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Research pedagogy

KAZA'S Carbons- Tools of Detoxification (Removal of Trace Elements like Lead, Manganese) of Aqueous Waste Industrial Effluent Water

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ABSTRACT

Industrial Effluents contain many heavy metals like Pb, Mn, Cu, Fe, Hg, Cr, etc., either in traces or in some quantities. Many of these elements exceed the limits given by WHO are carcinogenic and toxic towards human beings and animals though they are required for Human Beings in limited quantities. Several methods of removal of lead in industrial effluents are in vogue in different parts of the world. But almost all such methods involve high operational costs and they need highly skilled and trained technocrats for operation. Therefore, we have been chosen eco-friendly low cost adsorbents KAZA's Carbons prepared from Cajanus cajan (Fabaceae)(NCCC), Brassica (Cruciferae) (NBSC), Dolichos lablab (Fabaceae) (NDLC) and Typha angastata (Typhaceae) (NTAC) for removal of lead. By using other KAZA's Carbons prepared from Bombax Malabricum (BMC), Pithacalobium dulce (PLDC), Ipomoea batatas (IBC) and Peltophoram ferrugineum (PFC) for removal of Mn. Some other carbons used for other elements. This method gave better results and cheap. These carbons also used successfully for the removal of elements from some industrial aqueous effluents collected from many industrial areas [1-3].

Keywords: KAZA'S Carbon, detoxification, water.

INTRODUCTION

Heavy Metals and Health Hazards: Out of many number of pollutants, heavy metals are one of the major pollutants in industrial wastewater. Many industries consume large volumes of water for the production of different products. The toxicity and deleterious effects of lead are well documented. The federal centres for disease control in USA consider a blood level exceeding 300 mg L^{-1} to be excessive. The presence of lead above its permissible limit (0.05 mg L^{-1}) causes various types of diseases such as anaemia, encephalopathy, hepatitis and nephritic syndrome. The major biochemical effect of lead is in the interference with heam synthesis, which eventually leads to the haematological damage. Lead is also toxic to aquatic organisms to avoid water containing 0.3 mg L^{-1} lead and above 1 mg L^{-1}, lead is lethal to fish. Lead ions are also highly toxic to most of the animals and plants, inhibit - amino levulinate dehydrase and haemoglobin synthesis, affect gastro intestine. Lead has been recognized for centuries as a cumulative poison. Health studies done in Poland during the past 2 years have linked elevated levels of lead in the environment with retardation and learning disabilities of children. Lead poisoning causes diseases, such as damage to central nervous system, mental deterioration etc., Removal and recoveries of these toxic metal ions are the best approaches to control the metal pollution problem and safeguard the environment and human health. Acute lead poisoning in humans causes severe destruction in kidney, reproductive system, liver, brain and central nervous system. Mild lead poisoning causes anaemia, the victim may have headache and sore muscles and may generally feel fatigue and irritable.

Manganese (II) is present in water supplies as a result of natural process involving catchments and erosion, the dissolution of Mn containing sediments and minerals at or near the sediment water interface. Mn (II) in surface water is a micronutrient but elevated concentrations are toxic to fish and^{-1}
Humans and impair drinking water quality. As per the water supply regulations the permissible limit of Mn is 0.05 mg L^{-1}. There are number of problems which can occur if much Mn is present in the water. These are -

- . Staining of laundry and plumbing fixtures,
- . Discoloration of the water,
- . Taste to water,
- . Growth of iron bacteria is encouraged,
- . Formation of deposits in distribution systems and plumbing,
- . Interference with treatment processes such as disinfection.

Manganese poisoning also known as manganism, occurs when Individuals are exposed to high levels of Mn. Its poisoning attacks the central nervous system, kidneys and liver. It also causes a person to suffer from diminished motor skills and physiological disturbances.
Toxic trace elements in natural water and waste water, the sources, effects and acceptable values are presented in table 1.

Table 1. Toxic trace elements and limits

S. No	Elements	Sources	Effects and Significance	Aceptable value mg L^{-1}
1	Cadmium	Industrial discharge, mining waste, metal plating, water pipes	Replaces Zinc biochemically, causes high B.P, kidney damage, destruction of testicular tissue and RBC, toxicity to aquatic biota.	0.01
2	Chromium	Metal plating, cooling tower water additive. Chromate normally found as Cr(VI) in polluted water	Essential trace element; possibly carcinogenic as Cr (VI)	0.05
3	Copper	Metal plating, Industrial and domestic waste, mining, mineral leaching	Essential trace element; not toxic at moderate levels	0.05
4	Lead	Industry, mining, plumbing, coal, gasoline.	Toxic (anaemia, kidney disease, disorder), wild life disorder.	0.1
5	Manganese	Mining industrial waste, acidmine drainage, microbial action on manganese minerals at low pE	Relatively non toxic to animals, toxic to plants at higher levels, strains materials like room fixtures and clothing	0.105
6	Mercury	Industrial waste, mining, pesticides, coal	Highly toxic	0.001
7	Molybdenum	Industrial waste, natural sources	Possibly toxic to animals, essential for higher levels	---
8	Selenium	Natural geological sources, sulphur, coal	Essential at low levels but toxic at higher levels	0.001
9	Zinc	Industrial waste, metal plating, plumbing	Essential in many metalloenzymes, toxic to plants at higher levels	5.0

Preparation of lead (II) solution: A stock solution of lead (II) used in this study was prepared by dissolving an accurate quantity of lead nitrate in deionized water. The concentration of the stock solution was 1000 mg L^{-1}. Other concentrations were prepared by dilution of the stock solution. All the chemicals used were of analytical grade.

