

Waste seeds of ziziphus rugosa lam. as potential material for removal of heavy metal from waste

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Abstract

In recent years various toxic elements Lead (Pb), Mercury (Hg), Cadmium (Cd) and Copper (Cu) are present in the industrial waste water. Adsorption is important method for the removal of various heavy metal from waste water. Extensive material used for waste water treatment from various industries. The mechanical and chemical methods used are very costly. Now there is need of safe and economical methods for the elimination of heavy metals at very low cost. Now a day's biomass technology was used for adsorption. Biomass is alternative to chemical method for removing the heavy metals.

we have developed a simple method from waste seeds of *Ziziphus rugosa* Lam. These seeds occur everywhere in the waste so that we can develop inexpensive adsorbent for elimination of heavy metal from waste water. The experiments were performed at different conditions. The result obtained were fruitful. We develop simple method for the removal of heavy metal from waste seeds.

Keywords: ziziphus rugosa lam, heavy metals, adsorption

Introduction

The industrialization is increased very fastly in the world. During this process large amount of organic and inorganic material are used. (Tariq et al.2018) ^[1]. Most of the time organic pollutants are easily degraded but inorganic metals remain as it is in the environment (Gupta et al.2001) ^[2]. Large use of these inorganic materials in the various filed was led to the large pollution in water as well as soil (Gunatilake 2015). These toxic and heavy metal come into the water body from various industrial sources such as batteries industries, alloy industries and storage, smelting, chloralkali, tanneries, radiator manufacturing, metal plating, mining operations (Kadirvelu *et al.* 2001) ^[4, 26]. This industrial waste does not degrade remain as it in the soil or settle in it (Demcak *et al.* 2017; Zayat et al.2010; Huang *et al.* 2009) ^[5, 6, 7]. This include the simple material like Cu, Cr, Cd, Hg, Ni, As, Pb, Zn etc (Mohana et al.2017; Chen et al.2018; Keshvardoostchokami 2018) ^[9] the presence of heavy metal leads to the various diseases like reproductive system disorders, liver damage, kidney failure death (Gupta *et al.*2000) ^[11]. Due to such dangerous effect of these heavy metals there is need to reduce the heavy metal from waste.to do this there are large number of methods such as reverse osmosis, ion exchange, membrane filtration, chemical precipitation, electroextraction are present (Fu 2011; Zinicovscaia 2016) ^[12, 13], Sometimes chemical precipitation method can be used (Alfarra 2014) ^[14], but these methods are large sludge disposal, loses less amount, high costs, large amount of chemicals which are expensive (Kelly-Vargas *et al.* 2012) ^[15].

As we know these chemical methods are costly to remove the heavy metals. There are certain economical methods are

developed which are low cost and developed from the waste from bagasse of sugar cane (Mohanetal.2002; Khan et al.2001; Ayub et al.1998) ^[16, 17, 29, 18] from rice husk (Srinivasan et al.1998; Munaf et al.1970; Ajmal et al.2003; Suemitsu et al.1986; Khan et al.2003) ^[21, 22, 23, 28] using saw dust (Ajmal et al.1996) using different coconut husk (Kadirvelu 2003) ^[25], by the palm shell neem bark (Selvietal.2001). These are low cost, easily prepared, less by product (Baile et al.2015)

