SCIENTIFIC GRADING OF JUTE

Part V.—Determination of Acetyl Content and Ash of Different Grades of Jute

M. Manzoor-i-Khuda, A.S.M. Serajuddin, M.M. Anwarul Islam, Md. Nurul Amin,
M. Bose and Md. Shahjahan

Department of Chemistry, Technological Research Board, Jute Research Institute, Dacca 15

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The acetyl value of white jute (*Corchorus capsularis*) has been found to be higher than that of tossa jute (*Corchorus olitorius*). The ash content of different grades of white and tossa jute has been found to increase gradually from higher to the lower grade of jute. Tossa variety has comparatively less ash content than that of corresponding white variety.

Earlier communications on the subject indicated some correlation between some of the chemical analyses presented therein, with various grades of jute analysed.[1-4] The common bast fibres, e.g. jute and meshta, have some of their hydroxyl groups substituted with acetyl groups. Previous findings have established the acetyl value of jute and meshta as of very significant difference and it is now used as analytical criteria for distinguishing between jute and meshta. The reported acetyl value of jute being of the order of 72 to 92 m-equiv/100 g as compared to those of meshta which is of the order of 98 to 124 m. equiv/100/g[5] Some distinctions between white and tossa jute has also been reported.

The acetyl value of different new grades of Pakistani jute (white and tossa) was determined by conventional analytical method.[6,7] Analytical results showed that even though in case of tossa jute the acetyl value showed a slight increase from 72.38 to 76.76 from higher to the lower grade. The difference is probably not very significant so as to be used for intergrade distinction. Analytical results for white jute showed a maximal figure of 91.15 for the grade C jute as compared to somewhat lower figures for the superior and inferior grades. The average value for the white jute varying between 87.84 to 91.15 is, however, substantially higher than those for the tossa variety analysing between 72.38 to 76.76.

Minerals are also an integral part of jute fibre. Additionally extraneous impurities are also found in the jute which gets contaminated during various handling procedures. The origin of the metal ions present in jute depends largely on the maturity, condition and type of retting, quality of retting water and also use of fertilizer and type of land on which it is grown. The extraneous impurities can be somewhat eliminated by physical shaking to make it free from specks of barks and adhering dust particles. After the preliminary physical cleaning the ash content of the different grades of Pakistani jute was determined by igniting them in electric furnace. A marked gradation in the ash content has been observed between the various grades of jute wherein the ash content increases from the superior to the inferior grades of jute in both white (0.77 to 1.69%) and tossa (0.59 to 1.32%) jute. The ash value of tossa jute appears to be comparatively lower than the corresponding white grades.

Experimental

The pucca graded bales were purchased through Pakistan Jute Association.

Each sample of jute was cut into bottom and top portions and each portion into small pieces which were then dried in an oven at 110°C till free of moisture. The dried sample was kept in a desiccator for subsequent analyses.

Determination of Acetyl Value.—Dry jute sample (2.5g) was taken in a stoppered conical flask containing sodium hydroxide solution (100 ml, 2%) and kept for 24 hr with constant shaking. It was then filtered through a sintered funnel (porosity no. 4). An aliquot portion of 10 ml of the above filtrate was introduced into a Markham semimicrodistillation apparatus, followed by 5 ml sulphuric acid (2N). The mixture was steam distilled and the distillate containing liberated acetic acid was collected in a volumetric flask. The volume of the distillate collected each time was 250 ml. A blank experiment was also conducted for necessary correction.

The distillate was finally titrated against N/40 sodium hydroxide solution using phenolphthalein as an indicator. The results are expressed in terms of milliequivalents of acetic acid per 100 g of dry fibre.

The acetyl value was calculated as follows:

Milliequivalent of acetic acid per 100 g of dry fibre $= \dfrac{V_c}{W} \times 25$ where $V_c =$ volume of N/40 NaOH required (after correction for the normality factor) and $W =$ wt of jute sample (Tables 1 and 2).

Determination of Ash Content.—A bunch of jute fibre from each grade was taken, made free from barks, specks and adhering dust particles by physical means and finally chipped into bottom,

middle and top portions. The chips were oven dried at 110°C and weighed to a constant weight.

About 1.5 g of the moisture-free jute sample was placed in a weighed silica crucible and ignited[6,8] gradually in an electric muffle furnace. The furnace was heated to a dull red heat regulating the temperature at 750°C (6–8 hr). After the heating was completed, the ash was cooled in desiccator and weighed quickly.

The results are shown in Tables 3 and 4.

TABLE 1.—Acetyl Content Expressed in Terms of Milliequivalents of Acetic Acid/100 g Dry Sample in White Variety of Jute.

