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Production of paper from Groundnuts shell

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ABSTRACT

In recent years, with the growing shortage of wood from the forest, the search for alternative fibre producing plant material has been made in many countries of the world.Among them groundnut shells may serve partly as an alternative resource. In this project we produced pulp from waste groundnut shells using Kraft's process. We had also analysed the both process based on their yield and energy consumption. It is also a project from the waste material (groundnut shells)

Keywords:Groundnuts shell, pulp, kraft's and soda process,leguminous plants,versatile.

I.INTRODUCTION

Paper is a versatile material with many uses. It is prepared mainly by using cellulose pulp derived from wood and then drying them into flexible sheets.The most common use is for writing and printing; it is also widely used as a packaging material and even as a food ingredient -- particularly in Asian cultures. Paper and the pulp papermaking process is an ancient process which was developed in China.

Groundnut is also of value as rotation crop. As it is the plant, it improves soil nutrients, due to the presence of atmospheric nitrogen fixing bacteria in its root nodules. Thus, all parts of groundnut plant are fully useful. Groundnut shell has great potential for commercial use. Groundnut shell is used as a fuel, filler in cattle feed, hard particleboard, activated carbon, etc. The groundnut shell fibres possess good physical strength properties. The higher pentosan content together with gums of some species of groundnut plant may be a suitable source for producing paper.

II.PULPING

[1]It is important process for producing paper. Pulping is the process of production of pulp using wood material which is a lignocellulose fibrous material(in our case it is groundnut shells). It is prepared by taking the various chemicals in their desired proportion so as to form a proper solution and then heating it at very high temperatures for almost 3 to 4 hours.

2.1 Raw Materials

Generally, woods are two types. Hard woods and Soft woods. These woods contain basically two materials in them.

They are:

1. Cellulose
2. Lignin

The cellulose present in wood is mostly in the form of fibres. The cellulose fibres are obtained as pulp after pulping process. Cellulose fibre is a long chain of single monomer $C_6H_{10}O_5$.

2.2 Methods of Pulping

[2]Many processes came into existence for production of pulp from wood materials in past decades. These methods work differently based on the quality of pulp obtained after the process and also based on their efficiencies and also the heat energy that is required for pulping process. Mainly there are 2 methods.

2.3 Preparation for Pulp:

Wood chipping is the act and industry of chipping wood for pulp but in our case we require crushed,clean and dried groundnut shells.Only the heartwood and sapwood are useful for making pulp. Most pulping processes require that the groundnut shells be crushed uniformly and evenly to get a good quality of pulp.

2.3.1. Chemical pulping:

Chemical pulp is produced by combining small pieces of groundnut shells and chemicals in largevessels known as digesters where heat and the chemicals break down the lignin, without seriously degrading the cellulose fibres. Chemical pulp is used for materials that need to be stronger or combined with mechanical pulps to produce different characteristics.

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III.MATERIALS AND CHEMICALS

Groundnut botanically known as Arachishypogaea belongs to leguminous family. It is the fourth largest oil seed produced in world and India is the second largest producer of groundnut after china. A complete seed of groundnut is called as pod and outer layer of groundnut is called shell. Almost every part of groundnut is of commercial value. Groundnut seeds are nutritionally rich due to the presence of oil, protein, minerals, vitamins etc. As a result, it is often described as 'Poor man's Badam'. There is versatility with respect to the groundnut seed consumption, since it is consumed in raw or roasted or salted or sweetened states in Indian food preparations.

3.2 Chemicals

Sodium carbonate (Na_2CO_3), Sodium Hydroxide(NaOH), Sodium Sulphide(Na_2S),

IV.EXPERIMENTAL PROCEDURE FOR PRODUCTION OF PULP

4.1 Preparation of raw material

Initially Groundnut Shells are taken and washed several times with water to remove dust and soil particles present on it. Later it is crushed into short and tiny pieces. They are crushed to remove water content and later dried at 80ºC to 90°C for about 40-50 minutes to further reduce the water content.

4.2 Kraft's Pulping

[1]For cooking liquor to be prepared chemicals must be taken in right proportions so that effective cooking would happen. Kraft's pulping consists of following chemicals-

NaOH, Na_2SO_4, and Na_2CO_3.

These three chemicals must combine to give total of 12.5% by weight solution. In this 12.5% of solution, according to Kraft's pulping we took 58.6% of NaOH, -27.1% of Na_2SO_4, and -14.3% of Na_2CO_3.

But if we take basis as 1000 ml solution of cooking liquor, then by taking 12.5% by weight we got 125grams which was the total weight of all three chemicals required. Compositions of solids are given by wt.%. Then we calculated the individual weight of chemicals required, they were:

NaOH weight=0.586×125=73.25grams.

Na2SO4 weight=0.271×125=33.875grams.

Na2CO3 weight=0.143×125=17.875grams.

