Treatment of Lead Contaminated Waste Water By Mean of Adsorption into Rice Husk Ash

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Abstract

In this paper, the efficiency of adsorptive properties of rice husk ash have been studied. The two rice husk samples (Khon Lay Khon and Ayar Min) were collected from Kaung rice mill, Ye U Township, Sagaing Region. The elemental contents of samples were determined by EDXRF (energy dispersive X-ray fluorescence) technique. In this research, rice husk ash was used as adsorbent to water containing lead. The adsorptive properties of rice husk ash on Pb were determined by using filtration method. Furthermore, the adsorptive properties of rice husk ash samples were also compared. Moreover the removal of lead in waste water from Textile Industry, Salingyi Township, Sagaing Region was carried out by using rice husk ash of Ayar Min.

Key words: Adsorptive property, rice husk ash, Lead ion, Khon Lay Khon , Ayar Min

Introduction

Rice husk is one of the major agricultural wastes. It is a fibrous materials containing cellulose as the major constituent, lignin and ash. The rice husk contains about 75% organic volatile matter and the balance 25% of the weight of the husk is converted into ash during the firing process, is known as rice husk ash (RHA). Rice husk ash consisting more than 90% of amorphous silica obtained controlled burning rice husk.

Adsorption is the adhesion of atoms, irons or molecules from a gas, liquid or dissolved solid to a surface. This process creates a film of the adsorbate on the surface of the absorbent. Water pollution is a major global problem which requires ongoing evaluation and revision of water resource. Water quality is relative and is defined as the characteristic of water that influence its suitability for a specific use.

Lead and lead compounds can be highly toxic when eaten or inhaled. Although lead is absorbed slowly into the body, its rate of excretion is even very slow. Thus, with constant exposure, lead accumulated gradually in the body. Lead can cause lesions in the central nervous system and apparently can damage the cell making up the blood brain barrier that protects the brain from many harmful chemicals.

Rice husk ash is an amazing substance. It adsorbs more poisons than any other substance known to mankind. It can adsorb intestinal gas and deodorizes foul-smelling gases of various leads, lead acetate, strychnine, DDT, many drugs (including cocaine, iodine, penicillin, aspirin, Phenobarbital) and inorganic substances (chlorine, lead, and mercury). Thus, rice husk ash is used in water purification, air purification, and removing undesirable odours and impurities in food.

Experimental

Materials and Methods

The chemicals used were the analytical grade reagents. They were procured from British Drug House (BDH) London and Merck, unless otherwise stated. In all analytical procedures of experimental runs, recommended standard methods and techniques were applied (Vogel, 1997, Chapman, 1996 and Gray, 1999)

Balance (E – Mettler, Switzerland), oven (Gallenkamp, England), Electric furnace and other standard lab ware and glassware were used. The advanced instrument: EDXRF (energy dispersive X-ray fluorescence) spectrophotometer was used in the characterization of the samples.

Sample Collection

In this experiment, the raw materials of rice husk (Khon Lay Khon and Ayar Min) were collected from Kaung rice mill in Ye U Township, Sagaing Regions. All samples were dried in good ventilation place and stored in polyethylene bag during experiment. And then waste water sample was collected from Textile industrial, Saligyi Township, Sagaing Region.

