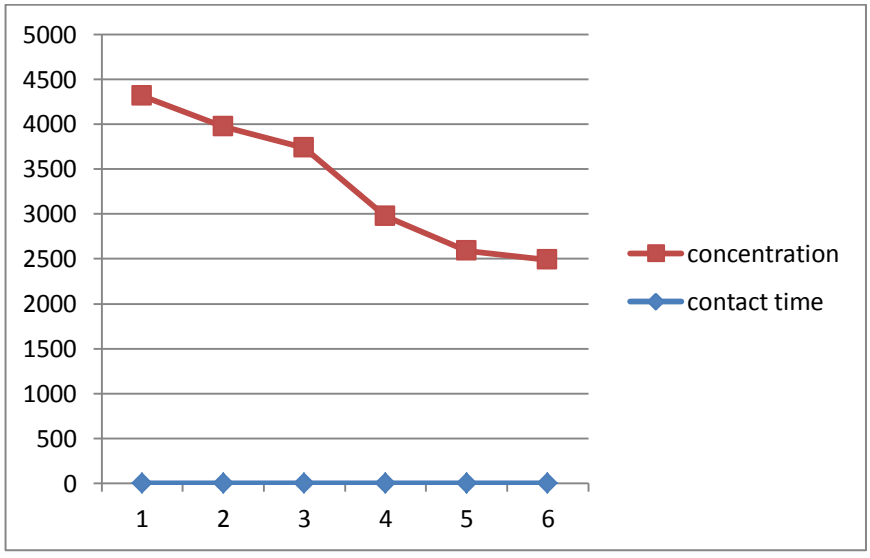
The graph shows the gradual decrease in the concentration of zinc metal ion with respect to time and on 24hrs of treatingthe concentration of adsorbent to the zinc solution is nearly 45%.

Zinc-Indian Beech tree

About 1 gram of Indian beech tree bark powder adsorbent is mixed with waste water sample, mixed thoroughly using a mechanical shaker and the concentration of zinc ion at various timeintervals is estimated by volumetric analysis (EDTA method) and the results are shown.

Amount of zinc ion present in Indian beech tree adsorbent

S.No	Contact time (in hours)	Amount of Zincion removed (mg/L)-Volumetric analysis
1	0	4313
2	1	2932
3	2	1437
4	3	1265
5	4	1150
6	24	862



Graphical representation of zinc ion concentration

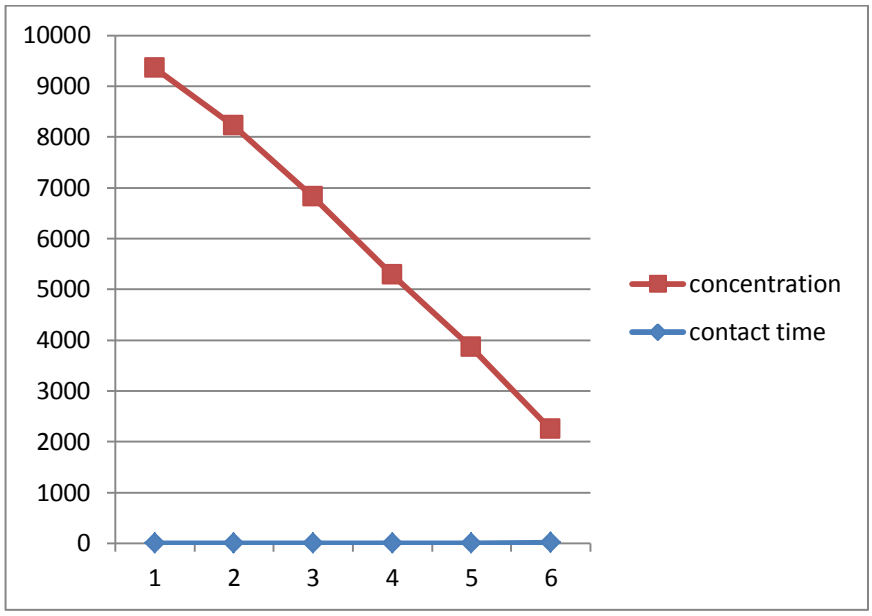
The graph shows the gradual decrease in the concentration of zinc metal with respect to time and on 24hrs of treating theconcentration of adsorbent to the zinc solution is nearly 80%

Cadmium-Neem tree

About 1 gram of Neem tree bark powder adsorbent is mixed with waste water sample, mixed thoroughly using a mechanical shaker and the concentrated cadmium ion at various timeintervals is estimated by volumetric analysis (EDTA method) and atomic adsorption spectroscopy and the values are in close agreement with respect each other.

