Determination of fibres and pith in bagasse

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ABSTRACT

The objective of this article is to submit a procedure for determination of fibres and pith in bagasse. The method applies for all kinds of bagasse i e. baled bagasse, fresh bagasse, old bagasse and depithed bagasse etc.

Some standard procedures for the determination of fibres and pith in bagasse might be available with TAPPI and ISO, however in our country ISI has not developed any procedure for this purpose. Bagasse based mills are using different procedures and it is difficult to compare the data generated by different mills. The procedure as suggested may be used by the bagasse based paper mills as standard method.

Introduction

Bagasse is one of the promising Raw Material for paper making after Bamboo and Woods in our Country. Bagasse coming from sugar mills contains 50% moisture, 47% fibres and pith, 2.5% sugar & 0.5% insolubles. On dry basis bagasse contains around 60% fibres, around 30% pith and around 10% solubles.

The pith separation from fibre is necessary to upgrade the bagasse quality. The Chemical Properties of fibres and pith are more or less similar but they differ vastly in physical and morphological properties. Pith contains lot of soft thin walled irregularly shaped parenchyma cells, has more ash and high absorbing property.

Due to its high absorbancy it consumes more alkali during cooking. Because of thin walled irregularly shaped fibrous cells, the pith will swell, make a dense sheet on paper machine wire and with slow drainage. The pith fines would be picked in press, dryer felts causing stickiness bringing down machine runnability. Pith fines also cause problem of fluff which effect on printing.

(ii) Most of the paper mills of India are following some method for assessing depithing efficiency.

In this paper authors have tried to present a standard procedure for determination of fibres and pith.

Procedure :

A. SCOPE :

The method describes determination of fibres & pith in bagasse.

B. Terminology :

For the purpose of this standard following definitions shall apply.

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i) **Fibres :**

Material retained on 10 mesh after disintegration and washing of bagasse.

ii) **Pith :**

Material passing through 10 mesh and retained on 300mesh after disintegration & washing of bagasse.

iii) **Solubles :**

Material passing through 300 mesh along with filtrate.

iv) **Oven dry mass :**

Constant mass obtained on drying of fibres and pith at a temperature of 150 ± 2°C.

C. Equipments :

i) **Disintegrator** having 3000 rpm speed and 2 litres capacity.

ii) **Drying oven** with good ventilation and capable of regulation of 105 ± 2°C temp.

iii) **Analytical balance** with an accuracy of 0-001 gram.

iv) **Standard sieves** of 10 & 300 wire mesh.

v) Drying trays.

D. Sampling :

i) Representative samples should be collected after bale breaker for determination of fiibres and pith in whole bagasse.

ii) Representative samples should be collected after depithing i.e. bagasse going to digester for determination of fibres and pith in depithed bagasse.

iii) Representative samples should be collected from bales to carry out areawise tests. In this case minimum 10% bales should be taken for sampling.

E. Description of Method :

i) Find out moisture content in bagasse sample in which fibres and pith are to be determined

ii) Take 20 gms O D. Sample on the basis of moisture content & disintegrate it at 3000 rpm in P.M A. disintegrator for 30 minutes maintaining 1% consistency.

iii) Take 300 mesh standard sieve and keep 10 mesh standard sieve over it. Now transfer the disintegrated bagasse over it in parts and wash it with water stream thoroughly.

iv) Material retained on 10 mesh is to be again disintegrated for 15 minutes maintaining 1% consistency assuming 30% losses which are either retained on 300 mesh or passed through 300 mesh.

v) Material disintegrated for 15 minutes should be again washed as mentioned above.

vi) Collect the material received on 10 and 300 mesh, dry in the oven and weigh.

F. Calculations and Report :

$$\text{Fibres } \% = \frac{A}{M} \times 100$$

$$\text{Pith } \% = \frac{B}{M} \times 100$$

$$\text{Solubles } \% = \frac{M-(A+B)\times 100}{M}$$

Where :

M = Oven dry mass of bagasse taken for testing.

A = Oven dry mass of fiibres retained on 10 mesh.

B = Oven dry mass of pith retained on 300 mesh.

C = Oven dry mass of solubles passed through 300 mesh.

$(C = M - (A+B))$

N.B. : Average value of minimum three tests should be reported.

G. Additional Information :

Bagasse having moisture content above 40% should be disintegrated for a longer time (30+30 minutes) as pith removal is low at higher moisture content in the bagasse.

Experimental :

i) Number of experiments were conducted using 18 and 300 mesh with single disintegration of 30 minutes. Fibres content obtained in whole bagasse and depithed bagasse under these conditions were high and pith content was low. (Table 1)

TABLE—1

Determination of Fibres and Pith in Whole Bagasse & Depithed Bagasse.