Digesting:

[2]Once the cooking liquor was prepared we took 400ml of it separately in a 100ml beaker to which 5 grams of raw material (dried banana stem) was added and the level was marked. The reason for marking the level is

described below. Industrially, steam is used for heating purpose. There are two reasons for selecting steam as heating source:

1. Firstly, it would serve as the heating medium for the digester.

2. Secondly, once the steam exchanges heat with the cooking liquor and the raw material the water present in the cooking liquor evaporates due to increase in temperature difference. Then the initial concentration of the cooking liquor is not maintained which would result in weak cooking. So, if steam is used, it condenses into the cooking liquor after exchanging heat, thereby maintaining the concentration of the cooking liquor.

Here, we had not used steam as heating source. If heat is continuously supplied the water present in the cooking liquor evaporates there by initial concentration of the cooking liquor is varied. So to bring back the concentration to initial we added water up to the marked level in the beaker. This was taken care by us throughout the process of digesting. Then we sulpplied heat by means of hot plate for about 4hr 30min at a temperature of 90ºC. At the same time we did stirring continuously throughout the process. In the process of digestion the strong basic cooking liquor and the action of heat combine and help breaking the bonds in lignin molecules. The broken lignin molecules dissolve in cooking liquor there by turning it into dark brown colour called as Black liquor and cellulose remains unaltered which is present in the cooking medium as brown stock along with the traces of lignin.

4.4 Soda Pulping

[1]In this process, 40% by weight solution of NaOH is required as cooking liquor. If we take 1000ml as basis 40% by weight gives 400grams of NaOH. These 400 grams of NaOH is dissolved in water and makeup to 1000ml to give required concentration of cooking liquor. Once the cooking liquor is prepared, 5 to 7 grams of raw material is taken in 800ml of cooking liquor in 1000ml beaker and the level is marked. The reason for the marking the level is already described above in Kraft's process (we performed the Kraft's process). The same reason applies here too. And water must be added continuously to maintain the initial concentration of the cooking liquor and this process must be repeated entire boiling time.

4.5 Filtration and washing of pulp

[4]After digesting, brown stock and black liquor are formed. Brown stock contains pulp and small amounts of lignin . This lignin gives brown colour to it. And the black liquor contains the dissolved lignin and cooking chemicals that can be recovered. Then the mixture is filtered using cloth to obtain black liquor as waste that contains cooking chemicals that can be recovered. Only one time filtration is not enough . So, we did filtration once again .We again washed it with water to let lignin and chemicals associated with the brown stock to dissolve in it completely.And,after that we got a good and filtered form of it. We washed it again with water (1000ml) to reduce the lignin content by about 5 times. Finally, the product obtained had less lignin content in it.

4.6 Bleaching

Once our filtration and washing was completed we dissolved the washed pulpin 200ml of water to which 5grams bleaching powder was added to completely remove the brown colour to obtain white paper grade pulp.

4.7 Drying

To find the yield, we removed entire water in the bleached pulp .To remove entire water content in the bleached pulp, it is dried at a temperature of 100ºC for one hour in hot air oven.

V.PAPER FROM PULP

[3]Once the pulp is ready, it is then used to make paper in a process that is quite similar (in the basic actions) to the process first used by the ancient Chinese more than 1,900 years ago. We spray the pulp mixture onto a flat and smooth surface to make a layered mat. The mat of pulp is then heated to remove water and then dry it out. Finally, we compressed it into one continuous roll of paper. When the paper has the desired thickness, it may be coloured or coated with special chemicals to give it a special texture, extra strength, or water resistance. We got a packaging paper from it.

VI.RESULTS AND CONCLUSION

[5]Firstly, we require only 4hr 30min in Kraft's process to break lignin molecules completely. Secondly, Kraft's process consists of strong cooking liquor which can break the lignin more effectively. Whereas soda process consist of weak cooking liquor. Because of this reason we can find the traces of lignin is more in Soda process than Kraft's process.

We compared the products from the two processes and got the conclusions. The pulp obtained in Kraft process in less dark in colour it contains less lignin content in it due to strong basic nature of the solution which break the lignin bonds. Soda process involves weak basic cooking liquor that acts weak in breaking lignin bonds.

VII.CONCLUSION

[6]After experiment we made the following conclusions:

1. Soda process reguires only one (limited) chemicals but it does not help in complete breakage of lignin bonds. On the other hand Kraft's process requires different chemicals but in fewer amounts and the lignin breakage is also proper.From this we can conclude that Kraft's process is more advantageous.

2. In terms of heat requirement Kraft's process is more advantageous, because the cooking liquor in this process is able to break and dissolve the lignin in it. Soda process is supplied with heat for one hour more and still the cooking liquor could not effectively break the lignin.

3. Pulp obtained after washing is added with bleaching agent. The amount of bleaching agent required is more in Soda process when compared to Kraft's process. So, the pulp obtained in Kraft's process can be used for high grade paper production and that obtained for soda process for low grade paper production . But as we interested

in making packing paper , so, the pulp must be entirely lignin free, because it acts as an impurity and may vary the conditions of the packed material. By this we can conclude that Kraft process is safer.

4. Thus after the production of paper after pulping we conclude that kraft's process is more advantageous than the soda process and the quality of paper is also good as compared to Kraft's process.

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