Fire-retardancy of jute fabrics with potassium sodium tartrate (Rochelle salt)

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INTRODUCTION

DIFFERENT chemical formulations have been developed for fire-retardant treatments on jute fabrics meant for different end-uses[1,2]. It has been found that diammonium hydrogen phosphate in combination with ammonium sulphate/sulphamate is the most effective of the bleachable treatments done so far. But jute fabrics treated with these reagents lose their tensile strength due to slowly liberated phosphoric and sulphuric acid. In this paper, the results of the investigation on the use of PST, which is the salt of a very weak acid, as a fire-retardant on jute fabrics are reported.

EXPERIMENTAL & RESULTS

General-strength of the fabrics was measured by Ravelled and strip method (10 x 20 cm) (Goodbrand & Co. Ltd., Stalybridge). The brightness index of the fabrics was measured on a Photovolt Reflection Meter (Model 610, Photovolt Corporation, New York). PST used was of analytical grade (certified reagent, Pfizer Ltd., Express Towers Nariman Point, Bombay).

Fire-retardant treatment of the fabric :- The construction of the grey jute fabric chosen for FR treatment was: 11 x 14-37.5"-369 gms/yd. The fabric was impregnated with aqueous solutions of potassium sodium tartrate (COOK. CHOH. CHOH. COONa. $4H_2O$) (15%, 20%, 25% respectively) at room temperature (material to liquor ratio 1:10) and padded to give a wet pick-up of around 150% and then dried at 105-110°C. for 6 mins. Results are given in the table.

As PST is highly soluble in water and the method IS: 4355 — 1977 requires to submerge the fabrics in water far certain period, the fabric failed to produce fire-retardant properties. But it could withstand the condition like steaming, brushing and 2 weeks cycling tests, so it has passed through the other tests as reported in the Table. From the table it is also clear that 25% W/V solution of PST was the optimum concentration (calculated add-on at 14% M.R. was 6.75%) to impart self-extinguishing properties in the fabric. Higher concentrations were not tried as they would possibly reduce the fabric strength further and will be uneconomical also.

Application of ammonium tartrate and tartaric acid, under the same conditions failed to produce fire-retardancy in the fabric. A saturated aqueous solution of potassium antimonyl tartrate could also not impart the fire-retardant properties.

ADVANTAGES

1. The treated fabrics can be utilised for automobiles, carpet backings & decorative purposes.
2. The process does not exert any undue adverse effect on the fabric, moreover it improves the brightness index of the fabric.
3. The add-on is relatively low.
4. There is no handling difficulty with the chemical and thus no need of any special equipment.
5. The evolved gas is mainly CO_2, which will further inhibit the fire in the surroundings.
6. The PH of the aqueous solution of PST is 7.

SUMMARY

The present investigation describes the use of potassium sodium tartrate (PST) as a fire-retardant on jute fabrics. Application of 6.75% of PST (on the weight of fabric) resulted in complete self-extinguishing property of the fabric.

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REFERENCES

1. Research Review, (Editor, R.G. Bose), Indian Jute Industries' Research Association, No. 17, August, 1975.
2. S.P. Mondal and A. Roy, Flame-retardant finishing of Textiles-the state of art in India', B.T.R.A. Silver Jubilee Monograph series., No. 12, 1981.

TABLE: TEST RESULTS ON THE PHYSICAL PROPERTIES AND FIRE-RETARDANCY OF UNTRREATED AND TREATED FABRIC (CONSTRUCTION: 11 x 14-37.5"-369 gm/yd.) WITH THREE DIFFERENT CONCENTRATIONS OF POTASSIUM SODIUM TARTRATE.

Test	Control:	PST Treated Fabric			Specification
		15% (W/V):	20% (W/V):	25% (W/V)	
1. Tensile strength (Avg. of 5 tests)					
Warp-way (kg.)	203	194	170	164	
Warp-way (kg.)	274	250	238	190	
2. Brightness Index	30.9	34.0	35.6	36.7	
3. Fire-resistance properties					
(a) Vertical Test (IS: 4355-1977) for Brattice cloth used in coal mines					Samples should be submerged in at least 2 lits of water at r. t., for 3 h., dried and conditioned at normal r. t. and humidity for 12h.
(i) Whether the flame extended beyond the marker-wire	Yes	Yes	Yes	Yes	
(ii) After-flame (sec.)	Completely burnt	Completely burnt	Completely burnt	Completely burnt	
(iii) after-glow (sec.)					
(iv) char length					
(b) Horizontal Test (FMVSS No. 302) — (Federal Motor Vehicle safety standard for flammability of interior materials in passenger cars, trucks and buses). Rate of Flame spread Inch/min. (avg. of 5 tests)					
Warp-way	3.94	3.64	3.5	Self-Extinguished	Should not be more than 4"/min.
Weft-way	3.32	3.10	2.9	Self-Extinguished.	
(c) 45° Angle Test (ASTM-D-1230-61) modified by IIIRA; for decorative fabrics					Time of flame spread shall be more than 3.5 secs. for burning 5" of fabric, after dry cleaning, laundering and drying.
Time required to catch flame (secs.) Avg. of 5 tests	3.4	3.9	4.5	5.6	
Range	(3.0-4.0)	(3.0-4.0)	(4.0-5.0)	(5.0-6.0)	
Time required for 5" propagation of flame (sec.) Avg. of 5 tests	15.2	17.0	17.9	Self-extinguished	
Range.	(14.0-17.0)	(16.0-18.0)	(16.18.0)		
(d) Methanamine Pill Test (ASTM-D-2859-70T) for carpet backing fabrics	Fails	Fails	Fails	Meets	Charred portion should not extend at any point to within 1.0" of the hole in the steel plate.