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Bambusa garuchokua the Less Utilised Bamboo of Assam and North-East India: An Analytical Study

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ABSTRACT: Physico-morphological and chemical composition of bamboo species ***Bambusa garushwkoa*** have been studied in this paper. The basic aim of this study is to document important contents of this bamboo. Knowing of different contents of bamboo is the integral part of uses of bamboos. This analytical study on Physico-morphological and chemical composition will provide basic information about the possible application of this less utilised bamboo species.

KEYWORDS: *Bambusa garushwkoa (*Owa nangwl*);* bamboo species ;Kokrajhar; analytical study ;Calibrated measurement; Fibre length; less utilised bamboo**.**

1. INTRODUCTION

Bamboos are naturally distributed in almost all the states, except Jammu and Kashmir and form an important constituent of deciduous and evergreen forests and spread from tropical to temperate regions, extending from sea level in the coasts to altitudes up to 3700m in the Himalayas(Barooah et Borthakur,2003).North-eastern India comprising the states of West Bengal(North Bengal, Himalaya), Sikkim, Arunachal Pradesh, Assam, Nagaland, Mizoram, Manipur, Meghalaya and Tripura has more than 50 per cent bamboo species reported from India(Biswas 1988, 1994; Tewari 1992).

The utilisation of bamboo in Assam and North-east India is ancient. Bamboo sometimes called poor man's timber, now focused as the timber of future. The utilisation of bamboo in this part of the country is immense and multiple in dimensions. The importance of Bamboo to rural community can hardly be over stressed since it is a versatile, multipurpose, forest species which contributes valuably towards the human economy providing a variety of goods. Even in today's world of plastic and steel this fastest growing species has not only maintained its place as a contributor of daily needs but also attained significance as an industrial raw material. (Tewari 1992)

Bamboos are used for many different purposes. Often only some species are suitable or preferred for certain uses, whereas other species are neglected or even disregarded. What are the criteria for such a selection? It is generally known that restrictions in processing and utilisation are often related to unsuitable properties. Therefore a thorough understanding of the relation between structures, properties, behaviour in processing and product qualities is necessary for promoting the utilization of bamboo (Liese, 1987).

Bambusa garushwkoa is sporadically cultivated all over Assam, nowhere found in wild state. This bamboo is seldom used because of its undurable culms. Therefore ,it is less known even among the common people(Barooah et Borthakur,2003).Since the common users have traditional idea on this bamboo species that it is not hard and durable bamboo, hence it is utilised in secondary uses, hence our aim to study this bamboo is, to clarify the users' concept on this bamboo by studying its contents.

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II. METHODS AND EXPERIMENT

The sample of bamboo for these studies was collected from 5 (five) different localities of Kokrajhar district of BTC, Assam, India. Altogether 5 (five) individual bamboo plants were harvested for studies. The sample collection was done during the month of June 2014.The method for studying different contents were followed the standards of American Society for Testing and Materials (ASTM). The sample sizes were prepared accordingly to perform different test.

Moisture content:

To study the moisture content the sample was cut into block into size around 10mmX10mm thickness. The initial weight was taken freshly and the final weight was taken after dried the sample in an oven at 105+-2^{o}C for 48 hours until a constant weight was attain. The sample was placed in desiccators for about 30 minutes for cooling prior to final weight.

The moisture content percentage of the bamboo sample is determined by the following formula

Moisture content %=$\frac{W2-W1}{W1}$X100

Where, W1=Initial weight of the sample
W2=Weight of the sample after drying.

Sl.no.	Sample no.	Weight of sample(in gm.)	Weight of sample after drying(in gm.)	Difference in weight(in gm.)	Moisture content%	Average of moisture content %
1	1.1.1	2.0968	1.1042	0.9926	47.338802	47.9508698
2	1.1.2	2.2477	1.1875	1.0602	47.168216	
3	1.1.3	2.1965	1.1612	1.0350	47.126855	
4	1.1.1	2.0828	1.0665	1.0163	48.794891	
5	1.1.2	2.3576	1.1947	1.1629	49.325585	

Table:1, Moisture content percentage **of Bamboosa garuchokua**

Alcohol-tolune solubility of Bamboosa garuchokua :

Around 2 (two) grams of oven dried bamboo sample was placed in a soxhlet extraction tube. The solution used was a 2:1 solution of ethyle alcohol (92%) and distilled toluene respectively. The boiling was done for 8 (eight) hours by 6(six) siphoning/hours. The content of the flask was oven dried at 103+-2^{o}C

The formula used to obtained the alcohol-toluene solubility is as follows,

Alcohol-toluene soluble (%)=$\frac{W2-W1}{W1}$X100

Where,W_1=weight of oven dry test sample in grams.
W_2=weight of oven dry extraction residue with glass crucible in grams.