In this work we have used *Ziziphus rugosa* Lam. Fruits seeds are used for the study waste seed are collected. *Ziziphus rugosa* Lam (Rhamnaceae) is shrub occur in Kokan region with subcordate leaves with paniculate flower and red hard fruit which on ripening turn white. It mainly occurs in evergreen forest (Bland et al.1996) ^[31]. This plant contains the cyclopeptide alkaloid which is present in its bark. It also has certain triterpenes or steroids aliphatic, betulinic oleanolic, 2- α -hydroxy xyruolic acids and ziziphuses ebelin lactone (Berger et al.2006) ^[32]. *Ziziphus rugosa* Lam (Rhamnaceae), contain the various flavonoids such as luteolin-7-O-glucoside, kaempferol-4'-methylether, luteolin present in the bark of *Z. rugosa* (Singh et al.2009) ^[33] *Z. rugosa* used in the treatment of hemorrhage, menorrhage, treatment of rheumatism, heal the wounds and used for diarrhea (Huie CW et al.2002) ^[34]. *Z. rugosa* bark shows the significant antibacterial activity against salmonella typhi, streptococcus pyrogens and shows very a few bacteria. *Z. rugosa* shows good free radical scavenging activity and shows the good medical property. Recently, antibacterial, insecticidal of methanol extract of pericarp of was reported. Present study deals with nutritive composition of *Ziziphus rugosa* Lam. Fruit pulp.

This is small shrub spines, broad base. Young branches and leaves 5-12.5x4-6 cm and short-tippes, base oblique, wrinkled, densely velvet-hairy. These are pedunculate cymes 1.5-2 mm long. Fruit c. 5-8 mm in diameter, globose or pyriform, white when ripe. Flowering: December-January, fresh seeds from the fruits are round and white Fig. 1. Plant material *Ziziphus rugosa* Lam collected from Sahyadri region of Maharashtra mostly from Konkan identified by the Dr. Arun Chandore from Abasaheb Marathe Arts and New Commerce, Science College, Rajapur- 416702. District- Ratnagiri (Maharashtra) and vocture specimen kept in the botanical Laboratory.



Fig 1: Fresh fruits of *Ziziphus rugosa* Lam

Materials and methods

Materials

Chemicals and apparatus

All the chemicals used were analytical grade. The tools Atomic Absorption Spectrophotometry (AAS), ovens, inert glassware, magnetic stirrers, 100 mesh sieve, mortars, shakers, furnaces, study heaters were used.

Industrial waste water

The waste water sample was collected from the industrial area. These waste water from the all industrial waste, the waste water contains lead (Pb) waste, cadmium (Cd) waste, copper (Cu) waste, mineral water, mercury waste (Hg) and various alkaline solutions.

Seeds of *Ziziphus rugosa* Lam

The seeds are collected from the waste in Konkan region. These seeds are identified by the Dr. Arun Chandore and specimen kept in the botanical Laboratory Abasaheb Marathe Arts and New Commerce, Science College, Rajapur- 416702. District- Ratnagiri (Maharashtra).

Preparation of the Adsorbent

The seeds of the fruits were used as biomass for the adsorption study. These seeds are washed, after drying the weight of the seeds recorded and grind into fine powder. The Powder obtained was dried at 100 °C for 5 hours. The obtained powder was kept in desiccator for 6 hours.

Methodology

This particular bio removal was carried out by preparing the standard of lead (Pb), copper (Cu), cadmium (Cd), mercury (Hg).

This removal has been carried out at pH 4 pH 7, pH9 and pH 11. For this particular the sample solution was prepared by taking 100 mg/L by taking the particular weight then diluted to one liter, then solution diluted to 50 mg/L in 100 ml volumetric flask. Adsorbent 0.75 g with particle size of 50 mesh put in the 100 mL glass bottle. The pH of the solution was control using nitric acid and sodium hydroxide. The rotation of 150 rpm was used for 50-60 min. The filtration was carried using the typical filter paper. During this typical study we have changed the pH and speed of the rotation can be seen from Table 1.

Table 1: pH, mixing speed of the rotation contact time and adsorbent dose.

Low cost adsorption Seed Powder	10 mg/100 ml					
	Run	Metals	pH	Mixing speed (rpm)	Contact time (min)	Adsorbent dose (g/l)
	1	Pb	4	100	10	05
	2		7	200	20	27
	3		9	400	30	25
	4		11	800	40	30
	5	Cd	4	100	10	04
	6		7	200	20	21
	7		9	400	30	15
	8		11	800	40	25
	9	Cu	4	100	10	06
	10		7	200	20	25
	11		9	400	30	24
	12		11	800	40	30
	13	Hg	4	100	10	07
	14		7	200	20	27
	15		9	400	30	28
	16		11	800	40	32

In above case if we observe that the as Rotation and pH is

Increased the rate of adsorption increases.

