PRODUCTION OF ACTIVATED CARBON FROM VARIOUS NATURAL RESOURCES AND ITS APPLICATION

[1]Mahesh Suryawanshi,Akash Bandgar[2], Chaitali Mhaske[3], Shruti Shetty[4]

[1]Assistant Professor, [2,3,4]Student
Department of Chemical Engineering,
Bharati Vidyapeeth College of Engineering, Navi Mumbai, India

Abstract : Activated carbon is also known as activated charcoal. The activated carbon is highly porous material and great adsorbent. Activated carbon has excellent performance in a number of process applications. The aim of this project is produce the activated carbon from natural resources such as coconut shell, bamboo, rick husk, sugarcane bagasse and groundnut shell .The sources are relatively cheap and easily available. The activated carbon will be obtained by burning the source material. The analysis of the adsorbents includes estimation of various parameters such as proximate analysis (moisture content, ash content, volatile matter, fixed carbon content), bulk density, PH, iodine number, surface area, burn-off weight percentage and percentage yield.The adsorbent shows the best surface area was used for adsorption. The activated carbon which is obtained from natural resources which is used to remove hardness of water, to remove dye which is present in wastewater of the textile industry, to remove organic and inorganic compounds which are present in water, reduce the chemical oxygen demand. Then finally compared which raw material is efficient.

***Keywords:-* Activated carbon, coconut shell, rice husk, bamboo, sugarcane bagasse, groundnut shell, hardness, dye.**

1.INTRODUCTION:-

Increase in population has boosted the growth of different industries leading to discharge of pollutants into the water bodies. Among those industries textile, food, cosmetic, paper industries lead to discharge of dye that needs immediate attention. Colour in the waste water results from various organic chemicals that prevent the sunlight to penetrate affecting the aquatic system. Aquatic organisms and plants are affected due to release of toxic organic chemicals. Various methods to address this issue have been published by many researchers such as sedimentation with clarification, coagulation and flocculation, chemical oxidation, filtration using membranes, adsorption, biodegradation etc. Among these Adsorption is well established technology. There are many low cost adsorbents such as sawdust, wheat barn etc. But due to its less adsorption capacity use of activated carbon as an adsorbent is greatly sorted.

Activated carbon , also widely known as activated charcoal or activated coal is a form of carbon which has been processed to make it extremely porous and thus to have a very large surface area available for adsorption or chemical reaction. Due to such high degree of micro porosity just 1 gram of activated carbon has a surface area in excess of 500 m2 as typically determined by nitrogen gas adsorption.

The organic material which has high carbon content is used as the raw material for the synthesis of activated carbon. There are many cheap, easily available such as coconut shells, rice husks, sugarcane bagasse, groundnut shells, and bamboo have been used as the source for the synthesis of activated carbon. To analyze the properties of activated carbon obtained from various natural resources such as Coconut Shell, Bamboo, Rice Husk, Groundnut Shell and Sugarcane Bagasse.

2.MATERIAL & METHOD:-

2.1.RAW MATERIALS:- Coconut shell, Bamboo, Rice Husk, Groundnut Shell, Sugarcane Bagasse were taken as precursor for the

SR.NO.	RAW MATERIALS	ACTIVATING AGENT TO BE USED	IMPREGNATION RATION	ACTIVATION TIME	ACTIVATION TEMPERATURE
1	Coconut Shell	H_3PO_4	1.345 to2:1	14.9 - 23.9 min	394 ^{0}C – 416 ^{0}C
2	Bamboo	KOH	25% by volume	120 - 180 min	800 ^{0}C
3	Rice Husk	H_3PO_4	0.75 : 1	30 min	700 ^{0}C
4	Groundnut Shell	20 % KOH	1 : 1	60 min	170 ^{0}C
5	Sugarcane Bagasse	$ZnCl_2$	0.75 : 1	30 min	700 ^{0}C

preparation of activated carbon. The precursor was washed several times with water to remove adhered dust particles from its surface. The precursor was then air dried in sunlight.