Amount of cadmium ion present in Neem tree adsorbent

S.No	Contact time (in hours)	Amount of Cadmium ion removed (mg/L)	
		Volumetric analysis	Atomic absorption spectroscopy
1	0	9349	9690
2	1	8212	-
3	2	6819	-
4	3	5279	-
5	4	3849	-
6	24	2236	2106



Graphical representation of zinc ion concentration

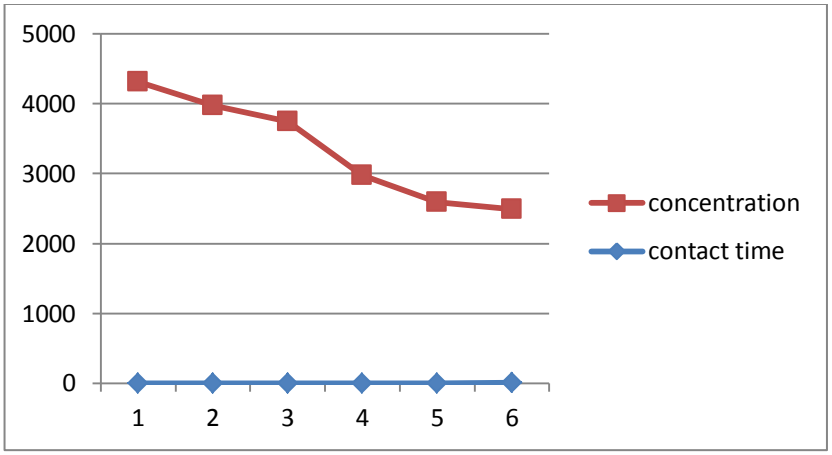
The graph shows the gradual decrease in the concentration of cadmium metalwith respect to time and on 24hrs of treating the concentration of adsorbent to the cadmium solution is nearly 76%.

Cadmium-Palm tree

About 1 gram of palm bark powder adsorbent is mixed with waste water sample, mixed thoroughly using a mechanical shaker and the concentration of cadmium ion at various time intervals is estimated by volumetric analysis (EDTA method) and atomic adsorption spectroscopy and the values are in close agreement with respect to each other.

Amount of cadmium ion present in Palm tree adsorbent

S.No	Contact time (in hours)	Amount of Cadmium ion removed (mg/L)	
		Volumetric analysis	Atomic absorption spectroscopy
1	0	9349	9690
2	1	7039	-
3	2	6049	-
4	3	4876	-
5	4	3886	-
6	24	3116	-



Graphical representation of cadmium ion concentration

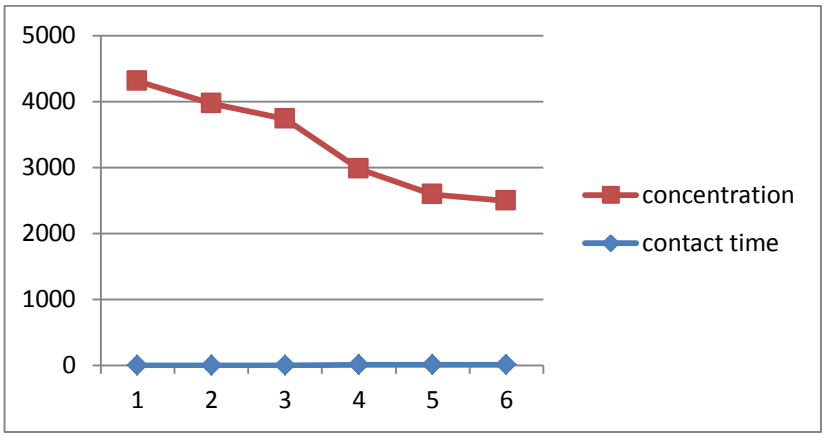
The graph 5.5 shows the gradual decrease in the concentration of cadmium metalwith respect to time and on 24hrs of treating the concentration of adsorbent to the cadmium solution is nearly 66%

Cadmium-Indian Beech tree

About 1 gram of Indian beech tree bark powder adsorbent is mixed with waste water sample, mixed thoroughly using a mechanical shaker and the concentrated cadmium ion at various timeintervals is estimated by volumetric analysis (EDTA method) and atomic adsorption spectroscopy and the values are in close agreement with respect to each other.

