



A Study on Production of Pulp From Groundnut Shells

Vallabh C. Chiplunkar¹, Vinayak J. Ainkar², Paresh M. Mali³ Prof.Dr. Satyajee Deshmukh⁴.

B.E.Students, Assistant Professor Department of Chemical Engineering, Datta Meghe Collage of Engineering, Navi Mumbai.

Abstract: In previous years, there is shortage of wood from forest, so for the production of the paper there is need to find an alternative fiber producing material is initiated in world. The generation of fast-growing biomass yielding plants is one of the solutions to meet up the requirement of cellulosic material. However, certain agriculture plants produce cellulose in large amounts so they are suitable substitute for fiber-based industries. Among various types of options groundnut shells serve as an alternative resource.[1]

Key Words: Groundnut shell, Production of pulp, Chemical process, Black liquor, Treatment.

INTRODUCTION

Paper is a very important material which has many uses in day-to-day life. Mainly it is produced by using pulp which is rich in cellulose and which is obtained from wood and after many treatments it is drawn in sheets. The production method is developed in China.[1]

Why and what is Groundnut?

Groundnut is a rotational crop which has a high value and also it has a good amount of cellulose. This plant improves soil nutrients, it is because of these roots atmospheric nitrogen fixing bacteria are present. It contains fibres and which have good strength and properties.[4]

Literature survey

Raw material

Basically, woods are of two types Hard Wood and Soft Wood. In wood basically 4 materials these are follows

Cellulose

Hemi cellulose

Lignin

Pectin

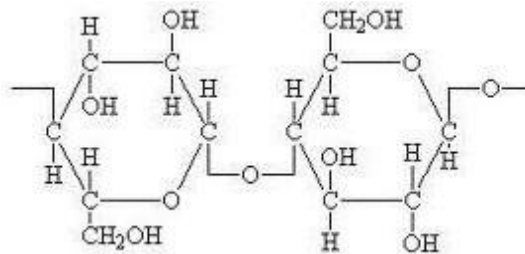


Fig.1 Cellulose[1]

Cellulose present in wood is mostly in the form of fibres. And it is obtained in the form of pulp after pulping process is done.

Composition	Dry weight Percentage
Cellulose	35.7
Volatile Solids	68.7
Organic Carbon	48.3
Ash	5.9
Total Nitrogen	0.8
Hemicellulose	18.7
Lignin	30.2

Table. 1 Composition of ground nut shell [4]

	Bamboo		Soft wood		Hard wood		Ground nut shell	
	Available	Extracted	Available	Extracted	Available	Extracted	Available	Extracted
Lignin	25.30	5.30	28.00	5.90	20.00	3.90	30.00	4.80
Cellulose	47.20	46.00	42.00	28.00	45.00	38.00	44.00	27.20
Hemi cellulose	23.90	14.00	26.80	13.80	29.00	16.80	18.70	10.70
Extractives	2.20	1.30	3.00	1.00	5.00	1.30	3.50	1.90
Ash	1.40	0.50	0.20	0.00	1.00	0.30	3.80	0.80

Table. 2 Comparison of composition analysis in various raw material [4]

Method of pulping

There are many processes for the production of pulp Obtained form wood but based on their efficiencies & heat energy required considered as 2 methods.

1. Chemical Pulping. – It is produced by combining chemically & wood chies in a big vessel which is called as digester where heating is done and adding Chemically so lignin is break down, which binds cellulose fibers without degrading the quality of cellulose.
2. Mech Pulping: Most of the modern mills uses chips instead of logs. If chies are just ground up with platy are called refiner mech. Pulp. It chips are steamed then it is Called as thermo- mech. Pulping. These pulps are used for products that required less strength such as news Papers.[1]

Materials & Chemicals

Ground nut Shell – India is 2nd most producer of groundnut after China. Seed & groundnut is Called as pod and outer Covering is known as Shell.

Like Coconut tree, every part of groundnut has Commercial value. It is nutritionally rich due to Presence of Oil, Proteins, minerals of many Vitamins. So it is also known as “Poor man’s badam”. It is rotation crop. & it improves soil nutrients. Ground nut shell is also use for cattle feed etc.

Chemicals

1. Sodium Carbonate: Sodium Carbonate Na_2CO_3 is sodium Salt of Carbonic acid & it is occurring in Crystalline Structure. In day to day life it is known as water Softener. It is also extracted from ashes of many plants. Synthetically It can be produced by Solvay process.

