Removal of Copper from Industrial Waste Water by Coconut Husk as a Low Adsorbent

Hanit Kumar Thapak[1], Prashant Singh[2], Manmohan Sharma[3], Siddharth Barolia[4]
[1]*Assistant Prof. of Chemical Engineering Department, ITM Universe, Gwalior (M.P), India*
[2,3,4]*B.E Student of Chemical Engineering Department, ITM Universe, Gwalior (M.P), India*

Abstract

Adsorption of catonic and heavy metal onto coconut husk as a low cost adsorbent was studied as a fuction of amount of adsorbent,Ph,contact time and concentration.it was found that percentage adsorption varied linearly with the ph and adsorption dose but varies nonlinearly with contract time.Coconut husk was collected near achlechwar temple(shiv temple) Gwalior m.p india. near achlechwar temple generated 2600kg of coconut husk waste per month which create tremendous problem in environment. As our honorable prime minister shri narendra modi more focus on clean and green india for this an effective adsorbent was developed by coconut husk waste which not only eradicate heavy metal but also removed harmful impurities from waste water. Adsorption is best way for effective purification and separation technique used in industry especially in wastewater treatments. Cost is an important factor for comparing the adsorbent materials. Therefore, there is increasing research interest in using alternative low-cost adsorbents. To removing this heavy metal activated charcoal as a good adsorbent but it is quite costly.The experiment result shows the maximum removal of copper by coconut husk adsorbent is 89%.

Index terms: *Coconut Husk, Heavy Metals, Adsorption, Industrial Wastewaters*

I. INTRODUCTION

Removal of heavy metal and dyes from effluent of chemical industries in a major problem and is increasing at an alignment rate which is not only a major concern not only to our country but also across the globe. Who are producing dyes of synthetic origin. These synthetic dyes release from chemical industries such as plastic , dye stuff, textile, pulp and paper etc. are mostly of synthetic origin and toxic in nature with effects. Such as earcinogenic and gentoxic effects . India is not a major producer of dye in the world but still produces 2% dyes annually discharge from textile industries coloring industries and associated large scale industries as well as small industries.

Most researchers are working on the removal of dyes from effluent and have mostly used commercially available high cost activated carbon in their studies and have achieve result to a greater extent. India is an agriculture country and produces tons and tons of agricultural waste like sugarcane bagasses ,coconut jute, nut shell, rice straw, risk husk, waste water leaves, crop waste , fertilizers etc . these waste can be utilized in the waste water treatment due to high adsoption capacity and low cost.

Producing activated carbon from these agricultural waste may be an unconventional technique and time consuming but can give successful results. Therefore the presence of these dyes and heavy metals even at very low concentration is very undesirable and can cause serious health related problem such as allergy, dermatitis, skin irritation, cancer and mutations in humans.

Annually large amount of dyes and heavy metals released from industries have different chemical structure. These heavy metals and dyes released have cationic and non-ionic depending upon the charge on the molecules. To alleriate this problem from the environment, it is challenging to treat such effluents having aromatic structures, which are biologically non-biodegradable and toxic.

Several chemical and physical methods are available but adsorption is the preferred method due to its effectiveness. Activated carbon is mostly used in water treatment plants which is successfully employed and effective but expensive due to its manufacturing. As mentioned earlier, India produces tons of agricultural waste and these waste be synthesized the use for treatment of waste water. The adsorbent produced from these waste have high adsorption capacity due t high ligno-cellulose material present in it. These adsorbents produced from these agricultural wastes having the nature of renewable and biodegradable are very efficient and have low cost.

These adsorbents are better due to their minimum processing such as grinding, drying and washing. These methods eliminate the cost of production and use of large amount of thermal energy

used in high cost activated carbon. Adsorbents produced by CCD(coconut coir dust) have high adsorption capacity due to lignins and tannins present in it nad is composed of cellulose, pentosan, furfural and lignin. Coconut husk is dark brown, spongy particle of low weight which falls out when fibre is shredded from the husk. We have already learned that the solid parts of coconut, coir dust etc has been considered as a waste and nuisance for which no industrial use have been developed.

