Effects of location and storage of reeds (Phragmites communis) on its pulping characteristics

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SUMMARY

Reeds (Phragmites communis) major fibrous raw material for pulp and paper industry of Iraq, grown in Central and Eastern Marshes of Iraq was subjected to sulphate pulping and study of pulp characteristics besides its proximate chemical analysis in the laboratory with relation to their location. Studies were extended to determine the effect of storage on pulping characteristics of Reeds from Eastern Marshes The results indicate that sulphate pulps prepared in laboratory under similar conditions of pulping are marginally superior in case of Reeds grown in Eastern Marshes as compared to those grown in Central Marshes. There does not seem to be any significant effect of storage on pulping characteristics of reeds from Eastern Marshes.

The fibrous raw material constitutes 50 to 75% of the manufacturing cost of pulp manufacture. Besides improvement in economy of fibrous raw material procurement operation, the pulp yield and pulp characteristics play vital role and have immediate effect on overall economy The environmental influence on the quality and the quantity of wood produced has been subjected to many studies with considerable conflicting results[1]. The quality of soil is an important factor and forest land is classified by range of site classes with widely varying average growth rates. The decisive environment factors for the rate of growth of fibrous raw material/wood quality are climatic day length, temperature, precipitation and winds etc.

The storage of fibrous raw material is particularly important for sulphite pulping industry especially for resinous hardwoods. On the other hand the decay of wood/fibrous raw material during storage may result in loss in pulp yield, brightness, cleanliness and strength properties even for sulphate pulps. Besides technical aspects of storage of fibrous raw material the economical aspect such as cost of storage either in wood-yard or in forest cannot be underestimated. There may be certain seasonal factors forcing the storage of raw material for certain period for consumption at mills owing to inclement weather conditions restricting felling/ harvesting operation during certain period of the year.

Along the deltas of many of the rivers in Eastern Europe, and Asia, huge quantities of Reeds are found. At present the production of reed pulp in U.S.S.R , China and Rumania totals about 270,000 metric tonnes annually.

About 1,000,000 tonnes of reeds grow annually in delta of Tigris and Euphrates rivers of Iraq. Reeds (Phragmites communis) is the major fibrous raw material being used in this country for manufacture of pulp and paper. There seems to be no record of any systematic studies carried out to determine the effect of location of reeds like those from Central Marshes or Eastern Marshes situated in different parts of the country and, effect of storage of reeds in forest or in millsite, on their pulping characteristics. It will be quite useful for the technical personnels at mill to know that reeds, from which particular location are most suitable for pulping besides what are the effects if reeds have been stored for different time intervals before consumption. The present investigation was undertaken to determine

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the effect of these two vital parameters on pulp and paper making characteristics of reeds.

Experimantal :

1. Preparation of Raw Material : The reed samples in bundle form were received from M/s Basrah Paper Mills. As per labels on the bundles these belonged to three different locations :

   A) Eastern Marshes (Suwaib) .. Two samples
   B) Central Marshes (Jabaish).....One sample
   C) Central Marshes (Al-Baida) .. ...One sample

The reeds recieved at Basrah Mills from Suwaib were in two lots. One that was recently cut and the other stored for two years. After cutting all the reed samples were chipped using laboratory three knife chipper. After air drying, a part of these chips was ground in laboratory Villy mill to dust, suitable for proximate chemical analysis Rest of the chips after sorting/screening were used for pulping experiments in laboratory digester.

2. Proximate Chemical Analysis : Reed dust was screened on 40+60 mesh screen as per standard procedure. Cold water solubility, hot water solubility, 1 : 2 Alcohol : Benzene solubility, Lignin content, ash content, holo cellulose, hemi-cellulose and cellulose content estimation were carried out using Tappi standard procedures[2-10] Table I, II.

3. Sulphate pulping of reeds : The reed chips (350 g.) were cooked by kraft process in electrically heated stainless steel rotating autoclave. Pulping conditions are recorded in Table III. At the end of all the cooks the pulps were thoroughly washed with water and disintegrated in standard laboratory disintegrator. Washed and disintegrated pulps were diluted to 0.3% consistency and screened on laboratory flat screen of 0.3 mm slot size with continuous flow of water. Acceptable pulp was collected on muslin cloth, squeezed and shredded to small pieces, air dried and stored.

4. Pulp Evaluation : All the unbleached pulps prepared were tested for their Kappa No. by Tappi standard method[11]. The Pulps were beaten in PFI Mill at 10% consistency, 33.3N per cm. bar length of beating pressure[12] at different freeness levels (°SR). Standard hand-sheets of approximately 60 g.s.m. were made[13] from beaten pulp using British hand-sheet former. Sheets were pressed hydraulically and air dried on rings & plates. After conditioning the sheets at 23±1 °C and 60% relative humidity, were subjected to following physical strength testing, employing Tappi Standard method :

   a) Basis weight[15]
   b) Thickness[16]
   c) Bulk[17]
   d) Drainage time[18]
   e) Tensile strength[19]
   f) Stretch[20]
   g) Bursting strength[21]
   h) Tearing strength[22]
   i) Folding endurance[23]
   j) Brightness[24]

5. Fibre Fractionation : All the unbleached reed sulphate pulps prepared under similar conditions of cocking were subjected to fibre classification using Bauer Mcnet classification unit and standard

Table—I. Proximate Chemical Analysis* of Reeds (Phragmites Communis)

S. No.		Reeds from Suwaib	Reeds from Jabaish	Reeds from Albaida
1.	Cold Water Solubles, %	6.8	5.4	5.0
2.	Hot Water Solubles,%	9.0	7.9	5.6
3.	1% NaOH Solubles, %	36.9	34.2	31.6
4.	Alcohol-Benzene Solubles, %	2.06	1.94	1.23
5.	Klasons lignin content, %	19.9	18.1	22.0
6.	Ash content, %	3.28	3.46	2.37
7.	Holocellulose content, %	75.9	79.8	78.9
8.	Cellulose content, %	46.7	44.7	46.3
9.	Hemicellulose content, (by difference), %	29.1	35.0	32.5

*All the percentages are expressed on O.D. wood basis.

