Preparation of adsorbent from karanja oil seed cake and its characterization

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ABSTRACT

The main objective of this work is the preparation of activated carbon by using Karanja oil seeds cakes which is a waste remain after the extraction of the karanja oil from the seeds by the method of Sulphuric acid (H2SO4) chemical activation. The karanja oil is used as an feedstock for biodiesel preparation and the cake is a waste which is thrown away with no further use, thus this can be used as a feed stock for the preparation of activated carbon. The characteristics and surface area of the prepared activated carbon were investigated. The experiments were carried out with carbonization temperature varied from 400°C to 550°C. The results show that in all cases, increasing the carbonization temperature the yield decreases. It was found that the specific surface area of activated was at a maximum value (about 343 m2/g) at carbonization temperature of 500°C and carbonization time 2.0 h .The XRD analysis shows that the phase change from amorphous to crystalline form has been taken place.

Keywords: - activated carbon, karanja oil seed cakes, surface area and XRD.

1. INTRODUCTION

Activated carbons (ACs) are particularly useful found and commonly used owing to their large adsorption capacity, fast adsorption kinetics and relative ease of regeneration. They adsorb organic and non-polar compounds from liquid and gaseous phases. Inexpensive sources and cost-effective preparation methods are in demand because of the importance of adsorption in pollution control. Worldwide sales of activated carbon are over one billion.US$. Besides coal, many agricultural byproducts such as walnut shell, coconut shell, cherrystone, Apricot stone, nuts, grape seeds, eucalyptus, olive and peach stones, sugar cane bagasse and oil palm trunks have been to be suitable precursors owing to their high carbon and low ash contents [1].

The inherent nature of the precursor or starting material, as well as the method and conditions employed for carbon synthesis, strongly affects the final pore size distribution and the adsorption properties of the activated carbons. In the last years, special emphasis on the preparation of activated carbons from several agricultural byproducts has been given due to the growing interest in low cost ACs from renewable, safe, copious supplies, especially for applications concerning treatment of drinking water and wastewater. The degree of impregnation and the carbonization temperature have been reported as governing the porous structure of the resulting ACs. The highest surface areas, published in the literature for a variety of precursor materials and different activation conditions, are generally obtained for heat-treatment temperature between 400 and 500 °C. Also the optimum ratio of impregnation appears to depend on the type of precursor material [2].

Activated carbon (AC) is the carbonaceous material which plays an important role in adsorption process. Its ability to remove organic and inorganic chemical waste, odor, color and taste from any kind of chemical industry process is based on their amazing properties. Activated carbon has high degree of surface reactivity which can influence its interaction with polar or non polar adsorbates. Besides, it also has higher surface area and micro porous structure. Activated carbon are widely use in wastewater treatment to remove harmful chemicals and heavy metal, industrial waste water or industrial flue gas [3]. Their application in industry includes removing organic and inorganic pollutants from drinking water, industrial wastewater treatment, decolorizing of syrups and purification of air and pharmaceutical product [4]. Because of their wide usage in industry, the demand of the activated carbon is increasing year by year. Commercial activated carbon is quite expensive. As such industry now seeks for the cheapest activated carbon derive from agriculture waste or residuals. The residuals can be seed cakes rice husk, sawdust or other carbonaceous material. The raw material were processed and optimized to obtain excellent adsorptive properties.

2. MATERIAL AND METHOD

1) **Material:** The materials used for preparation of activated carbon are karanja oil cake.
2) **Method: Activated Carbon preparation:-**This includes preparation method of activated carbon from karanja oil seed cake. In this case cake is obtained after extracting oil from the karanja seeds. This cake is then dried and digested by using Sulfuric acid followed by carbonization in muffle furnace.

2.1) **Preparation of dried cake:-**

The cake is collected from the karanja oil mill.
This cake is first dried in the sunlight for 20 days
This naturally dried material kept in the oven for 12 hours at the temperature 55^0c.

2.2) **Digestion of the solid cake**

100 gms of sample is crushed manually.
Dil. Sulphuric acid solutions are prepared.
70 ml of acids are utilized to digest the cake.
This is kept at 30^0c for 7 hours.