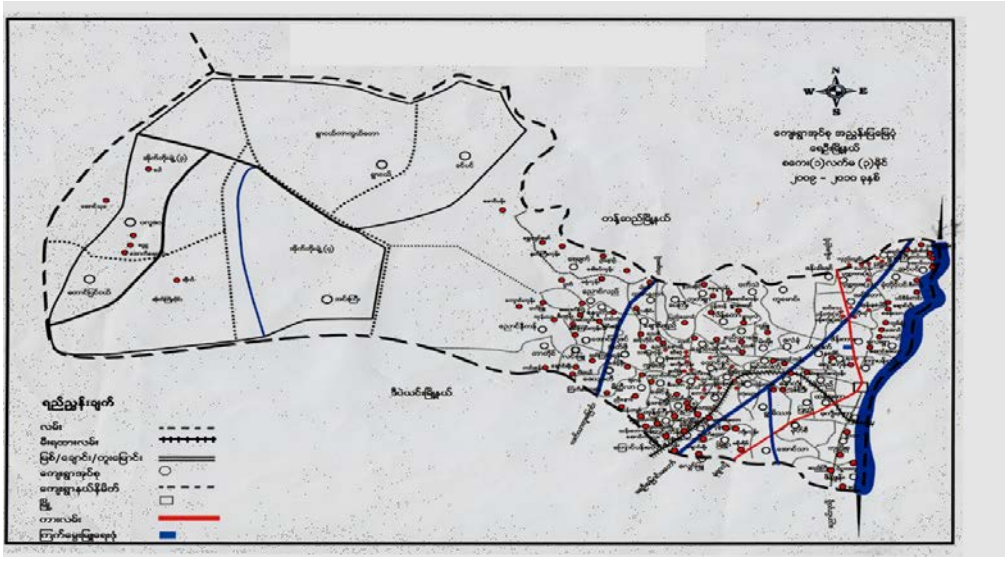

Figure (1) Location map of Ye U Township Sagaing Region

Determination of the Ash in Various Paddy Species

The contents of ash of various paddy species were determined using electric furnace.

Determination of Elemental Contents of Rice Husk Ash Samples

The contents of Si, K, Al, Ca, Fe, Cl, Ti, Sr, Mn, V, S, Cs, Zn, Pb, Hf in rice husk ash sample were determined by EDXRF at URC (University of Research Center) Monywa.

Comparison of Percent Removal of Lead from Lead Compound in Water Sample

Comparison of percent removal of lead from lead compound in water sample was determined with rice husk ash of selected rice samples (Khon Lay Khon and Ayar Min) by using complexometric titration.

Removal of Lead Content in Waste Water Sample

Lead content in waste water sample were removed with rice husk ash (Ayar Min) by filtration method.

Results and Discussion

The Content of Ash in Various Paddy Species

The contents of ash rice husk ash samples were determined and the results were shown in Table 1.

Table 1. The Content of Ash in Various Paddy Species

No	Rice husk Sample	Ash (%)
1	Khon Lay Khon	26.11
2	Ayar Min	19.25

Elemental Contents of Rice Husk Ash

The elemental contents of rice husk ash were studied by EDXRF and the results were shown in Table 2.

Table 2. Elemental Contents of Rice Husk Ash of Khon lay khon and Ayar min

No.	Elements	Amount (%)	
		Sample 1	Sample 2
1	Silicon (Si)	41.1700	41.7400
2	Potassium (K)	1.0900	1.4260
3	Aluminum (Al)	0.0367	0.0097
4	Calcium (Ca)	0.3630	0.3634
5	Iron (Fe)	0.0586	0.1357
6	Chlorine (Cl)	0.3706	0.4888
7	Titanium (Ti)	0.0048	0.0066
8	Strontium (Sr)	0.00312	0.0019
9	Manganese (Mn)	0.06930	0.0825
10	Vanadium (V)	0.0030	0.0033
11	Sulfur(S)	0.0201	0.0152
12	Cesium (Cs)	0.0004	0.0004
13	Zinc (Zn)	0.0051	0.0056
14	Lead (Pb)	0.0004	0.0019
15	Hafnium (Hf)	0.0005	0.0004

Sample 1 = Khon Lay Khon Sample 2 = Ayar Min

From the results of EDXRF examination, it can be seen that the amount of K was second highest and Si was highest elements in both samples.

The amount of Si was also higher than the other elements. Therfore, the rice husk ash should be used as an adsorbent.

Comparison of Removal of Lead

The effect of weight of rice husk ash samples on adsorption of lead was studied and the results were shown in Table 3.

Table 3. Comparison of Percent Removal of Lead

No.	Wt. of Ash (g)	Lead content in water samples					Percent removal of lead	
		Initial weight (mg)	Sample 1		Sample 2		Sample 1	Sample 2
			Remaining weight (mg)	Removal Weight (mg)	Remaining weight (mg)	Removal Weight (mg)		
1	1	51.59	43.51	8.08	42.27	9.32	15.70	18.07
2	2	51.59	38.54	13.05	36.05	15.54	25.30	30.12
3	3	51.59	36.47	15.12	33.56	18.02	29.30	34.93
4	4	51.59	34.60	16.99	31.70	19.89	32.90	38.55
5	5	51.59	32.50	19.09	30.05	21.54	37.00	41.75
6	6	51.59	31.50	20.09	28.80	22.79	38.90	44.18
7	7	51.59	29.63	21.96	26.32	25.27	42.60	49.06
8	8	51.59	27.14	24.45	24.66	26.93	47.40	52.20
9	9	51.59	26.94	24.65	23.21	28.38	47.70	55.01
10	10	51.59	22.79	28.80	21.76	29.83	55.80	57.82

Sample 1 = ash of Khon Lay Khon Sample 2 = ash of Ayar Min

In this result, adsorptive power of rice husk ash of sample 2 is higher than the sample 1.

