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Impact of Copper from Textile Industry Effluent and Treatment using Activated Carbon

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***Abstract*—** Activated carbon produced from coconut shell is used as adsorbent to remove copper ions from industrial waste water. Adsorption experiment was conducted to examine the effects of adsorbent dosage and contact time. The adsorption determined as a function of adsorbate initial concentration and adsorbent dosages. Initial concentration of copper is 3.175 mg/l and it is reduced to permissible limit. This permissible limit is achieved by adding activated carbon in the range of 20 grams. The study also showed that activated carbon prepared from coconut shell can be efficiently used as low cost adsorbent for removal of metal ions.

***Keywords*—** Adsorbent, Activated Carbon, Heavy Metal, Copper

I. INTRODUCTION

Presence of heavy metals in wastewater is of interest because of their known toxic effects on the receiving environment and also on the performance of biological treatment processes.

On the other hand, the performance of wastewater treatment processes in terms of metal removal is also of great importance in determining the quantity of heavy metals discharged into receiving waters, especially in areas where water re-use is practiced. Therefore, recovery of heavy metals from wastewater became an important environmental issue, recently.

Heavy metals present in many industrial wastewaters such as automobile, metal finishing, leather tanning, electroplating, petroleum and textile dying are known to have toxic effects to the receiving environment. Heavy metal containing wastewaters cause detrimental effects on all forms of life upon direct discharge to the environment.

Copper, zinc, lead, mercury, chromium, cadmium, iron, nickel and cobalt are the most frequently found heavy metals in industrial wastewaters.

Different methods were developed for the removal of heavy metals from wastewater. Conventional techniques commonly applied for the removal of heavy metals from wastewater include chemical and physical methods.

Chemical methods are chemical precipitation neutralization, coagulation /flocculation, solvent extraction. Physical methods are electro dialysis, ion exchange, membrane separation, adsorption and filtration. In chemical precipitation, chemicals such as ferrous sulfate, lime, caustic and sodium carbonate are commonly used.

However, these chemical and physical methods have significant disadvantages, including incomplete metal removal, producing large volume of sludge, requirement for expensive equipment and monitoring systems, high reagent or energy requirements and generation of toxic sludge or other waste products that require disposal.

New technologies are required that can reduce heavy metal concentrations to environmentally acceptable levels at affordable costs.

Adsorption process is an affective option for the removal of heavy metals from wastewater. An economical and easily available adsorbent would make the adsorption-based process an attractive alternative for the removal of heavy metals from wastewaters. Activated carbon is the most widely and effectively used adsorbent.

II. OBJECTIVE

To determine adsorption capacity of activated carbon obtained from coconut shell for copper removal present in textile industry wastewater.

III. MATERIALS

A. Coconut Shell

The coconut tree (*Cocos nucifera*) is a member of the family Arecaceae (palm family). *Cocos nucifera* is a large palm, growing up to 30 m (98 ft) tall, with pinnate leaves 4–6 m (13–20 ft) long, and pinnae 60–90 cm long; old leaves break away cleanly, leaving the trunk smooth.

B. Advantages Of Coconut Shell

Coconut Shell Charcoal is a renewable source of energy. Coconut Shell Charcoal is made out of 100% Organic and Charcoal Briquette contains very Low Ash Content.

Coconut Shell Charcoal is Environmental Friendly and friendly to living things and human health. Coconut Shell Charcoal is free from sulfur or any other toxic materials

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C. Preparation Of Coconut Shell

Coconut Shells were collected and cut into small pieces, followed by washing with simple tap water for removal of dust adhere to it. It was dried in the sunlight for 15-20 days.

Dried materials were kept inside the furnace at 150°C for 24 hours for removal of moisture and other volatile impurities. After that it was crushed with a locally made crusher and sieved to 300-700 μm size range. The adsorbent prepared is thus stored in an air tight container for adsorption process.

IV. METHODS

Adsorption may be defined as the process of accumulation of any substance giving higher concentration of molecular species on the surface of another substance as compared to that in the bulk. When a solid surface is exposed to a gas or a liquid, molecules from the gas or the solution phase accumulate or concentrate at the surface. The phenomenon of concentration of molecules of a gas or liquid at a solid surface is called adsorption. Adsorption is a well established and powerful technique for treating domestic and industrial effluents.

The basic principle of operation for carbon adsorption is the mass transfer and adsorption of a molecule from a liquid or gas into solid surface. Activated carbon is manufactured in such a way as to produce extremely porous carbon particles whose internal surface area is very large. This porous structure attracts and holds organic molecules as well as certain metal and inorganic molecules.

V. EXPERIMENTAL SETUP

The effluent is passed through the layers of the column setup and sample is collected using the beaker at the bottom. The sample thus collected is tested for the chromium using atomic adsorption spectrometer.

VI. RESULTS AND DISCUSSION

Initial concentration of copper is 3.175 mg/l. Figure 1 shows that the usage of activated carbon adsorbent is proven to be more efficient in removing the chromium. The permissible limit of copper prescribed by the IS codes is 1.5 mg/l and that is achieved by adding 20 grams of activated carbon.

VII. CONCLUSION

The adsorption process is carried out to the study the effect of activated carbon prepared from coconut shell as a low cost adsorbent in the removal of copper from textile industrial effluents. The initial concentration of copper is found to be 3.175 mg/l. As per IS code, limit of copper in industrial effluent is 1.5mg/l. The adsorbent concentration is varied from 10 to 25 mg/l and adsorption process is carried out in batch process. The final concentration is measured using atomic adsorption spectroscopy. It is found that the copper is removed by activated carbon prepared from coconut shell. Thus we can use activated carbon prepared from coconut shell as a low cost adsorbent in treating textile industrial effluents.

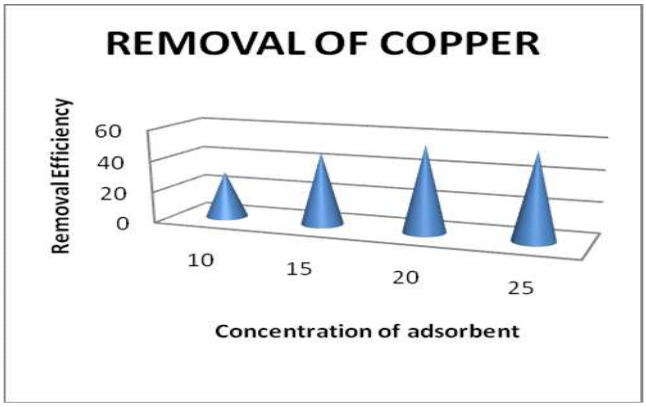

Figure 1: Removal Efficiency

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