2.3) **Washing of the Digested cake:-**

The digested cakes were washed using distilled water, 10 to 12 washing were given.

2.4) **Determination of pH:-**

The determination of pH of the carbonized material had been done.

2.5) **Carbonization of the sample.**

The whole sample is taken in a container and kept at 500^0c in muffle furnace for 2 hrs. Then oversize and undersize particle is separated by using 300 mesh.

2.5.1) **Feed container**: - the feed container was a Crucible which could sustain temperature 500^0c and above.
2.5.2) **Desiccators**: - the activated carbon was kept in the desiccators. It keeps activated carbon moisture free.
2.5.3) **Sieving**:-the carbon above procedure was crushed manually and passed through the 300 mesh sieve plate to produce carbon of uniform size.

3. RESULTS AND DISCUSSION

The studies were carried out with potential adsorbent obtained from karanja oil cake to evaluate its properties as an adsorbent. The parameter chosen for the study and their variations on the adsorption are depicted in the following manner.
The parameters are:-

1. carbonization temperature
2. pH of the adsorbent
3. Surface area of the adsorbent
4. XRD Analysis

1. Effect of carbonization temperature:

One of the most important parameter affecting the surface characteristics of the carbon is the carbonaceous temperature. The carbonization carried out at 400 ^{0}C to 550 ^{0}C. At 550 ^{0}C the material gets converted into complete ash form while at remaining temperature carbon formation occurred. On sieve analysis two particle sizes got i.e. through and above 300 mesh sizes. It is observed that with the increasing temperature from 400 ^{0}C to 550 ^{0}C the cake get converted into carbon and finally to ash.

The optimum carbonization temperature for the preparation of the adsorbent was found to be 500^0C. The results are shown for adsorbent with carbonization temperature 500 ^{0}C.

2. pH of the adsorbent

pH of the adsorbent is considered to be one of the most important factors as we treat the feed with various acids and other chemicals therefore it is necessary to maintain the neutral pH.

3. Surface area of the adsorbents = 343 m^2/g

4. XRD analysis:

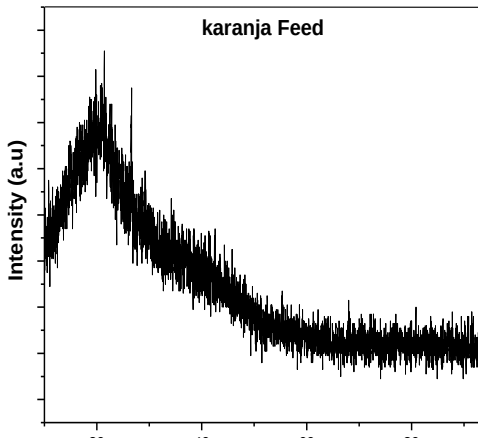

Fig 1(*XRD of Karanja feed*)

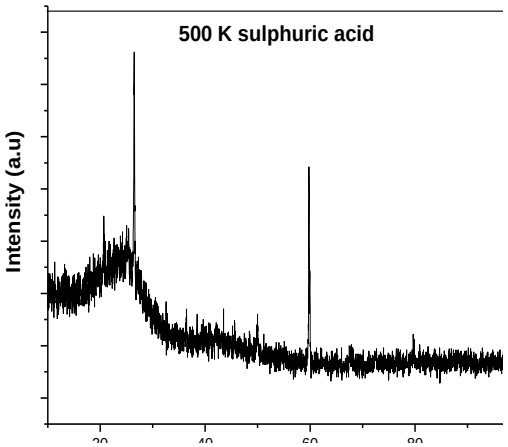

Fig 2(*XRD of carbonized karanja*)

Fig 1 and Fig 2 shows the phase change from amorphous to crystalline form by the change in peak height.

4. CONCLUSION

The activated carbon prepared at carbonization temperature 500^0C, carbonization time 2 hrs and sulphuric acid as an activating agent gives the good surface area i.e. **343 m^2/g** and also shows the crystalline phase in the activated carbon**.**

5. REFERENCES

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