Table 1 Chemical Properties of Coconut Husk Adsorbent

Chemical Characteristics	Percentage
Moisture	5
Volatile matter	18
Ash	9.97
Fixed carbon	67.1

II. MATERIAL AND METHODS

A. Preparation of the Adsorbent

Coconut coir or coconut husk was obtained from Achleshwar Temple Gwalior to make adsorbent. As coconut comes at a reasonable rate so its coir price is also reasonable, hence adsorbent prepared by the help of coir is quite efficient. The method of preparing adsorbent from coconut coir is quite simple. The equipments used are pulverizer for grinding or crushing, sieve shaker of range less than 6 micrometer to 480 micrometer to obtain fine particles within this range, muffle furnace.

Fig 2.1 Pictorial View of Pulverizer

Take about 300 to 400 gram coconut coir and pulverize it with the help of pulverize. After pulverizing put the pulverized material into sieve shaker and shake it for approximately 5 to 6 minutes. We only need particle size of 6 micrometer and below and rest is not used. Transfer the powdered material into crucible and weigh it on a weighing machine. Put the crucible into muffle furnace at 350 to 400 deg. Celsius for approximately 20 to 25 min. As burning increases surface area so coconut coir surface area is increased and it converts into activated carbon.

Fig2.2 Pictorial View of Sieve Shaker

B. Preparation of Synthetic Wastewater

Synthetic Waste Water was made by dissolving analytical grade $CuSo_4.5H_2o$ in distilled water so that copper concentration of this solution was 1000mg/l.

C. Analysis of Adsorbate

The residual concentration of copper was determined spectrophotometrically at 314nm.

Fig 2.3 UV-Visible Spectrophotometerically

III. RESULT AND DISCUSSION

The percentage of removal efficiency of copper ions can be determined

Metal ion removal (%) = $[(C_0 – C_e)/C_0] *100$

Where C_0 is the initial metal ion concentration of test solution, mg/l and C_e is the final equilibrium concentration of test solution, mg/l.

In this experiment following factor effecting adsorbent is

- Effect of contact time
- Effect of pH
- Effect of adsorbent dose

A. *Effect of Contact Time*

The pictorial figure 3.1 shows the variation in the percentage removal of heavy metal with contact time using 0.6g of coconut husk adsorbent at 6 pH for varying concentration 10ppm to 30ppm. The percentage removal of copper is increases from 30 to 120 min and sharply decreases from 120 to 180 min. It is observed that for Cu^{2+} the percentage removal is nearly 81% throughout the 120 min. contact times.

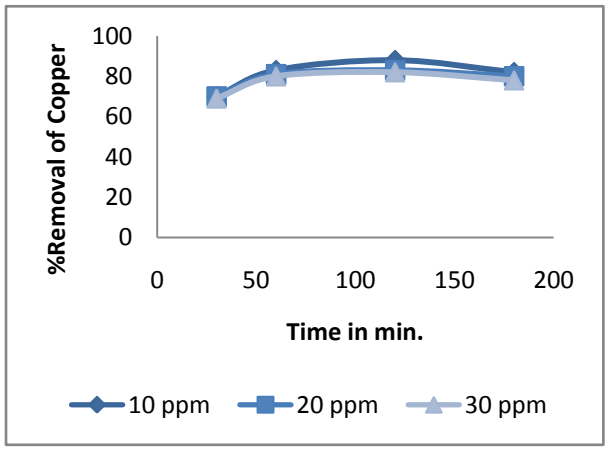

Figure 3.1: Effect of Contact Time of % Removal of Copper ion by Coconut Husk Adsorbent.