Sl. No.	Whole Bagasse			Depithed Bagasse.		
	Fibres %	Pith %	Solubles %	Fibres %	Pith %	Solubles. %
I.	68.81	25.35	5.84	80.00	15.97	4.03
2.	68.18	24.66	7.16	75.24	14.55	10.21
3.	67.12	26.51	6.37	68.00	15.23	16.77
Avg.	68.03	25.50	6.47	74 41	15.25	10.34

N.B. : Testing Conditions

i) Consistency : 1%

ii) Disintegration : 30 Min.

iii) Sieves used : 18 and 300 wire mesh.

Remarks : i) Pith content in whole bagasse is observed low due to fine mesh (18) and Single disintegration.

ii) Fibres received in whole bagasse are also high.

ii) On the basis of above experiments double disintegration was started keeping other conditions constant as mentioned above. In this way fibre content were reduced but pith content was not effected much (Table 2).

iii) A few experiments were also done using wider meshes i.e. 8 & 60 maintaining consistency 2% instead of 18 & 300 meshes maintaining 1% consistency. In these experiments solubles were found to be quite high. (Table 3).

iv) Number of experiments were done using 10 and 300 mesh with whole bagasse (fresh and old), depithed bagasse and old bagasse etc., and results obtained were found quite satisfactory. It is recommended that disintegration time should be extended from 45 minutes to 60 minutes if the moisture content in fresh bagasse is more than 40% (Table 4, 5 & 6).

v) Experiments were also done to compare our findings with Tappi method (UM 3 1984). In case of Tappi method fibres obtained were low and pith content remained high (Table 7 & 8).

Results of Discussion :

In India for one tonne of bleached pulp, about 5.5 tonnes of mill wet bagasse is required. The main reason for such a high pulp to bagasse ratio is presence of high moisture and pith. Pith is removed during depithing process. Depithing is done in paper mills either by dry depithing process or wet depithing process. Very clear and uniform bagasse fibres can be obtained from wet depithing process as compared to dry depithing process.

To assess the depithing efficiency, continuous monitoring from laboratory is required which will result in better quality of pulp and ultimately the paper.

Composite samples of bagasse can be collected after bale breaker and before digester and can be sent to laboratory for analysis daily or weekly depending upon availability of man power. Spot samples can also be sent to laboratory after any modification work has been done in the depithers.

Laboratory should follow the above mentioned procedure for determination of fibres and pith in

TABLE - 2

Determination of Fibres and Pith in Whole Bagasse & Depithed Bagasse.

Sl. No.	Whole Bagasse.			Depithed Bagasse		
	Fibres %	Pith %	Solubles %	Fibres %	Pith %	Solubles %
1.	60.30	27.80	11.90	71.60	17.10	11.30
2.	59.98	27.22	12.80	73.65	14.48	11.87
3.	59.57	29.65	10.78	72.37	17.05	10.58
4.	62.61	26.30	11.09	76.56	15.52	7.92
Avg.	60.61	27.74	11.65	73.54	16.03	10.43

N.B. : Testing Conditions :

i) Consistency : 1%

ii) Disintegration : 30 min + 15 min.

iii) Sieves used : 18 and 300 wire mesh.

Remarks : Fibres were observed low in whole bagasse as compared to experiment No. 1 (Table).

TABLE—3

Determination of Fibres and Pith in Wnole Bagasse.

Sl.No.	Fibres %	Pith %	Solubles. %
1.	65.5	25.7	8.8
2.	59 5	28.5	12 0
3.	57.0	26.7	12.7
Avg.	60.6	26.7	12.7

Testing Conditions :

i) Consistency : 2.0%

ii) Disintegration : 15 Min + 15 Min.

iii) Sieves used : 8 and 60 wire mesh.

Remarks : i) Solubles were observed high.

ii) Suggested by Shri S.G. Rangan (Past President—IPPTA)

TABLE—4

Determination of Fibres & Pith in Whole and Depithed Bagasse.

Sl. No.	Whole Bagasse			Depithed Bagasse.		
	Fibres %	Pith %	Solubles %	Fibres %	Pith %	Solubles. %
1.	62.5	25.92	11.58	69.85	14.80	15.35
2.	60.15	26.80	13 05	72.75	13.25	14.00
3.	66.50	25 65	7.85	72 35	12.90	14.75
Avg.	63.05	26.12	10.82	71.65	13.65	14.70

N.B. : Testing Conditions :

i) Consistency : 1.0%

ii) Disintegration : 30 + 15 Min.

iii) Sieves used : 10 and 100 wire mesh.

Remarks : Solubles are observed high in depithed bagasse as some pith is passed away by 100 mesh.