Sample no.	Weight of test sample(gms.)	Weight of glass crucible(gms.)	Weight of glass crucible+extract residue (gms.)	Weight of extract residue	Alcohol-tolune soluble%	Average of alcohol-toluene soluble %
1.1	2.0067	17.4184	17.5503	0.1319	6.572981	6.228316
1.2	2.0052	17.4173	17.5310	0.1137	5.670257	
1.3	2.0015	17.4065	17.5328	0.1263	6.310267	
1.4	2.0013	17.4065	17.5326	0.1261	6.300904	
1.5	2.0009	17.4065	17.5323	0.1258	6.287171	

Table:2, Alcohol-tolune solubility percentage **of Bamboosa garuchokua**

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Water solubility percentage of Bamboosa garuchakoa:

Around 2 grams of oven dried bamboo sample was taken into an Erlenmeyer flask of 250ml. The sample was mixed with 100ml of distilled water. The sample was gently boiled into a water bath by attaching a glass condenser to the flask. The whole setup was allowed to boil for about 3 hours. The sample was then filtered and oven dried at 103+-2oC.

The water solubility content % are determined by the formula

Water solubility content percentage (%) $=\frac{W2}{W1}$ X100

Where, W_1= Weight of oven dried bamboo sample (gm)

W_2=Weight of hot water extraction of bamboo (gm)

No. of sample	Weight of oven dried bamboo sample(gm)	Weight of water soluble content of bamboo (gm)	Percentage of water soluble content (%)	Average of water soluble %
1.1	2.0002	0.1865	9.324068	9.1608368
1.2	2.0000	0.1850	9.250000	
1.3	2.0008	0.1749	8.741503	
1.4	2.0001	0.1845	9.224539	
1.5	2.0002	0.1853	9.264074	

Table:3, water solubility percentage of *Bamboosa garuchokua.*

Ash content percentage of Bamboosa garuchakoa:

Around 2 gram of air dried bamboo sample was taken into a crucible and oven dried and weight until the weight is constant. After that the crucible and the content was ignite in the muffle furnace until all the carbon was removed. The heating was slowly and increases upto the final heating 580oC to 600oC.

The ash content % are determined by the formula

Ash content percentage (%) $=\frac{W2}{W1}$ X100

Where, W1= Weight of oven dried bamboo sample (gm)

W2=Weight of ash content of bamboo (gm)

No. of sample	Weight of oven dried bamboo sample(gm)	Weight of ash content of bamboo (gm)	Percentage of ash content (%)	Average of ash content %
1.1	2.1359	0.0238	1.114284	1.1603516
1.2	2.0126	0.0229	1.137832	
1.3	2.0095	0.0256	1.273949	
1.4	2.0098	0.0219	1.089661	
1.5	2.1163	0.0251	1.186032	

Table:4, Ash content percentage of *Bamboosa garuchokua.*

Determination of Klason Lignin:

Around 1grams of oven dried bamboo sample was taken in to a beaker of 150 ml. The sample was mixed with 15ml of H_2SO_4 (72%) slowly. The reaction was allowed to continue for 2 hours by placing the whole set into a water bath maintained at 20 ^oC. A 560 ml of distilled water was added to dilute the H_2SO_4. After that a glass condenser was added to the flask and the whole set up was place in a boiling water bath. The content of the flask was washed with 500ml hot water. The cont was oven dried at 103+-2^oC.

To determine the % of Klason lignin content, the following calculation is used

Klason Lignin content percentage (%) $=\frac{W2}{W1}$ X100

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Where, W1=Initial weight of the sample (gm)
W2=Weight of extracted sample (gm)

No. of sample	Weight of oven dried bamboo sample(gm)	Weight of extracted bamboo sample (gm)		Percentage of Klason Lignin content (%)	Average of of Klason Lignin %
1.1	1.0454	0.2013		19.0896	20.11032
1.2	1.0113	0.2233		22.0804	
1.3	1.0206	0.1895		18.5675	
1.4	1.0442	0.2146		20.5516	
1.5	1.0132	0.2053		20.2625	

Table:5, Klason Lignin content percentage of *Bamboosa garuchokua.*

Determination of Holocellulose content:

Around 2 grams of oven dried bamboo sample was taken into an Erlenmeyer flask of 250ml. The sample was mixed with 150ml of distilled water, 0.2ml of glacial acetic acid and 1(one) grams of $NaClO_2$ and placed into a water bath maintained at 70^{o}C. The reaction was allowed to continue for about 5(five) hours, after that the flask was cooled at ice water to lower the temperature to 10oC. The content of the flask was filtered and washed with 500ml. Cold water to make it free of ClO_2.After that the content was oven dried at 103+-2^{o}C.