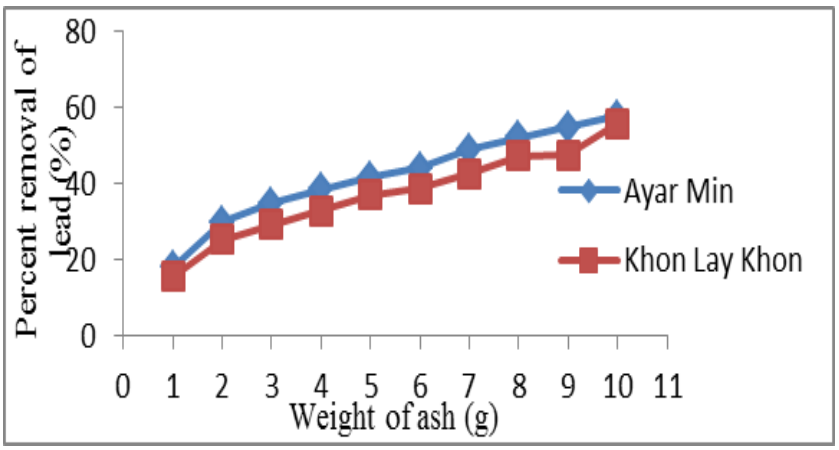

Figure 2. Removal of lead by using various weight of rice husk ash of selected samples

Removal of Lead in Waste Water from Textile Industry by Sample 2

The percent removal of lead in waste water from Textile Industry was studied by using rice husk ash of Ayar Min. The resulting data were shown in Table 4.

Table 4. Removal of Lead in Waste Water from Textile Industry by Sample 2

No.	Wt. of Ash (g)	Initial weight of lead (mg)	Remaining Weight of lead (mg)	Removal Weight of lead (mg)	Percent removal of lead (%)
1	1	31.49	27.35	4.14	13.14
2	2	31.49	25.90	5.59	17.75
3	3	31.49	25.07	6.42	20.38
4	4	31.49	24.24	7.25	23.02
5	5	31.49	22.58	8.91	28.29
6	6	31.49	20.72	10.77	34.20
7	7	31.49	19.48	12.01	38.14
8	8	31.49	18.44	13.05	41.44
9	9	31.49	17.82	13.67	43.41
10	10	31.49	17.61	13.88	45.62

According to these data, the adsorptive power of rice husk ash increased with the weight of rice husk ash increase.

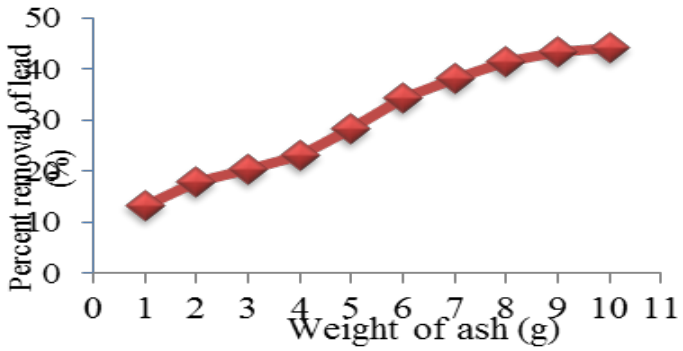

Figure 3. The percent removal of lead in waste water from Textile Industry

Conclusion

In this research, the elemental contents of rice husk ash were studied by EDXRF method. According to EDXRF data, The amounts of silicon (41.1700%Khon Lay Khon, and 41.4700% Ayar Min) are the highest in both samples. The amount of potassium (1.0900% Khon Lay Khon and 1.4260%Ayar Min) are the second highest.

The adsorption property of rice husk ash on lead ions was studied by using complexometric titration. It was observed that the percent removal of lead increase with increasing the weight of ash.

From the result of comparative studies of percent removal of lead, the adsorptive power of rice husk ash of Ayar Min is better than rice husk ash of Khon Lay Khon.

The removal of lead in waste water from Textile Industry, Salingyi Township, Sagaing Region was carried out by using rice husk ash of Ayar Min. According to this result the adsorptive power of the smple was increase with increasing their weight.

It can be concluded that the rice husk ash are suitable for the removal of metal ions from the solution. Moreover, this method is low cost, and effective for the environ.

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