THE USE OF SALAK HUSK FOR REMOVAL IRON, CADMIUM, CHROMIUM, ZINC AND COPPER FROM WASTE WATER

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ABSTRACT

It has been studied the use of salak husk to adsorb of iron, cadmium, zinc, and copper. The salak husk, which has been grounded, screened and activated, looked for optimum condition. Several parameter that can be affect iron, cadmium, chromium, zinc, and copper uptake such as particle size of salak husk, pH, contacting time, concentration, the heating temperature and heating time of salak husk were described. At the optimal condition iron metal removal from aqueous solution is 94.58 %, cadmium 93.38 %, chromium 93.20 %, zinc 88.78 % and copper 80.30 % by using atomic absorption spectrophotometric. The method was applied to multi component solution giving adsorption in iron 95.68 %, cadmium 74.93 %, chromium 85.50%, zinc 76.50%, copper 73.90 % and removal iron, cadmium, chromium, zinc, and copper present in Utama Service and Rama Motor workshop Padang.
Key word: Salak husk, iron, cadmium, chromium, zinc, copper, atomic adsorption, spectrophotometric, wastewater.

INTRODUCTION

Environmental concern has caused a lot of research to concentrate on the effects of toxic metals on the environment, since the ultimately reach and accumulate into animal and human tissues.

Heavy metals are one of the most important sources of pollution both in aqueous solutions and in polluted soils. In order to strongly decrease their concentration in aqueous solutions, the uptake of metals by agricultural product and by-product appears to be an efficient process, due to their numerous functional groups and low capital cost.

Salak husk, a by-product of salak, is readily available in great abundance in Indonesia. It is generally discarded as a waste. The cell walls of husk consist mainly of cellulose, and lignin and the have a lot of hydroxyl groups in their structures, where the ion-exchange properties of the husk are due to the presence of their various functional groups. These polyfunctional biosorbent exhibit unique toxic pollutants adsorption abilities (2).

The goal of the present research was to study the capability of salak husk to removal of iron, cadmium, chromium, zinc and copper from wastewater. The metals concentration is determined by using atomic absorption spectrophotometric method.

MATERIAL AND METHODS

Treatment of Salak Husk

Salak husk were washed with an excess of pure water, dried at room temperature for one day. Then, the husk wan ground and screened to obtain particle sizes of 150, 180, 250, 245 μm.

Five gram of salak husk particle is rinsed with 20 ml 0,1 % nitric acid for two days and then washed with 50 ml deionized the salak husk was dried at room temperature for one day before use.

Chemical and Apparatus

All reagent employed in this work were of analytical reagent grade or better, and obtained from E. Merck (Darunstadt, Germany). Nitric acid, sodium hydroxide, zinc sulfate, ferric chloride, copper sulfate, cadmium chloride, chromium chloride, potassium chromate were used as the reagent. Column experiment were conducted in the glass tube (150 x 10 mm id), glass wool was inserted at the top to prevent the substrate from floating. Metal concentration in the initial solution an effluent were analyzed by using Atomic Absorption Spectrophotometer (ALPHA-400, England).

Procedure

One gram of treated salak husk was inserted into the column made of glass tube. Water was then slowly added to wet the packing. The metal solution was passed through the column. The initial and final concentration of metal solution is determined by Atomic Absorption Spectrophotometric method.

The procedure for the removal of heavy metal from wastewater is as follows: 20 ml of wastewater sample is flowing into the column experiment. The flow rate of eluate was controlled to be the same. The initial and the final concentration after the column was determined as described above.

RESULT AND DISCUSION

Effect of pH Solution on the Metals Uptake by Salak Husk

The pH dependence of the adsorption of iron, cadmium, chromium, Zinc and copper was shown in Fig 1. It is obvious form Fig 1. that amount of ions removed decreased as the pH of the solution increased. The optimum condition is at pH 3.