Amount of cadmium ion present in Indian beech tree adsorbent

S.No	Contact time (in hours)	Amount of Cadmium ion removed (mg/L)	
		Volumetric analysis	Atomic absorption spectroscopy
1	0	9349	9690
2	1	7919	-
3	2	6929	-
4	3	4876	-
5	4	3519	-
6	24	2383	2364



Graphical representation of cadmium ion concentration

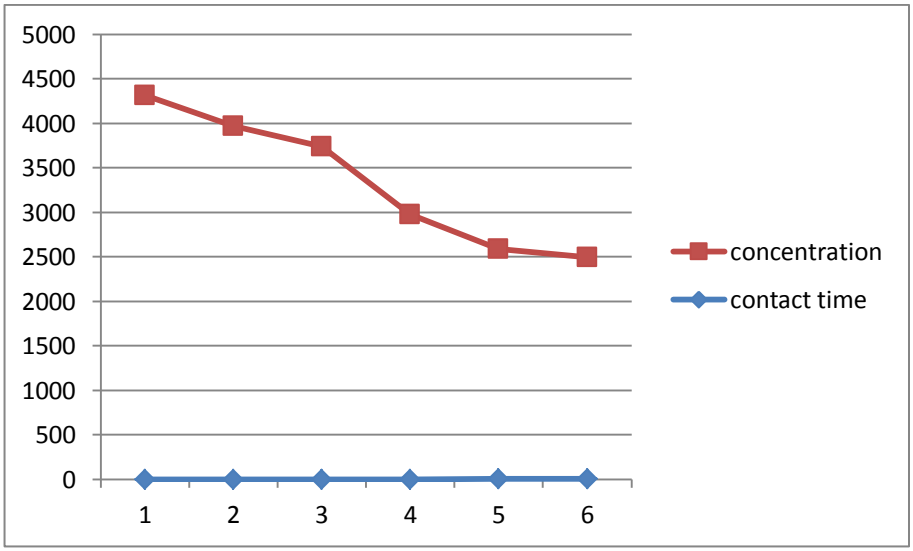
The graph shows the gradual decrease in the concentration of cadmium metalwith respect to time and on 24hrs of treating the concentration of adsorbent to the cadmium solution, the removal is nearly 75%.

Copper-Neem tree

About 1 gram of Neem tree bark powder adsorbent is mixed with waste water sample, mixed thoroughly using a mechanical shaker and the concentrated zinc ion at various timeintervals is estimated by volumetric analysis (EDTA method) and atomic adsorption spectroscopy and the values are in close agreement with respect to each other.

Amount of copper ion present in Neem tree adsorbent

S.No	Contact time (in hours)	Amount of Copper ion removed (mg/L)	
		Volumetric analysis	Atomic absorption spectroscopy
1	0	686	609
2	1	558	-
3	2	494	-
4	3	462	-
5	4	414	-
6	24	383	416



Graphical representation of copper ion concentration

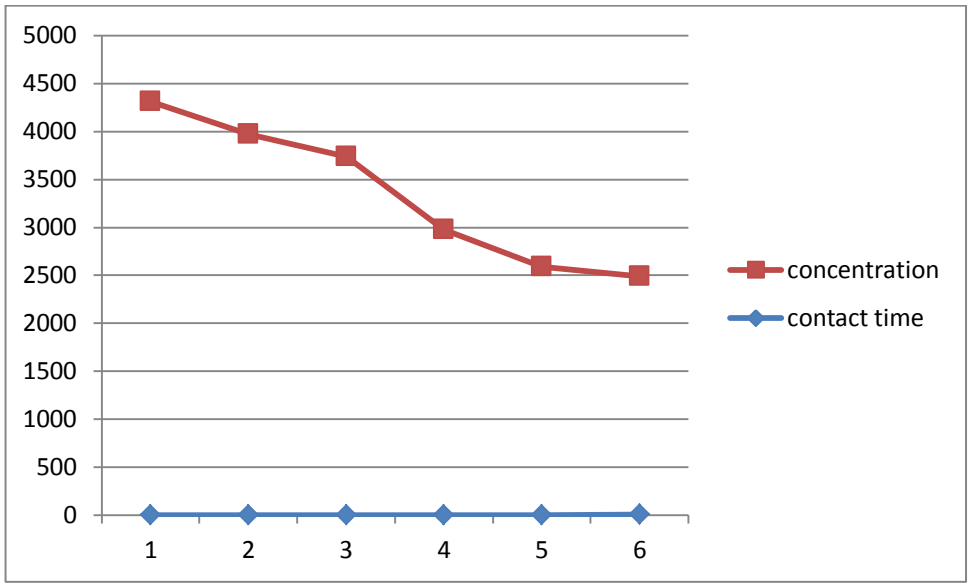
The graph 5.7 shows the gradual decrease in the concentration of copper metal with respect to time and on 24hrs of treating the concentration of adsorbent to the coppersolution, the removal is nearly 44%.