TABLE—5

Determination of Fibres & Pith in Whole Bagasse & Depithed Bagasse

(Fresh)

Sl. No.	Whole Bagasse.			Depithed Bagasse.		
	Fibres %	Pith %	Solubles %	Fibres %	Pith %	Solubles %
1.	63.5	29.1	7.4	73.8	18.3	7.9
2.	60.4	30.1	9.5	75.5	15 8	8.7
3.	64.8	27.9	7.3	76.5	14.7	8.8
4.	62 5	28.9	8.6	77.6	14.2	8.2
5.	60.5	31.0	8.5	69.5	20.0	10.5
Avg.	62.3	29.4	8.3	75.6	16.6	8.8

N.B. : Testing Conditions :

i) Consistency : 1%
ii) Disintegration : 30 Min + 15 Min.
iii) Sieves used : 10 and 300 wire mesh.

TABLE—6

Determination of Fibres & Pith in Fresh Whole Bagasse & Old Whole Bagasse.

Sl. No.	Whole Bagasse (Fresh)			Whole Bagasse (Ten Months Old)		
	Fibres %	Pith %	Solubles %	Fibres %	Pith %	Solubles. %
1.	60.0	30.5	9.5	54.5	37.0	8.5
2.	59.5	26.0	14.5	47.8	42 9	9 3
3.	60.5	31.5	7.5	44.4	46.3	9.3
Avg.	60.0	29.5	10.5	48.9	42.0	9.0

N.B. : Testing Conditions :

i) Consistency : 1.0%
ii) Disintegration : 30 Min + 15 Min.
iii) Sieves used : 10 and 300 wire mesh.

TABLE—7

Depithing of whole Bagasse & Depithed Bagasse by SVPM Method.

(Five Months Old Bagasse)

Sl. No.	Whole Bagasse			Depithed Bagasse.		
	Fibres %	pith %	Solubles %	Fibres %	pith %	Solubles %
1.	66.2	26.9	6.9	71.6	23.05	5.35
2.	64.6	29.9	5.5	73.25	17.8	8.95
3.	66.5	28.9	4.6	72.7	18.2	9.1
4.	64.4	30.0	8·6	22.5	19.2	8.3
5.	62.8	29.5	7.7	74.0	16.5	9.5
Avg.	64 9	29.04	6.06	72.81	18.95	8.24

Testing Conditions :

i) Consistency : 1%

ii) Disintegration : 30 + 15 Min

iii) Sieves used : 10 and 300 wire mesh.

TABLE—8

Depithing of whole Bagasse & Depithed Bagasse by Tappi Method.

(UM 3 1984) (Five Months old Bagasse)

Sl. No.	Whole Bagasse			Depithed Bagasse		
	Fibres %	Pith %	Solubles %	Fibres %	Pith %	Solubles %
1.	53.8	39.75	6.45	62.5	29.5	8.0
2.	56.15	37.4	6.45	65.0	29.2	5.8
3.	57.7	36.4	5.9	66.0	24.8	9.2
4.	55	35.45	9.55	68.65	28.0	3.35
5.	53.5	40.5	6.0	67.85	26.7	5.45
Avg.	55.23	37.9	6.87	66.0	27.64	6.36

Testing Conditions :

i) Consistency : 1%

ii) Disintegration : 33 + 20 Min.

iii) Mesh used : i) Perforated sieve of 1.5mm diameter and a pitch of 3mm.
ii) Wire sieve 300 mesh.

Remarks : Procedure sent by M/s. Tamil Nadu Newsprint Ltd.

bagasse and report the result to concerned authorities for taking appropriate decision to change the process conditions.

During experimental work number of meshes were tried (i.e. 8, 10, 12, 16 and 200, 250, 300 and 350) to separate out fibres and pith. It was observed that 10 and 300 mesh are most ideal to get satisfactory results. Similarly PMA or TAPPI pulp disintegrator having 3000 rpm is the best suitable equipment and one hour is the optimum time to assess depithing efficiency for any kind of bagasse. Consistency below 1% may break the fibres.

Conclusion :

For production of good bagasse pulp, depithing is one of the most important treatment. To assess the depithing efficiency a standard procedure is required. At present there is no ISI procedure available in the country for this purpose. Procedure described in this article should be tried by bagasse based paper mills of our country so that data available can be compared easily. Tappi method (UM 3 1984) is not a standard method but has been accepted by Tappi as a useful method which shows less fibres, high pith and more solubles in whole as well as in depithed bagasse. Combined efforts should be done by paper mills to finalise a standard procedure acceptable to ISI.

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iii) I S. 6213 (Part XVII)-1978, to follow the ISI pattern, reference has been given.

iv) Personal discussions with Shri S.G.Rangan, Past President, Ippta, procedure sent by him was followed.

v) Personal discussions with M/s. Tamil Nadu Newsprint Ltd.