B. *Effect of pH*

The pictorial figure 3.2 shows the variation in the percentage removal of heavy metal with pH using 0.6g of coconut husk adsorbent at 120min for varying concentration 10ppm to 30ppm.The % removal of copper is increases 2 to 6 pH and sharply decreases from 6 to 7 pH.It is observed that for Cu^{2+} the percentage removal is nearly 89% at 6 pH.

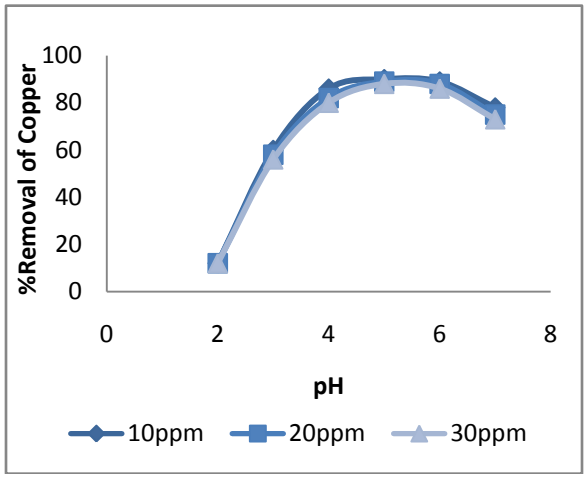

Figure 3.2: Effect of pH on %removal of copper ion by coconut husk adsorbent.

C. *Effect of Dose:*

The pictorial figure 3.3 shows the variation in the percentage removal of heavy metal with adsorbent dosage using 120min contact time at 6 pH for varying concentration 10ppm to 30ppm.the % removal of copper ions is increases from (0.2 to 0.8) gram and decreases from (0.8 to 1.0) gram. It is observed that for Cu^{2+} the percentage removal is nearly 88% at 0.6 gram adsorbent dose.

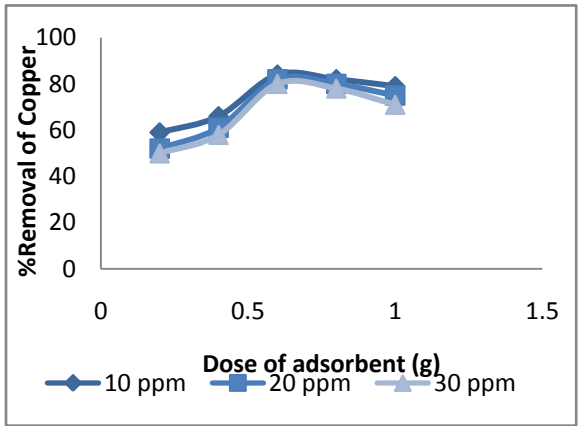

Figure 3.3: Effect of Dose on % Removal of Copper ion by Coconut Husk Adsorbent.

IV. CONCLUSION

Experiment results showed that maximum removal of copper ion by coconut husk adsorbent (6 pH, 120 min. Contact time, 0.6gram adsorbent dose and 10ppm concentration) is 89%.

REFERENCES

[1] Coconut, Plant of Many Uses. University of Califonia, Los Angelis course on Economic Botany (1994).

[2] W.P. Armstrong, Botanical Records Breakers, 19. The Most Valuable Botanical Jewels: (2008).

[3] J.M. Smith, Chemical Engineering Kinetics. New York: McGraw-Hill (1970).
[4] Agency for Toxic Substances and Diseases Registry (ATSDR). Toxicology Profile for Copper Atlanta: U.S. Department for Health and Human Services, Public Health Service (2004).
[5] B.S. Cho, A Study on Heavy Metal Adsorption Using Shrimp Shell (D). M.Sc. degree Thesis, Chosum University, Korea (1994).
[6] Amuda,O.S.;Giwa,A.A.;Bello,I.A. Removal of heavy metal from industrial wastewater using modified activated coconut shell carbon.Biochem. Eng.J.2007,36, 174–181.