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Adsorption Studies For Treatment Of Sugar Industry Wastewater By Low Cost Adsorbents Banana Peel, Orange Peel And Bilva Leaves.

REMOVAL OF COLOR, BOD AND TURBIDITY

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ABSTRACT - *The comparative study of different low cost adsorbents in treatment of wastewater from sugar industry is carried out, the goal being to remove organic pollutants and procedure water that can be reused in the production process this study focus on removal of BOD, COD, Turbidity, TOC, Color, TDS, Conductivity and pH in waste water of sugar industry mill using mixed bed adsorbent prepared from Banana peel, Orange peel, and Bilva leaves. The activated carbon are evaluated for reduction in BOD, COD, Turbidity, TOC, Color , TDS, Conductivity and pH of a sugar industry effluents using batch process to find out the effect of operating parameters.(contact time, amount of activated carbon, waste water, concentration of pH solution etc.)*

Keywords:*Sugar industry waste water, Banana peel, Orange peel, Bilva Leaves,Color,BOD,Turbidity.*

INTRODUCTION

India is one of the largest producers and consumers of 22 million tons of sugar per annum in the world and about 1000L of wastewater is produced for every ton of cane crushed .Its importance is related to energy contribution in combination with the capacity to sweeten. The discovery of sugarcane, from which sugar is derived, dates back unknown thousands of years. It is thought to have originated in New Guinea, and was spread along routes to South East Asia and India. The process known for creating sugar, by pressing out of the juice and then boiling it into crystals, was developed in India around 500 Before Christ (B.C) Sugars are a major form of carbohydrates and are found in all green plants. They occur in significant amounts in sugarcane and sugar beet. They are also found in lesser quantities in fruits and vegetables. There are three main simple sugars, sucrose, fructose and glucose and the body quickly break down in to these separate substances. Apart from sugar being the cheapest instant source of energy, it has several medical and the rapeutical values, such as treatment of oral rehydration in infants and healing wounds. And also sugar is the best carrier of Vitamin A and E and minerals. Approximately 70% of sugar is produced from sugarcane which is largely grown in tropical countries and 30% of sugar is produced from sugar beet which is grown in temperate zones. India is the largest sugar producing country in the world. India has been known as the original home of sugar and sugarcane. Presently, about four million hectares of land is cultivation of sugarcane with an average yield of 70 tons per hectare [1]. There are more than 550 installed sugar industries in the country [2]. In India most of the sugar mills are situated in the country side and sugar is mainly produced from sugar cane. Production of sugar from sugarcane is a seasonal operation, depending on the availability of sugarcane, which lasts for about 4-8 months i.e. from October to May. Rapid urbanization, industrialization and population growth have led to the severe contamination of most of the fresh water resources with untreated industrial and municipal wastes [3]. Demands of clean industrial wastewater to avoid environmental pollution and especially contamination of fresh water resources have become national and international issues [4]. The increase in the volume of wastewater discharge in to the environment that pollutes freshwater resources is the result of modification in the manufacturing processes. The sugar industries utilize around 1500-2000L of water and produce about 1000L of wastewater per ton of cane crushed. The sugar manufacturing process produces wastewater which possess high content of organic material and subsequently high Biochemical Oxygen Demand (BOD) which ranges from1700-6600 mg/L, the Chemical Oxygen Demand (COD) is from 2300-8000 mg/L and the total suspended solids are up to 5000 mg/L and the ammonium content is high [5]. As the wastewater from the industry is rich in organic matter, managing the same is a challenging task. The wastewater leads to rapid depletion of dissolved oxygen content in water bodies, rendering them unfit for both aquatic and human uses.

Table: 01 Characteristics of combined waste from sugar industry

SI NO	PARAMETERS	STANDARD PRESCRIBED BY BOARD
01	pH	4.60 to 7.10
02	COD	600 to 4400 mg/l
03	BOD 20^{o} C	300 to 2000 mg/l
04	Total solids	870 to 3500 mg/l
05	Total volatile solids	400 to 2200 mg/l
06	Total suspended solids	220 to 800 mg/l
07	Total Nitrogen	10 to 40 mg/l
08	COD/BOD ratio	1.30 to 2.00

Types of adsorption

Based on the bonding between adsorbent molecules and solid surface, adsorption can be classified as follows.

I. Chemical adsorption
II. Physical adsorption
III. Exchange adsorption.

Table: 02 Characteristics of Different Adsorbents

Type	Characteristics	Use	Disadvantages
Activated Carbon	Hydrophobic, favors organics over water	Removal of organic pollutants	Difficult to regenerate
Zeolites	Hydrophilic, polar, regular channels	Air separation, dehydration	Low total capacity
Silica gel	High capacity, hydrophilic	Drying gas streams	Trace removal not effective
Activated alumina	High capacity, hydrophilic	Drying gas streams	Trace removal not effective

MATERIALS AND METHODS

Name of the adsorbent used for experimental works:

- **Banana peels:** Fresh banana peels are to be collected from domestic wastes, as its availability and transportation was easy. Banana peel contains lipids (1.7%), proteins (0.9%), crude fiber (31%) and carbohydrates (59%). The various minerals present are potassium (78.10 mg/g), manganese (76.20 mg/g), sodium (24.30 mg/g), calcium (19.20 mg/g) and iron (0.61 mg/g). The peels were washed several times with tap water and followed by distilled water. The washed material then cut in to small pieces and allowed to dry in a hot air oven at 80˚C for 24 hours. The moisture content was lost from it and the color change was observed from yellow to brownish black. The dried material was finely ground and screened through the sieves of cut size of 150-212µm.