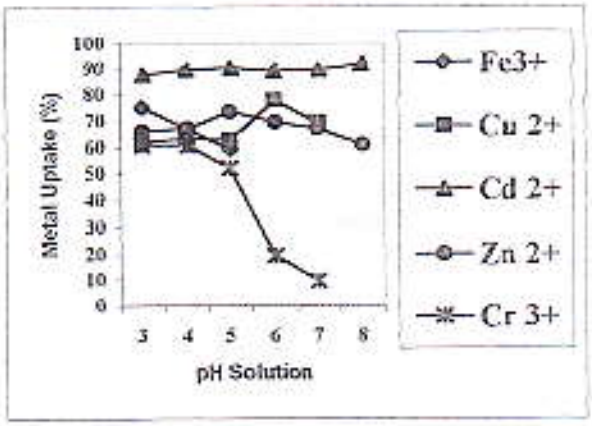

Figure 1. Effect of pH Solution on the Metals Uptake by Salak Husk

Effect of Particle Size on the Metals Uptake

The adsorption capacity of salak husk strongly depends on the surface activity like other synthetic ion exchangers, viz, specific surface area available for solute-surface interaction, which is accessible to the solute.

Figure 2. shows the plots of the percentage of ions uptake versus particle size of salak husk. Although the ions uptake was optimum (97.17 %) for the husk with 250 µm, the result indicated that for other size of salak husk the sorption was still satisfactory e.g. 7 0 – 96%. From the result 250 µm was selected for the further experiment.

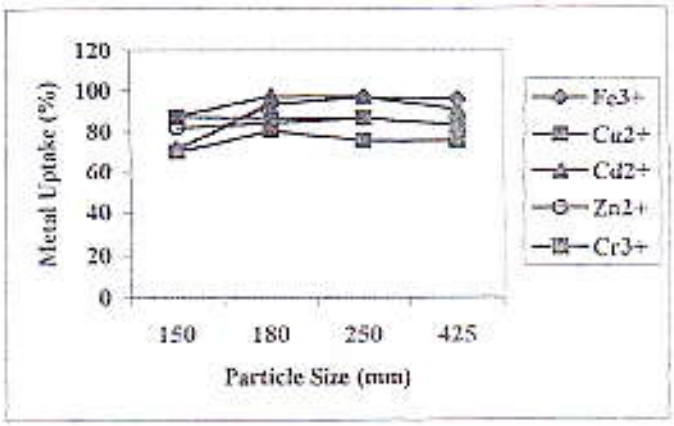

Figure 2. Effect of Particle Size on the Metals Uptake

Effect of Contacting Time on the Metals Uptake

Figure 3. shows the percentage of metals ion adsorb versus contacting time between metals ion solution and salak husk. The result indicate that the optimum adsorption of metals ion by salak husk is occurred at 45 min contacting time.

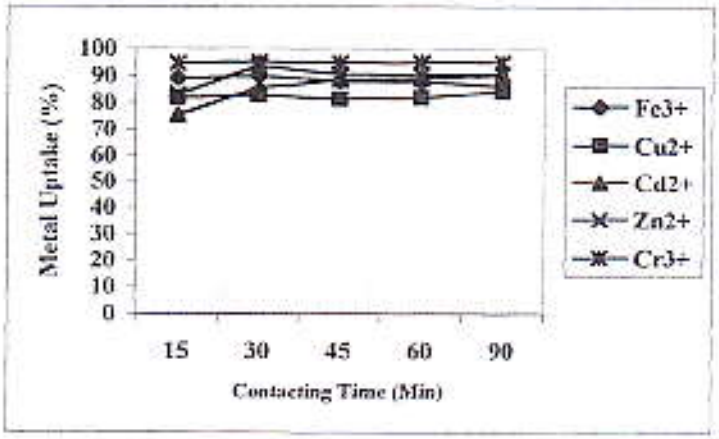

Figure 3. Effect of Contacting Time on the Metal Uptake

Effect of Metal Concentration on Metals Uptake

Figure 4. shows the plots of the percentage of metals ion uptake versus the concentration of ion solution. The percentage of metals ion uptake increased as the concentration of metals ion solution increased. At concentration 10 ppm of metals solution gave an optimum adsorbed for salak husk.

Figure 4. Effect of Metal Concentration on Metals Uptake

Effect of Heating Temperature of Husk on Metals Uptake

The effect of heat treatment on the sorption of metals ion onto salak husk was examined. Metals uptake obtained on fresh and dried (up to 150° C) of the husk were compared based on the same dry weight. The results indicated similar capacity of metals ion uptake (74 – 98 %). The optimum heating temperature was about 120° C.