Table—II. Chemical composition of Reeds (Phragmites communis) stored for different time intervals.

S. No.		Suwaib stored for three months	Suwaib stored for two years
1. Cold Water Solubles,	%	6.80	6 20
2. Hot Water Solubles,	%	9.00	9.70
3. 1% NaOH Solubles,	%	36.9	30.6
4. 1 : 2 Alocohol Benzene Solubles,	%	2.00	1.60
5. Lignin content,	%	19.9	19 1
6. Ash content,	%	3.28	3.12
7. Holocellulose,	%	75 9	74.5
8. Cellulose content,	%	46.7	47.4
9. Hemicellulose content, (by difference)	%	29.1	27.5

*All percentages are expressed on O.D. wood basis.

Table—III. Kraft Pulping conditions*

S. No.	Particulars	
1.	Active alkali, as Na O, %	15.0
2.	Bath ratio, ratio, (Mat. : Liq.)	1:5
3.	Sulphidity, %	25.0
4.	Cooking temperature, °C	160
5.	Time to cooking temperature, min.,	60
6.	Time at cooking temperature, min.,	90
7.	Blowing time, min,,	50

*Conditions common to all the cooks.

procedure[25]. Time for all the classification experiments was kept as 10 minutes.

Results and Discussion :

The holocellulose content is qualitative indication of fibrous raw material to be compared for its suitability for making pulp and paper. Results recorded in Table I indicate that reed from Central Marshes (Jabaish) contain highest holocellulose and lowest lignin content as compared to those from Eastern Marshes (Zwaib). Apparently as can be seen from proximate chemical analysis, reeds from Jabaish should be superior to those from Swaib and Albaida for pulp and paper making. Reeds from Albaida has significantly lower ash content and lowest solubility in water, alkali and Alcohol-Benzene. Proximate chemical analysis of reeds from Suwaib with storage time of two years when compared, do not indicate any adverse effect of storage on chemical constituents of reeds, except for little change in caustic soda solubility in stored reeds which could be attributed to loss of small quantity of low molecular weight poly-saccharides during storage.

All the Kraft pulps prepared under similar conditions of cooking were evaluated for physical strength properties. Pulping conditions are recorded in Table III and its pulp characteristics are recorded in Table IV. It is observed from the scrutiny of results of Table IV that :

1) The reeds from Suwaib yield pulp marginally in higher yield and lower Kappa number as compared to those from Jabaish and Albaida.

2) Inspite of the fact that longer fibre fraction is higher in pulps prepared from reeds from gabaish and Albaida as compared to that prepared from Suwaib reeds, still the former beat much faster than the later. It could partly be due to higher hemicellulose content aiding in rapid selling of fibre during beating.

3) The pulp from Suwaib reeds, though it is slow beating but it imparts higher tensile strength, better stretch, higher bursting strength as compared to faster beating pulps from contributing to freeness, bursting strength and folding endurance.

4. Tearing strength in pulps prepared from Suwaib reeds passes maxima much earlier during beating as compared to Albaida and Jabaish pulps. At 31°SR pulp from Reeds shows highest tearing strength.

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Table—IV. Reed Pulp Characteristics

S. No.	Pulp from Suwaib reeds Stored Reeds				Fresh Reeds				Pulp from Jabaish Reeds				Pulp from Albaida Reeds			
1. Screened yield, %	52.9				53.2				53.7				52.4			
2. Rejects, %	Nil				Nil				2.2				1.8			
3. Fibre classification	30/41.5	50	100	200—200	30	50	100	200—200	30	50	100	200-200	30	50	100	200-200
+Mesh % fraction	41.5	28.6	12.5	5.2	11.9	34.1	30.7	15.5	7.1	11.8	40.3	30.1	11.9	6,2	11.5	42.5	29.7	11.7	5.4	10
4. Ash, %	3 03				2 96				3.27				2.85			
5. Kappa No.	47.8				48.5				5?.5				54.0			
6. Beating Rev. PFI,	0	700	1200	1600	0	500	1000	1500	0	700	1200	1370	0	700	1200	1370
7. Freeness °SR	15	28	36	46	15	24	31	43	15	29	40	44	15	28	41	46
8. Basis weight, gsm,	63 3	63.9	62.9	62.2	63.3	63.5	63.3	64.1	63.4	62.8	61.5	62.0	62.6	62.7	65.5	63.4
9. Bulk, c.c/g	2.5	1.7	1.6	1.5	2.4	1.9	1.7	1.5	2.4	1.7	1.6	1.5	2.6	1.8	1.6	1.6
10. Breaking length, KM,	1.13	4 35	4.89	5.30	0.77	3.48	4.52	5.67	1.05	4.50	5.37	5.26	0.37	3.37	4.27	4.35
11. Stretch, %	1.6	4.6	4.9	5.5	1.3	3.8	4.7	6.1	0.9	4.0	4.8	4 7	0.9	3.6	4.7	4.7
12. Burst, factor,	11	30	38	42	12	23	32	38	12	33	41	42	12	24	28	31
13. Tear factor,	20	61	57	47	21	73	75	57	25	70	65	68	16	60	65	68
14. Folding endurance, (Double folds)	Nil	10	35	42	Nil	5	12	63	Nil	18	75	132	Nil	5	17	23
15. Brightness, °PV	19	18	18	17	22	21	20	20	18	17	17	17	18	17	17	17

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