2.2.METHODOLOGY:-

CHEMICAL ACTIVATION:-Chemical activation involves carbonization and activation process in a single step. Chemical activation involves the reaction of the precursor with the activating agents at temperature between 500 and 800 0C. The reagents most commonly used in industry are zinc chloride, phosphoric acid or sulphuric acid. These are both dehydrating agents and oxidants so that carbonization and activation take place simultaneously. The raw material is impregnated with

The given chemical agent in the form of a concentrated solution by mixing and kneading this procedure causes the cellulose to break down. The impregnated material is then extruded and pyrolyzed in the absence of air. In this stage, the chemical activator dehydrates the raw material as a result of which the carbon skeleton is charred and aromatised and a porous structure is created. The product is then cooled and washed to remove the activating agent.

3.PROPERTIES:-

3.1PROXIMATE ANALYSIS:-

3.1.1.Moisture Content:- Small amount of activated carbon sample weight was measured and then taken in a petri dish. It was spread nicely on the dish. It was then heated in an oven at a temperature of 105-110 0C for 1.5 hr. The petri dish was left open during the heating process. After heating, the petri dish was removed and cooled in a desiccator. After cooling the weight of the dried sample was measured.

% Moisture Content (M)= 100(B-F)/(B-G)

B = Weight of petri dish + original sample

F = Weight of petri dish + dried sample

G = Weight of petri dish

3.1.2.Ash Content:- One gram of sample was taken in a silica crucible. It was heated in a muffle furnace to 750 0C for 1.5 hr. During this heating process the crucible was left open. After the required heating, the crucible was left open. After the required heating the crucible was cooled in a desiccator and then weight of the ash was measured.

% Ash Content (A)= 100(F-G)/(B-G)

G= Weight of crucible

B= Weight of crucible + sample

F= Weight of crucible + sample (after heating)

3.1.3.Volatile Matter Content:- A known quantity of sample was taken in crucible. It was then heated to 925 0C for exactly 7 minutes in a muffle furnace. Then the crucible was cooled in a desiccator and weighed.

% Volatile Matter Content (VM)= 100[100(B-F)-M(B-G)]/[(B-G)(100-M)

G= Weight of crucible

B= Weight of crucible + sample

F= Weight of crucible + sample (after heating)

M =% Moisture content

3.1.4.Fixed Carbon Content:-

% Fixed Carbon Content (FC)= 100 - (% moisture content + % ash content + % volatile matter content)

3.2.IODINE NUMBER:-

Iodine Number is the milligrams of iodine adsorbed by 1 gram of activated carbon from a standard 0.1N iodine solution when the equilibrium iodine concentration is exactly 0.02N. Procedure for calculating iodine number:-

Part I:- 10c.c.of 0.1N iodine solution was taken in conical flask. Two drops of starch solution was added to it. The pale yellow colour of Iodine Solution turned Blue. Titration of the formed solution was done with 0.05N sodium thiosulphate till it becomes colourless. Burette reading corresponds to Blank reading. (B)

Part II:- 1 gm of activated carbon was weighed very accurately. It was introduced into the Iodine flask which should be completely dry. 160cc of 0.1N iodine solution was then added. The flask was shaken properly for 4 minutes and then filtered. The filtrate was collected in a dry flask and then 10cc of the filtrate was titrated against standard sodium thiosulphate solution using starch as indicator. Burette reading corresponds to (A).

Iodine Value = C * Conversion Factor (mg/gm)

Conversion Factor =Mol.Wt.of Iodine127×Normality of Iodine ×160Wt.of Carbon ×Blank reading

C = B-A

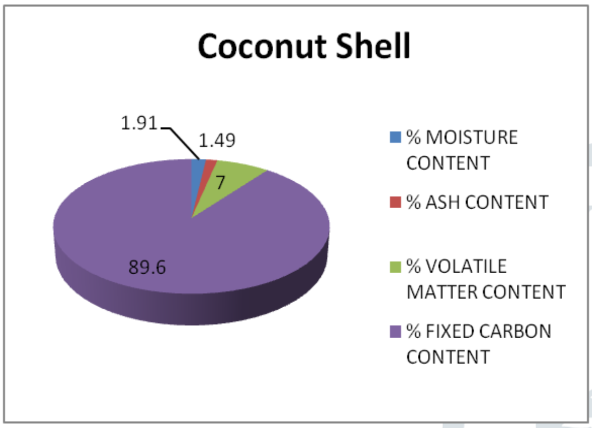
3.3.SURFACE AREA:- The surface area was determined by using iodine adsorption number.