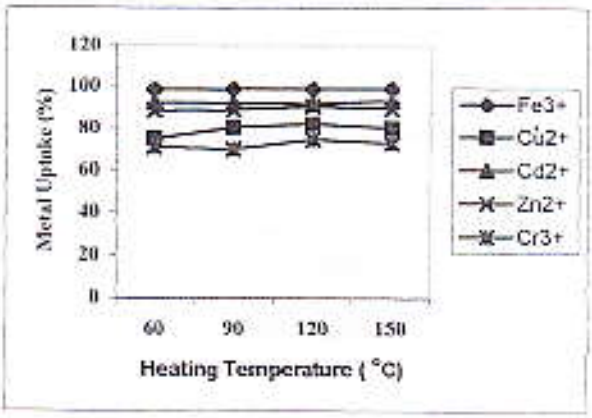

Figure 5. Effect of Heating Temperature of Husk on Metals Uptake

Effect of Heating time of Husk on Metals Uptake

Figure 5 shows the percentage of metals ion uptake versus heating time between metals ion solution and salak husk. The result indicate that the optimum adsorption of metals ion 94,5 % by salak husk occurred at 45 min. heating time.

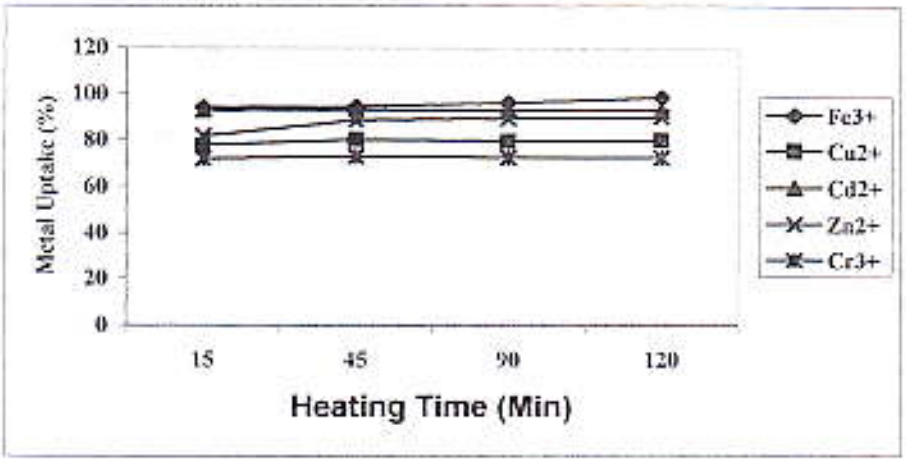

Figure 6. Effect of Heating time of Husk on Metals Uptake

Table 1. Removal Of Metals From Multi Component Solution

	Fe^{3+}	Cu^{2+}	Cd^{2+}	Zn^{2+}	Cr^{3+}
Original Concentration (ppm)	10	10	10	10	10
Final Concentration (ppm)	0.431	2.610	2.561	2.350	1.050
Metal Uptake (%)	95.68	73.90	74.39	76.50	89.50

Table 2. Removal Of Metals Form The Utama Service And Rama Motor Workshop

Padang

Sample	Original Concentration (ppm)			(mg/L^{-1}) Effluent			Metal Uptake (%)		
	Fe^{2+}	Cu^{2+}	Zn^{2+}	Fe^{2+}	Cu^{2+}	Zn^{2+}	Fe^{2+}	Cu^{2+}	Zn^{2+}
Utama Service	0.876	0.520	0.380	0.177	0.450	0.359	79.79	13.46	5.50
Rama Motor	1.542	0.610	0.499	0.477	0.520	0.945	71.10	14.75	10.82

CONCLUSION

In conclusion, the salak husk could be used as potential biosorbent for removal iron, cadmium, chromium, zinc and copper from wastewater. In the capability of salak husk for removal heave metals waste water need to be assessed.

REFERENCES

1. Jenkins. L. Larry, Russel, " Heavy Metals Contribution of houshold Washing Products To Municipal Waste Water," Water environ Res, 66, 1994, pp 805-813

2. E. Munaf, R. Zein, Refilda. I. Kurniadi, "The use of Rice Husk for Removal of Phenol From Waster Water as Studied Using 4-Aminoantipyrine Spectro photometric Method", Environ. Tec, 18, 1997 pp 355-358

3. E. Munaf, Refilda, R. Zein, Deswati, V. Oktasari, "Remofal of Phenol From Hospital Waste Water Using Manggis Husk", J. Kimia Andalas 4.2, 1998, PP. 111-117.