- **Orange peels:** Orange peel powder was selected as adsorbent for carbon dioxide. Oranges were collected from local market, and peeled. Peels were washed thoroughly to remove dirt, dried and powdered. The powder was analyzed for chemical composition, structure and surface area. Original powder used for the capture of carbon dioxide. Carbon was made from the powder with the help of 98% H2SO4. The yield of reaction was 66.3% with

concentrated H2SO4 and orange peel powder to produce carbon. The continuous experiments were carried out for different weight of the material, and different flow rate of gas.

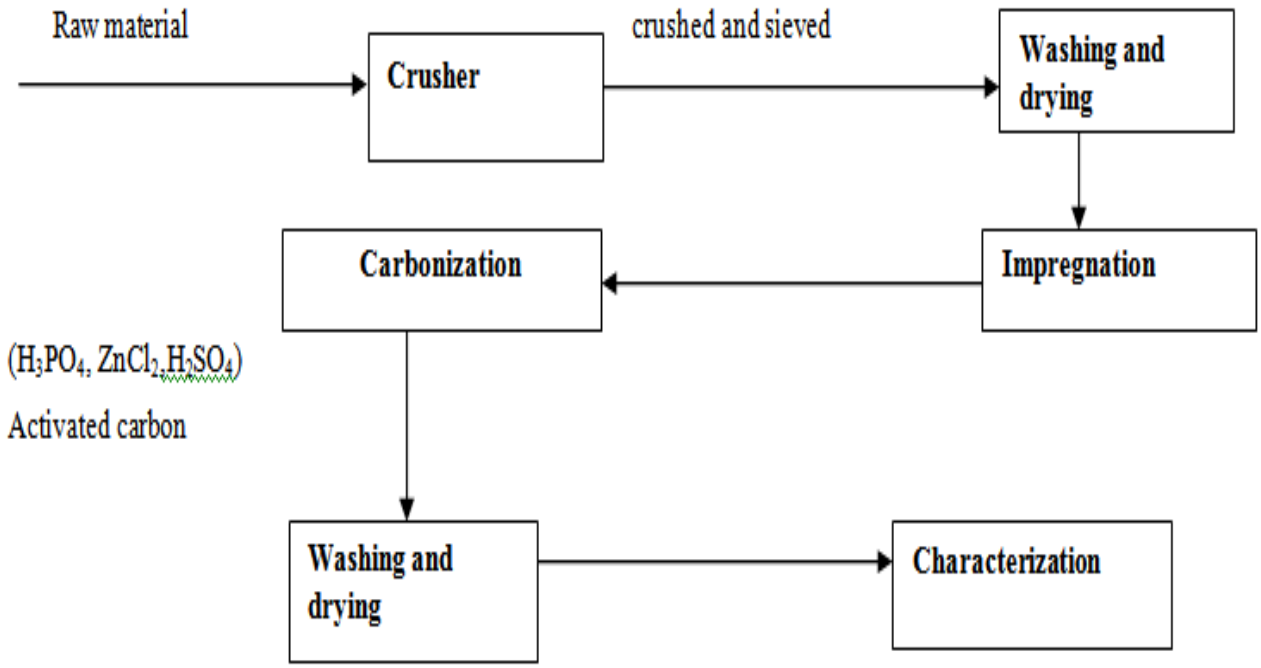
- **Bilva leaves:** Collected near by college.

Preparation of Activated Carbon

The activated carbon is prepared out of the material used i.e. Banana peels, Orange peels, and Bilva leaves by the following process.

- **Crusher:** The samples are firstly cut into small pieces or crushed and are sieved to a pore size of 0.25mm.
- **Washing and draying:** The sieved samples are washed several times with tap water and then with distilled water to remove adhered dust and is dried in oven at 110^0 C for 24 hours to remove hydrocarbon and then taken off the oven and is cooled for room temperature.
- **Impregnation:** The cooled saple is chemically treated homogeneously. For activation, 100grams of sample is thoroughly mixed with 100ml of activating agents ($H3PO_4$, $ZnCl_2$, H_2SO_4) in ratio 4:1.5.
- **Carbonization:** The solution is taken into the beaker and placed into the over at 110 C in oven for24hrs .Sample is soaked in distilled water and is subsequently replaced until the pH of solution is Stable.
- **Washing and drying:** the sample is then washed with 2% HCl (v/v) or NaHCO4 (W/V) , and then with distilled water to remove any activating agent.it is dried at 110 C the dried samples will be transferred to the muffle furnace at 650 C for 6^{th} and the activated carbon is prepared for characterization of the effluents.

Schematic diagram for preparation of activated carbon



CONCLUSION

- This study shows that IAC-C has good efficiency in BOD and COD reduction of sugar industry wastewater.
- The effect of various parameters such as adsorbent dose, pH, adsorbent treatment time and agitation speed showed a significant variation in percentage removal efficiencies of BOD and COD.
- The optimum operating parameters for maximum BOD and COD reduction are, Adsorbent dose: 3.5gm/100ml of sample, pH: 4 and 3 for Bod and COD resp.

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