Grade	Sample used	Wt of dry sample (g)	Alkali* reqd (ml)	Mean of alkali (ml)	Correction for blank titration (ml)	Corrected volume of alkali reqd (ml)	Acetic acid m-equiv 100 g	Mean of bottom and top (m-eqniv/ 100 g)
Pak White "Special"	Bottom	2.5812	10.40 10.44 10.74	10.42	0.46	9.96	86.62	88.15
	Top	2.5758	10.76 10.74	10.75	0.46	10.29	89.67	
Pak White 'A'	Bottom	2.5008	10.10 10.16 10.12	10.13	0.44	9.69	86.53	87.84
	Top	1.7560	7.46 7.44	7.45	0.44	7.01	89.15	
Pak White 'B'	Bottom	2.4460	9.98 9.90 9.95	9.94	0.44	9.50	86.74	89.09
	Top	2.5156	10.70 10.75 10.79	10.74	0.44	10.30	91.44	
Pak White 'C'	Bottom	2.3290	9.76 9.88 9.70	9.78	0.48	9.30	89.17	91.15
	Top	2.7816	12.08 12.08	12.08	0.48	11.60	93.13	
Pak White 'D'	Bottom	2.2004	9.02 9.08 9.22	9.05	0.48	8.57	86.97	90.20
	Top	2.1006	9.30 9.34	9.27	0.48	8.79	93.43	
Pak White 'E'	Bottom	2.4948	10.49 10.45 10.56	10.47	0.46	10.01	90.87	90.76
	Top	2.5112	10.55 10.57	10.56	0.46	10.10	90.68	

* Strength of alkali used for titrations 0.8976 and 0.8933 N/40 NaOH.

Table 2.—Acetyl Content Expressed in Terms of Milliequivalent of Acetic Acid/100 g Dry sample in Tossa Variety of Jute.

Grade	Sample used	Wt of dry sample (g)	Alkali* reqd (ml)	Mean of alkali (ml)	Correction for blank titration (ml)	Corrected volume of alkali reqd (ml)	Acetic acid /m-equiv 100 g	Mean of bottom and top (m-eqniv/ 100 g)
Pak Tossa 'Special'	Bottom	2.0970	7.02 6.90 6.80	6.90	0.45	6.45	72.46	72.38
	Top	2.5090	8.20 8.22 8.10	8.15	0.45	7.70	72.30	
Pak Tossa 'A'	Bottom	2.4580	8.02 8.18	8.10	0.45	7.65	72.32	72.98
	Top	2.0660	6.84 6.80 6.82	6.82	0.45	6.37	72.64	
Pak Tossa 'B'	Bottom	2.3080	7.58 7.64 7.59	7.60	0.45	7.15	72.98	73.79
	Top	1.8632	6.34 6.35	6.35	0.45	5.90	74.61	
Pak Tossa 'C'	Bottom	2.1100	6.76 6.72	6.74	0.42	6.32	73.38	73.96
	Top	2.0772	6.76 6.80	6.78	0.42	6.36	74.54	
Pak Tossa 'D'	Bottom	2.3274	7.48 7.42	7.45	0.42	7.03	74.00	74.23
	Top	2.2864	7.36 7.44 7.34	7.37	0.42	6.95	74.47	
Pak Tossa 'E'	Bottom	2.3187	7.92 8.08 8.06	8.02	0.45	7.57	76.92	76.75
	Top	2.3196	7.98 8.00 8.00	7.99	0.45	7.54	76.59	

* Strength of alkali used for titrations 0.9424 and 0.98 N/40 NaOH.

Table 3.—Ash Content % in White Jute.

Grade	Portion	Dry wt of jute (g)	Wt of of ash (g)	Ash (%)	Mean percetage	Mean of bottom+ middle+ top (%)
Pak White 'Special'	Bottom	1.4730 1.1658 1.4562	0.0144 0.0086 0.0120	0.77 0.74 0.82	0.78	0.77
	Middle	1.2500 1.1296 1.0792	0.0092 0.0088 0.0088	0.73 0.78 0.81	0.77	
	Top	1.2974 1.4270 1.2986	0.0096 0.0120 0.0092	0.74 0.82 0.71	0.76	

Table 3 (*Continued*)