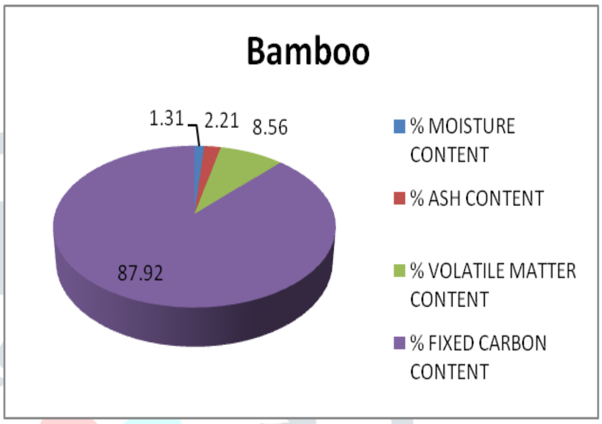
S_{BET} = 0.9946 × Iodine number – 4.91

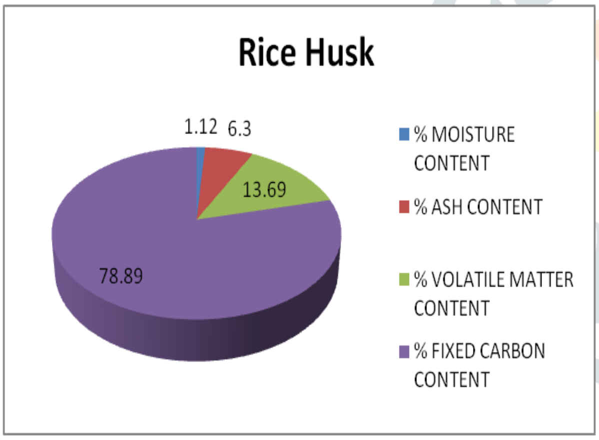
4.RESULTS:-

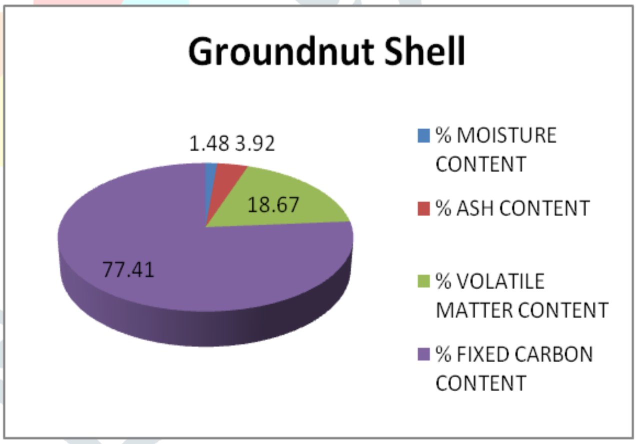
4.1.The results of proximate analysis is as follows:-

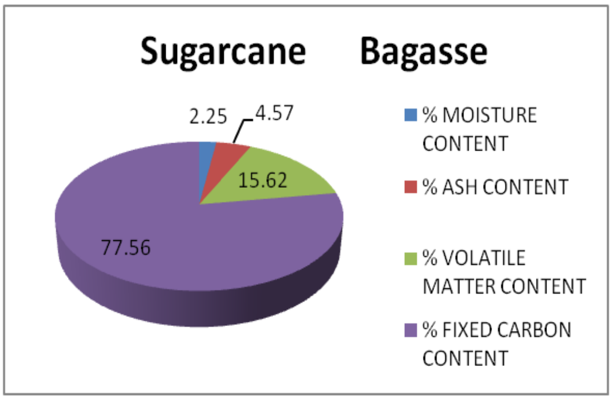
SR.NO.	RAW MATERIAL	% MOISTURE CONTENT	% ASH CONTENT	% VOLATILE MATTER CONTENT	% FIXED CARBON CONTENT
1	Coconut Shell	1.91	1.49	7	89.6
2	Bamboo	1.31	2.21	8.56	87.92
3	Rice Husk	1.12	6.3	13.69	78.89
4	Groundnut Shell	1.48	3.92	18.67	77.41
5	Sugarcane Bagasse	2.25	4.57	15.62	77.56