To determine the % of Holocellulose content, the following calculation is used

Holocellulose content percentage (%) $=\frac{W2}{W1}$ X100

Where, W1=Initial weight of the sample (gm)
W2=Weight of extracted sample (gm)

No. of sample	Weight of oven dried bamboo sample(gm)	Weight of extracted bamboo sample (gm)	Percentage of Holocellulose content (%)	Average of Holocellulose %
1.1	2.0015	1.2213	61.0192	62.0389
1.2	2.0023	1.2783	63.8415	
1.3	2.0022	1.2325	61.5572	
1.4	2.0013	1.2594	62.9290	
1.5	2.0009	1.2175	60.8476	

Table:6, Holocellulose content percentage of *Bamboosa garuchokua*

Determination of α-cellulose content:

Around 3 grams of oven dried holocellulose sample was taken in to a Erlenmeyer flask of 250ml. A 50ml of NaOH (17.5%) was added to the sample and mixed well for about 1 minute. After few minute reactions, 50 ml of distilled water was added to the sample and mixed well. The whole setup was carried out into a water bath maintained at 20oC. The content of the flask was filtered and washed with 50 ml NaOH (8.3%) and then40ml of acetic acid (10%) and then washed with hot water to make it acid free. After that the content was oven dried at 103+-2oC.

To determine the % of α-cellulose content, the following calculation is used

α-cellulose content percentage (%) $=\frac{W2}{W1}$ X100

Where, W1=Initial weight of the sample (gm)
W2=Weight of extracted sample (gm)

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No. of sample	Weight of oven dried bamboo sample(gm)	Weight of extracted bamboo sample (gm)	Percentage of α-cellulose content (%)	Average of α-cellulose %
1.1	3.0004	1.1940	39.7946	40.0826
1.2	3.0013	1.2080	40.2492	
1.3	3.0010	1.1869	39.5501	
1.4	3.0021	1.2150	40.4716	
1.5	3.0027	1.2115	40.3470	

Table:7, α-cellulose content percentage of *Bamboosa garuchokua*

Study of Fibre length:

To study the fibre length, the bamboo sample is macerated with the method. The sample is first cut into small pieces of 0.25x0.25x5cm. The pieces of samples are macerated with the maceration solution of Glacial acetic acid, 30% hydrogen peroxide and distilled water in ratio 5:1:4 respectively. The time for maceration is 48 hours at 60^{o}C. The fibre that obtained is measured under microscope using calibrated ocular scale.

Calibration of ocular scale of the microscope that used during the experiment:

29spaces on the ocular scale =10 spaces on the stage scale (5Xx5X magnification)

Thus, 1 ocular space= 10x 0.1mm/29

1 ocular space=0.0344mm

Out of 50 sample measured the length measurement was ranges from 55 to 70 in ocular scale, accordingly the calibrated measurement of the sample is ranges from 1.8920mm to 2.4080mm. The mean value of the calibrated measurement of the fibre length of the bamboo is 2.1500mm.

Figure:1, A view of Bamboosa garuchakoa

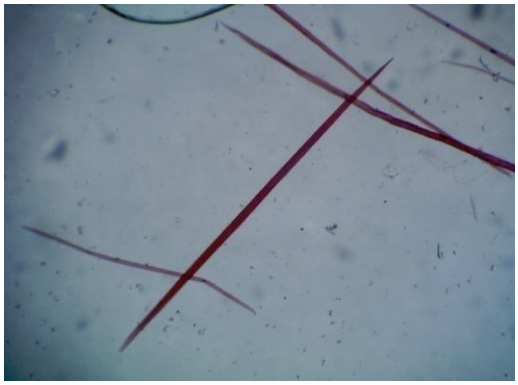

Figure2. View of fibre of Bamboosa garuchakoaN under microscope (10X magnification)

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Figure:3, Culm-sheaths of *Bambusa garuchokua* Barooah et Borthakur Measuring 13 cm. Long and 22 cm. broad

III. RESULTS AND CONCLUSIONS

The result of the study of major content of the *Bambusa garuchokua* is as in the following table.

Sample no.	Moisture content %	Alcohol-tolune solubility%	Hot water solubility %	Ash content %	Lignin %	Holocellulose %	α-cellulose %
Bambusa garuchokua	47.9509	6.2283	9.1608	1.1604	20.1103	62.0389	40.0826

Table: 8, summary of major content percentage of *Bamboosa garuchokua*

This analytical study on Physico-morphological and chemical composition tells about the possible application of this less utilised bamboo species. The basic chemical content including cellulose and lignin composition of this bamboo is not to far less in compared to other highly utilised bamboo species. The fibre length of this bamboo can be compared with highly utilised species like *B. tulda*. Though at present this bamboo is less popular among the local users but the study tells about its potential for uses in coming days.

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