Results and discussion

Heavy Metal Adsorption at Different pH

We have observed Fig. 2. That the pH 7 shows the maximum adsorption as compared to more acidic or basic pH. This adsorption is carried at the neutral pH. This happens because of the most of phytochemicals remain active at very basic PH they form salt such salt are soluble in water and adsorption decreases. While same happens with the acidic pH. so we have observed that at neutral maximum adsorption takes place.

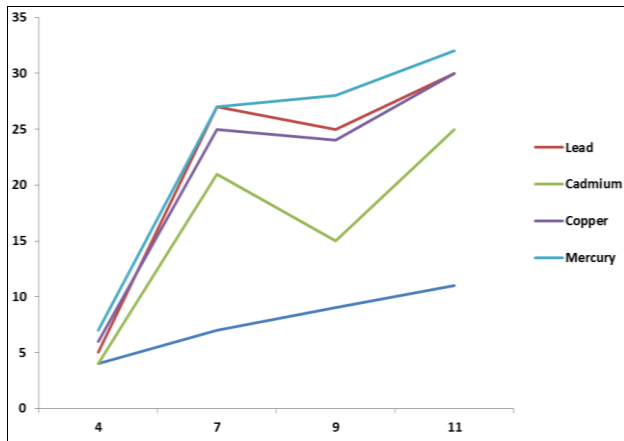


Fig 2: At different pH heavy metals adsorption

Heavy Metals Adsorption at Different R.P.M

When the adsorption is carried at neutral pH with various rotation fixed time intervals we observed that maximum adsorption occurs at the 20-25 min. while at lower time least adsorption occurs. While as we increase the time rate of adsorption occurs very slowly. Fig. 3.

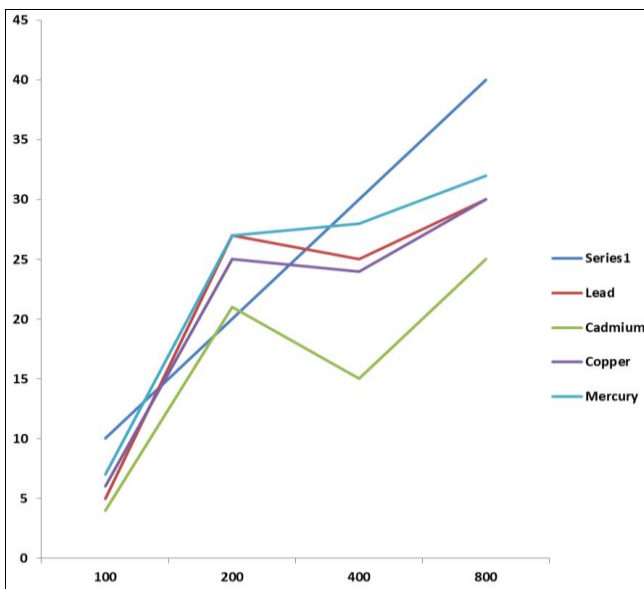


Fig 3: Heavy metals adsorption at different rotation

Adsorption at different times

Adsorption at different times the maximum adsorption Fig. 4. occurs 20-25 min we have observed that if we kept the pH constant and the RPM then time of adsorption is important in such case adsorption occurs at 20-25 min. is maximum then after that it remains constant or decreases.