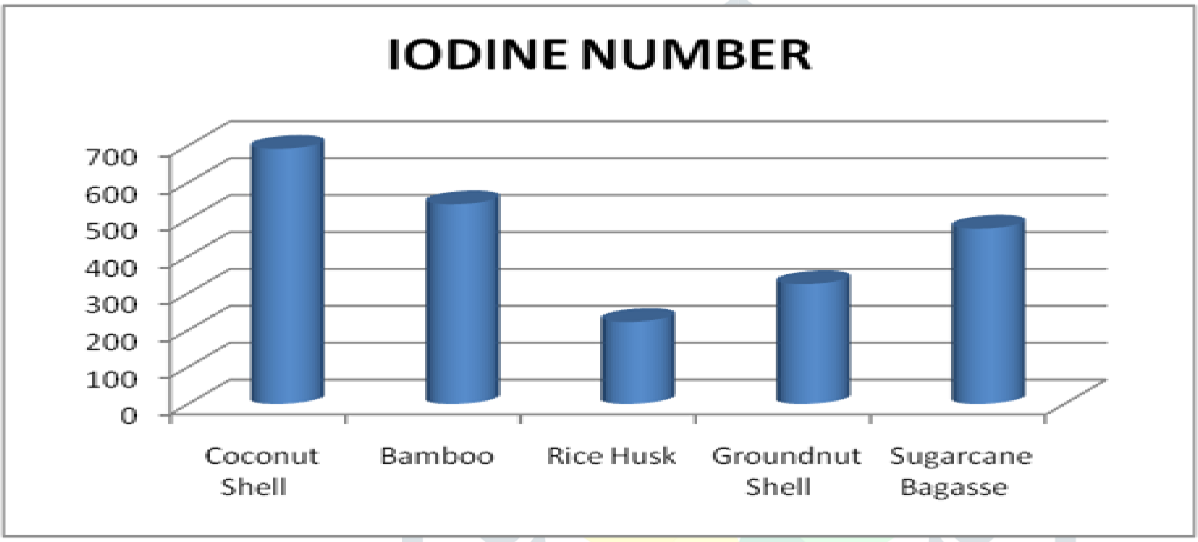






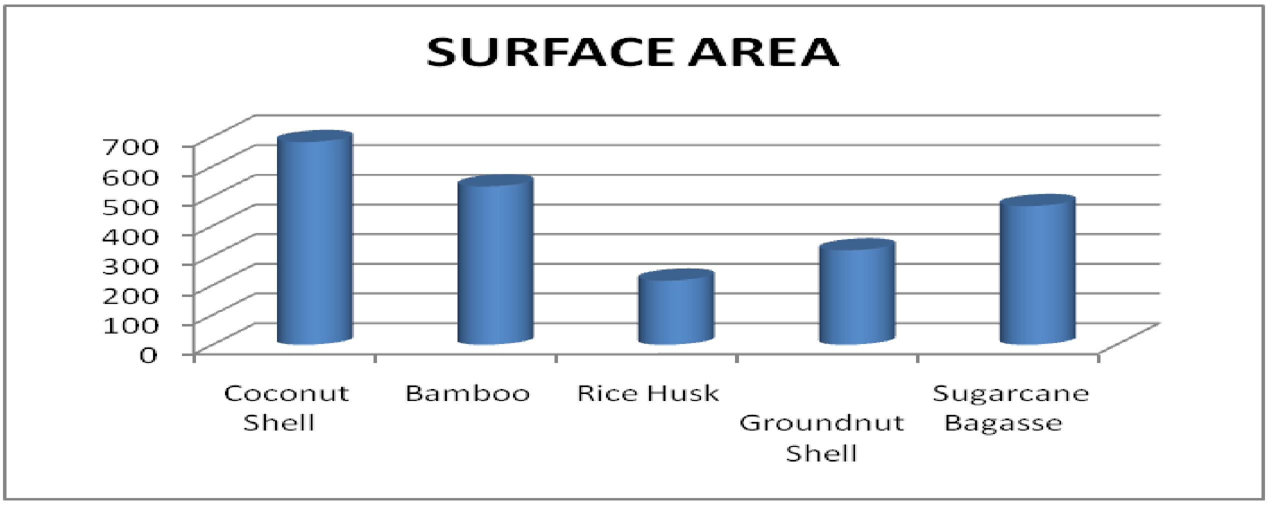
4.2. The results of iodine number is as follows:-