Grade	Portion	Dry wt of jute (g)	Wt of of ash (g)	Ash (%)	Mean percetage	Mean of bottom+ middle+ top (%)
Pak White 'A'	Bottom	1.0984	0.0106	0.97		
		1.0632	0.0090	0.85	0.88	
		1.0380	0.0084	0.81		
	Middle	1.0658	0.0100	0.94		
		1.1486	0.0108	0.94	0.94	0.95
		1.2036	0.0112	0.93		
	Top	1.2224	0.0125	1.02		
		1.0974	0.0112	1.02	1.03	
		1.1676	0.0120	1.03		
Pak White 'B'	Bottom	1.3080	0.0108	0.83		
		1.4354	0.0114	0.79	0.80	
		1.4040	0.0110	0.78		
	Middle	1.6618	0.0148	0.89		
		1.4212	0.0130	0.91	0.88	0.98
		1.3980	0.0116	0.83		
	Top	1.5220	0.0204	1.34		
		1.7168	0.0252	1.46	1.27	
		1.1780	0.0120	1.02		
Pak White 'C'	Bottom	1.1972	0.0116	0.97		
		1.3672	0.0132	0.96	0.97	
		1.0846	0.0106	0.98		
	Middle	1.2592	0.0158	1.25		
		1.2104	0.0150	1.24	1.24	1.16
		1.3676	0.0168	1.23		
	Top	1.2828	0.0172	1.34		
		1.4502	0.0174	1.20	1.26	
		1.1892	0.0148	1.25		
Pak White 'D'	Bottom	1.0088	0.0120	1.19		
		1.8782	0.0200	1.06	1.11	
		1.3012	0.0140	1.07		
	Middle	1.3994	0.0155	1.11		
		1.1746	0.0135	1.15	1.16	1.20
		1.2404	0.0152	1.23		
	Top	1.2862	0.0172	1.34		
		1.2854	0.0170	1.32	1.32	
		1.1616	0.0152	1.30		
Pak White 'E'	Bottom	1.3078	0.0224	1.71		
		1.0108	0.0174	1.72	1.72	
		1.0242	0.0178	1.73		
	Middle	1.1854	0.0204	1.72		
		0.8374	0.0136	1.62	1.66	1.69
		0.7972	0.0132	1.66		
	Top	0.9408	0.0150	1.59		
		0.5215	0.0090	1.72	1.60	
		0.4660	0.0082	1.76		

TABLE 4.—ASH CONTENT % IN TOSSA JUTE.

Grade	Portion	Dry wt of jute (g)	Wt of of ash (g)	Ash (%)	Mean percetage	Mean of bottom+ middle+ top (%)
Pak Tossa 'Special'	Bottom	1.5180	0.0094	0.62	0.63	
		1.1836	0.0078	0.65		
		1.2720	0.0078	0.61		
	Middle	1.2176	0.0064	0.52	0.53	0.59
		1.1496	0.0062	0.54		
		1.1242	0.0060	0.53		
	Top	1.3704	0.0082	0.59	0.62	
		1.3108	0.0086	0.65		
		1.4034	0.0086	0.61		
Pak Tossa 'A'	Bottom	1.0934	0.0048	0.44	0.45	
		1.2156	0.0054	0.44		
		1.5664	0.0074	0.47		
	Middle	1.7366	0.0103	0.59	0.56	0.53
		1.7158	0.0098	0.57		
		2.0082	0.0104	0.52		
	Top	1.1250	0.0062	0.55	0.59	
		0.8394	0.0052	0.59		
		1.1064	0.0070	0.63		
Pak Tossa 'B'	Bottom	1.1808	0.0098	0.83	0.79	
		1.0416	0.0080	0.77		
		1.0552	0.0082	0.78		
	Middle	1.1800	0.0086	0.73	0.67	0.69
		1.1036	0.0074	0.67		
		1.1922	0.0072	0.60		
	Top	1.1630	0.0074	0.64	0.61	
		1.4714	0.0090	0.61		
		1.2128	0.0072	0.59		
Pak Tossa 'C'	Bottom	1.1916	0.0124	1.04	1.07	
		1.1918	0.0134	1.12		
		1.0656	0.0112	1.05		
	Middle	1.5696	0.0162	1.03	1.00	1.00
		1.6350	0.0154	0.94		
		1.2526	0.0128	1.02		
	Top	2.6056	0.0150	0.93	0.92	
		1.6160	0.0154	0.95		
		1.1500	0.0102	0.89		
Pak Tossa 'D'	Bottom	1.5212	0.0212	1.39	1.28	
		1.2546	0.0176	1.40		
		1.1110	0.0116	1.05		
	Middle	1.4766	0.0218	1.47	1.22	1.19
		1.3516	0.0146	1.08		
		1.4878	0.0166	1.12		
	Top	1.4272	0.0144	1.01	1.09	
		1.5996	0.0196	1.22		
		1.1642	0.0120	1.03		

Table 4 (*Continued*)

Grade	Portion	Dry wt of Jute (g)	Wt of ash (g)	Ash (%)	Mean percetage	Mean of bottom+middle+top (%)
Pak Tossa 'E'	Bottom	1.7568	0.0268	1.52		
		1.3176	0.0222	1.68	1.55	
		1.2260	0.0178	1.45		
		1.2826	0.0190	1.48		
	Middle	1.3872	0.0144	1.04	1.26	1.32
		1.3492	0.0170	1.26		
		1.0800	0.0108	1.00		
	Top	1.2330	0.0174	1.41	1.14	
		1.1740	0.0120	1.02		

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