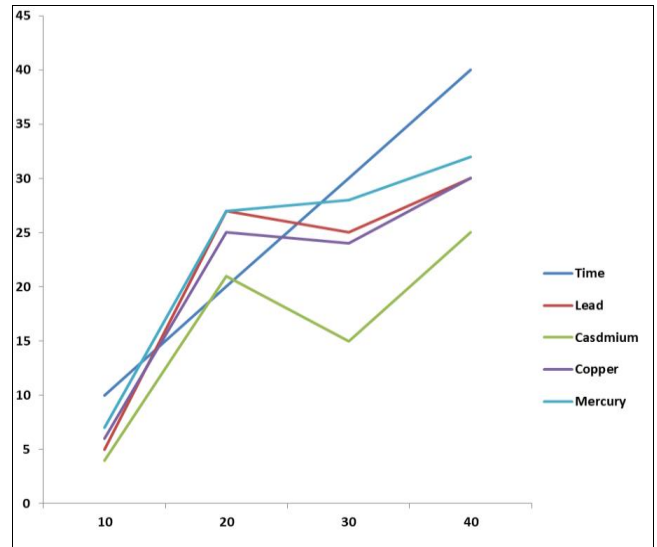


Fig 4: Heavy Metals Adsorption at Different Times

Treatment of wastewater using ziziphus

In this we are using the waste seeds of the fruit. These seeds act as good adsorbents. They can easily adsorb heavy metals up to 99%, so we can use this simple technique for the adsorption of various heavy metals from industrial wastewater. This adsorption occurs so we can develop a simple filter system. This can be used in our water filters also instead of synthetic filters we can use very simple filters.

Table 2: Removal of Lead

Heavy Metal	Adsorbent dose mg/100mL	Removal ratio %
Lead	20	60.80
	30	75.70
	40	85.80
	50	90.90
	60	98.70

Table 3: Removal of Cadmium

Heavy Metal	Adsorbent dose mg/100mL	Removal ratio %
Cadmium	20	55.80
	30	67.89
	40	78.80
	50	87.90
	60	97.90

Table 4: Removal of Copper

Heavy Metal	Adsorbent dose mg/100mL	Removal ratio %
Copper	20	62.90
	30	75.80
	40	84.80
	50	90.80
	60	99.20

Table 5: Removal of Mercury

Heavy Metal	Adsorbent dose mg/100mL	Removal ratio %
Mercury	20	60.70
	30	78.90
	40	80.90
	50	95.90
	60	99.70

From Fig. 5. We have quantify the quantity of the adsorbent we have kept PH constant 7.1 rotation constant but vary the quantity of the catalyst. we observe that the at 60 mg/100 ML the catalyst or adsorbent shows the maximum adsorption, for all four heavy metals,

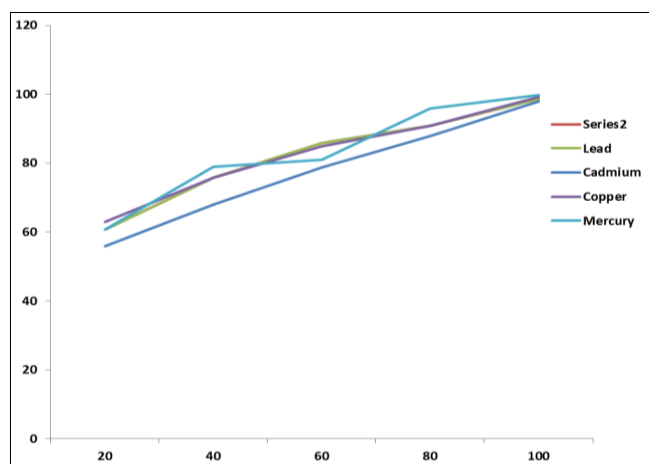


Fig 5

Conclusion

We can use very low-cost adsorbent for the removal of the heavy metals. We can remove upto 99 % of the heavy metal. This can be used for removal of various heavy metal. Percent's of heavy metal removal is depending on the dose. The experiment carried at pH 7, and maximum adsorption occur at 20-25 min at the rotation of 200-300 rpm. We can setup the natural filtration system from the waste and we can reuse for the filtration. We can develop the simple filter from it.

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