SR.NO.	RAW MATERIAL	IODINE NUMBER
1	Coconut Shell	691.26
2	Bamboo	540.99
3	Rice Husk	222.407
4	Groundnut Shell	324.594
5	Sugarcane Bagasse	474.869



4.3.The results of surface area is as follows:-

SR.NO.	RAW MATERIAL	SURFACE AREA
1	Coconut Shell	682.62
2	Bamboo	533.15
3	Rice Husk	216.29
4	Groundnut Shell	317.93
5	Sugarcane Bagasse	467.39



5.APPLICATION:-

Main methods/ technologies for colour removal can be divided into three categories provided below. These methods of colour removing are as under:-

Biological Treatment

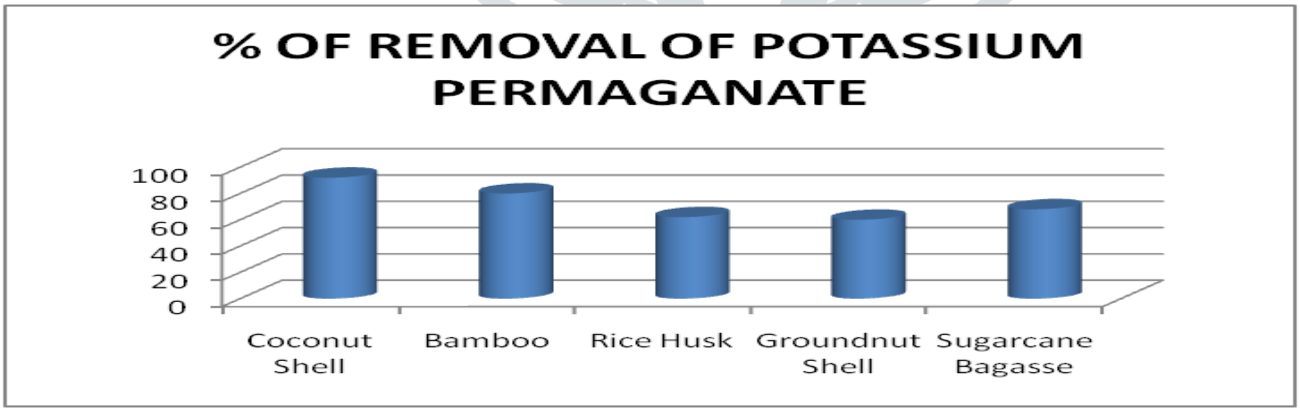
Chemical Treatment

Physical Treatment

Procedure of doing removal of Dye:-Prepare 50 g/L of Potassium Permanganate Solution. In a 20 ml solution of potassium permanganate add 5 gram of activated carbon. Properly mixed and settled for 1 hour. After that using filter paper filter the solution and to find out the concentration of potassium permanganate the solution is titrating against 0.1M standard solution of oxalic acid.

The values of dye removal is as follows:-

SR.NO.	RAW MATERIAL	% OF REMOVAL OF POTASSIUM PERMANGANATE
1	Coconut Shell	92
2	Bamboo	80
3	Rice Husk	62
4	Groundnut Shell	60
5	Sugarcane Bagasse	68



6.CONCLUSION:-

The result of this study shows that it is feasible to prepare activated carbon with relatively high surface areas by Chemical Activation. Proximate analysis of activated carbon provides a good idea about the physical properties of samples. From this analysis it is found out that the fixed carbon content of coconut shell activated carbon is higher than the other four. From the experiment it is found that the Iodine Number of coconut shells is 691.26 mg/gm. This result indicates which sample is better over others. Iodine Number is basically a measure of the micro-pore content of the activated. Iodine number shows a direct proportionality with the micro-porosity of the sample, thus, a higher iodine number signifies higher micro-porosity of the sample.From the experiments it is found that the surface area of coconut shell 682.62 m2/gm which is more than the bamboo, rice husk, groundnut shell, sugarcane bagasse.

From the test of dye removal it is found that the adsorption capacity of coconut shells is higher than the bamboo, rice husk, groundnut shell and sugarcane bagasse.

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