Preparation of manganese (II) solution: A stock solution of lead (II) used in this study was prepared by dissolving an accurate quantity of 1.0 g of manganese metal in 50 mL of 6N HNO_3 and dilute to 1L (1000 mg L^{-1}). Other concentrations were prepared by dilution of the stock solution. All the chemicals used were of analytical grade.

Unit operations of Kaza's Carbon Method for the removal of lead and manganese

- Determine the optimum conditions in removal of metals for the selected Activated Carbons. For the adsorbents (KAZA, Carbons) Characterision and Kinetic studies to be made [4].
- Optimum amount of activated carbon (KAZA'S Carbon) prepared from bio-waste added to a beaker
- Spiked with 5mg L^{-1} of metal solutions of mentioned metals and pH maintained
- Stir solution → contact developed for metal solution with carbon
- Keep the system for 30min -1h to settle carbon
- Filter out water
- Determine the metal contents.

APPLICATIONS

Treatment of industrial effluents for removal of lead using prepared Activated Carbons: The effluent samples were collected from different locations of Hyderabad industrial areas, Andhra Pradesh. Three effluents are taken and treated with activated carbons. The lead concentrations before and after passing through activated carbons are evaluated and tabulated in table 2. The prepared activated carbons successfully removed the lead from effluents to a maximum of 81.429 %.

Table 2: The lead concentration in effluents before and after treatment of activated carbons

S. No	Concentration of lead before treatment mg. L^{-1}	After treatment mg. L^{-1}				Max.% removal of lead
		NTAC	NBSC	NDLC	NCCC	
1	17	0.514	0.645	0.823	1.023	75.417
2	14.5	1.562	1.745	1.789	1.985	75.714
3	12.5	1.123	1.356	1.412	1.632	81.429
4	90.4	0.201	0.368	0.375	0.398	78.667
5	11.3	0.568	0.669	0.687	0.951	80.000

Treatment of industrial effluents for removal of manganese using prepared Activated Carbons: The effluent water samples were collected from Bandlaguda area which falls in Patancheru Industrial area, Medak Dt. India. Four effluent water samples were taken and treated with activated carbons. The Mn concentrations before and after passing through activated carbons are evaluated and tabulated in table 3. The prepared activated carbons successfully removed the manganese from effluents to a maximum of 78-99 %.

Table 3: Removal of Mn (II) from water samples

No. of the water sample	Adsorbent name	Initial concentration Ci mg.L^{-1}	Equilibrium concentration Ce mg.L^{-1}	Amount Adsorbed Qe mg.L^{-1}	% removal
1	BMC	0.675	0.0067	0.1336	99
	PDLC	0.675	0.0324	0.1168	95.2
	IBC	0.675	0.0743	0.1092	89
	PFC	0.675	0.1417	0.0969	79
2	BMC	0.7	0.0004	0.1399	99.93
	PDLC	0.7	0.0329	0.1212	95.3
	IBC	0.7	0.0684	0.1148	90.22
	PFC	0.7	0.14	0.1018	80
3	BMC	0.725	0.0058	0.1438	99.2
	PLDC	0.725	0.0435	0.1239	94
	IBC	0.725	0.087	0.116	88
	PFC	0.725	0.145	0.1054	80
4	BMC	0.75	0.0075	0.1485	99
	PLDC	0.75	0.0375	0.1295	95
	IBC	0.75	0.075	0.1227	90
	PFC	0.75	0.165	0.1063	78

These Carbons are also used for removal of other metals successfully. These methods are Eco-Friendly and low-cost. These methods are also useful for defluoridation, decolorization [5-7] and antimicrobial, antifungal activity studies. So the applications of these KAZA's Carbons are vital. Since these are prepared from Bio- Waste materials, play an important role in – Clean and Green, Wealth from waste, Swatch Bharat.

Suggestions to Researchers: Fresh Researchers lot of Scope to work on these KAZA's Carbons –

- By preparing Activated Carbons from different raw bio-waste materials and Applications.
- By preparing Graphene from Carbons (Graphene has more surface area) and Applications. Compare with Activated Carbons
- By preparing Nano carbons from raw bio-waste materials, study its Applications and compare with Activated Carbons.

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