2. Sodium Hydroxide

It is also known as Caustic soda & has formula NaOH . It is Soluble in water, methanol and ethanol. It absorbed moisture & CO_2 which present in air.

3. Sodium Sulphate: It is a chemical Compound which has formula Na_2S . Mostly it is in a hydrated form $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$. [1]

Expt. Procedure – (Lab Scale)

1. Preparation of raw material

Firstly, Groundnut Shells are taken & washed many times with water. For removing of dust & Soil Particles present in it. After that shells are cut down in long pieces. After that they crushed to remove water present in it & dried at around 80°C for around 30 min.

Kraft's Pulping

For Cooking liquor prepared chemicals must be taken in appropriate Properties so it generally Pulp effectively. For the Kraft's Process. NaOH , Na_2SO_4 & Na_2CO_3 these three Chemicals Combinly gives 12.5% of total weight of solution.

According to Kraft's analysis in that 12.5%

58.6% NaOH

27.1% Na_2SO_3 &

14.3% Na_2CO_3

If basis taken 500ml. of cooking liquor then 12.5% by weight gives 62.5 gives of total weight of these three.

Exact weight of these three is as follows

$\text{NaOH} = 0.586 \times 62.5 = 36.63$ grams

$\text{Na}_2\text{SO}_4 = 0.271 \times 62.5 = 16.94$ grams

$\text{Na}_2\text{CO}_3 = 0.143 \times 62.5 = 8.94$ grams

Digesting – After preparation of liquor of around 400 ml. Take out 100 ml in a beaker & add 5 gram of raw material & level is marked. For industrially manufacturing Steam is required. But for lab process Steam is not required. It needs continuously heating for evaporating water present in liquor. Heat is Supplied by means of hot plate for around 4.30 hrs. at 90°C temp. Also it requires continuously steaming. In this process basic cooking liquor & achieve of heat Combinly gives results in breaking in bonds of lignin. After breaking bonds, the color of liquor turns in black. [3]

Soda Pulping

In this Process 20% by weight of NaOH solution is required as cooking liquor. If we take 500 ml as basis so it required 100 grams of NaOH. So dissolved it in DM water & make up upto 500 ml. After that add 5 grams of raw material in liquor. Water is added continuously for maintaining initial concentration In this Process 90°C temperature is required but time is greater than 1 hour as of Kraft's process for breaking of lignin Structure. [2]

Filtration & washing of Pulp After digesting process black liquor & brown stock is generated. In brown stock small traces of pulp & lignin Present. Brown Colour is given by lignin. In black liquor dissolved Chemicals & dissolved lignin present, so for removing it, it requires many times filtration. After that it was washed with Water for reduce lignin.[3]

Bleaching

After filtration & washing is done effectively Pulp is further Wash with 200ml water + 5 grams bleaching Powder. It is required for removing brown colour for white grade pulp.

Drying

For complete removal of water, it is dried at temperature of 100°C in hot oven for around 1 hour.

Sr. No	Process	Groundnut shells taken (grams)	Pulp Produced (grams)
1	Kraft's Process	5	1.735
2	Soda Process	5	1.273

Table No. 3 Results

Conclusion

Soda process requires only one chemical but this is not enough to break lignin bonds. On the other hand, Kraft's process requires many chemicals but, in few amounts, and by which lignin braking is also proper. So from that we can say Kraft's process is more advantageous. Also, Kraft's process is advantageous in terms of less heat requirement, the liquor itself break the lignin. In soda process more heat is required and due to less liquor breakage of lignin is not sufficient.[3]

Reference: -

1. A Study on Production of Ground Nut Shells by Y N Ramgopal, M Reshma Chowdary, V Chaitanya IJSER Volume 7, Issue 6, June-2016
2. Production of Paper from Groundnut Shell, T Goswami, Dipul Kalita, P G Rao, North East Institute of Science and Technology (CSIR).
3. Production of Paper from Groundnuts Shell by Upendra Kadre, Akshay Talekar, Vedika Hatekar, Dhanashree Kachhawaha, Prathmesh Shete ASTM 2018.
4. Manufacture of Pulp Extraction to Produce Paper from Ground Nut Shells by Karthikeyan S, Anees Varghese K T, Maddekar Mohammed Sanan, Sathish Kumar S, Barathiraja P, IJLTEMAS Volume VIII, Issue I, January-2019.
5. Improvement in Properties of Paper, Yuan-Shing Perng, Eugene I-Chen Wang.
6. Cellulose content in both hard wood and soft woods, Sunday, Abert Lawal and Benjamin Lyenagbe Ugheoke.