Copper-Palm tree

About 1 gram of palm tree bark powder adsorbent is mixed with waste water sample, mixed thoroughly using a mechanical shaker and the concentrated copper ion at various time intervals is estimated by volumetric analysis (EDTA method) and atomic adsorption spectroscopy and the values are in close agreement with respect to each other.

Amount of copper ion present in palm tree adsorbent

S.No	Contact time (in hours)	Amount of Copper ion removed (mg/L)	
		Volumetric analysis	Atomic absorption spectroscopy
1	0	686	609
2	1	622	-
3	2	588	-
4	3	494	-
5	4	446	-
6	24	399	-



Graphical representation of copper ion concentration

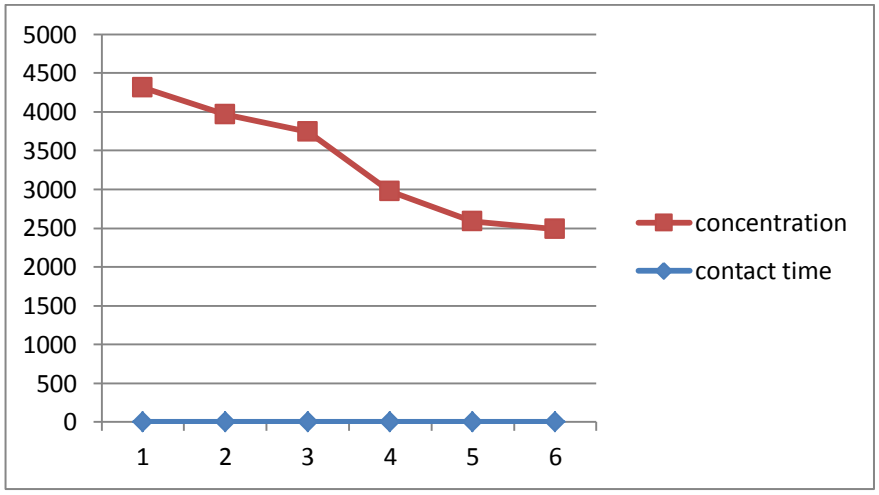
The graph shows the gradual decrease in the concentration of copper metal with respect to time and on 24hrs of treating the concentration of adsorbent to the copper solution, the removal is nearly 42%.

Copper-Indian Beech tree

About 1 gram of Indian beech tree bark powder adsorbent is mixed with waste water sample, mixed thoroughly using a mechanical shaker and the concentrated copper ion at various time intervals is estimated by volumetric analysis (EDTA method) and atomic adsorption spectroscopy and the values are in close agreement with respect to each other

Amount of copper ion present in Indian beech tree adsorbent

S.No	Contact time (in hours)	Amount of Copper ion removed (mg/L)	
		Volumetric analysis	Atomic absorption spectroscopy
1	0	686	686
2	1	638	-
3	2	574	-
4	3	526	-
5	4	462	-
6	24	367	367



Graphical representation of copper ion concentration

The graph shows the gradual decrease in the concentration of copper metal with respect to time and on 24hrs of treating the concentration of adsorbent to the coppersolution, the removal is nearly 46%.

From the above results, it is observed that the concentration of metal ions decreases with increase in contact time.

Conclusion

Water is essential for life and is a resources to be protected at any cost. Treatment of wastewater both domestic and industrial therefore becomes necessary. In the present study, the dried bark is used as an adsorbent to remove heavy metal ions from synthetic waste water. Results obtained also showed that the zinc metal is adsorbed to greater percentage than the cadmium and copper metal ions. This study suggested that natural bark of trees have the potential to be applied to industries which use heavy metals as their major sources which are eco-friendly in nature.

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