PROTECTION OF SERVICE TENTS AGAINST WEATHERING DEGRADATION : UREA-FORMALDEHYDE AND COPPER-CHROME TREATMENTS

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It has been established by outdoor exposure trials of Service tents at Kanpur and Bombay representing hot-dry and hot-humid climates respectively, that treatment of the basic tent fabric with ureaformaldehyde or copper-chrome affords adequate protection against weathering degradation.

The efficacy of urea-formaldehyde resin treatment for protecting cotton fabrics against solar radiation, ultra-violet light, micro-organisms and weathering degradation has been previously reported [1,2]. Earlier studies were based on the exposure of small-sized fabric panels, 3 ft. $\times$3 ft. It was considered desirable to assess the efficacy of this treatment by exposing full-size tents to outdoor weathering prior to recommending this treatment for Service use. As urea-formaldehyde treatment of fabrics requires facilities for baking at 150°C, which are not available easily, it was considered desirable to try copper-chrome treatment, which has also been found to impart protection against weathering degradation[3].

MATERIALS & METHODS

Cotton *dosuti*, 7 oz/sq. yd., which is the basic material of Indian tentage, was used for the fabrication of tents IP 40 lb. MK. II. The fabric was scoured by kier boiling.

Urea-formaldehyde treatment—Scoured cotton *dosuti*, olive-green as well as blue, was treated with urea-formaldehyde resin at 12°Tw at Sri Ram Mills, Bombay. The treated fabric was baked at 150°C for 5 to 7 mt.

Copper-chrome process—The fabric was impregnated with basic chromium sulphate solution to give a final chromium content of 0·8 per cent in the fabric. The fabric was then freed of excess of water by passing through a padding mangle and developed in a solution containing 3 per cent by weight of sodium carbonate (anyhdrous) at a temperature of 82—93°C. The fabric was thereafter given 3 rinses in cold water, squeezed and again treated in a cold solution containing 3 per cent by weight of crystalline copper sulphate. The fabric was then finally washed, squeezed and dried at 100°C. The copper content of the fabric was 0·3 per cent.

Fabrication of tents—Only outerfolds of the tents consisting of two flies were exposed to outdoor weathering. Outerfolds of store tents (IP 40 lb MK II) were fabricated at Elgin Mills, Kanpur from treated and untreated fabrics.

Details are given below:—

Tent 1—Both the inner as well as the outerfly of the outerfold were treated with urea-formaldehyde resin (12°Tw).

Tent 2—Only outerfly of the outerfold was treated with urea-formaldehyde resin (12°Tw).

Tent 3—Only the outerfly of the outerfold was treated with copper-chrome process.

TABLE 1

PERCENTAGE LOSS IN BREAKING STRENGTH OF OUTERFLY OF TENTS DUE TO EXPOSURE

Treatment	Kanpur						Bombay					
	Period of exposure in months						Period of exposure in months					
	2	4	6	8	10	12	2	4	6	8	10	12
Urea-formaldehyde resin	4	17	24	35	32	53	7	39	44	43	65	80
	8	8	17	29	44	53	6	22	42	46	66	83
—do—	3	13	22	32	37	54	0	34	43	49	72	82
	8	7	33	26	44	65	11	23	48	47	69	81
Copper-chrome	16	16	10	18	25	43	14	24	15	25	45	69
	18	21	28	38	55	62	11	25	33	47	58	66
Untreated control	12	43	55	69	72	100	30	64	31	92	94	..
	25	38	53	59	68	98	31	70	87	88	88	..
—do—	21	28	43	55	65	100	24	60	82	86	..	..
	28	19	40	44	60	86	36	70	74	84	..	..

N.B.—Two readings against each exposure are given for two directions North and South respectively of exposure.

TABLE 2

PERCENTAGE LOSS IN BREAKING STRENGTH OF INNERFLY OF TENTS DUE TO EXPOSURE

Treatment	Kanpur						Bombay					
	Period of exposure in months						Period of exposure in months					
	2	4	6	8	10	12	2	4	6	8	10	12
Urea-formaldehyde resin	8	8	6	7	47	47	6	9	11	19	14	52
	8	7	10	8	20	20	6	6	9	14	23	48
Urea-formaldehyde resin	8	22	17	32	69	70	15	18	17	42	19	67
	14	16	14	18	59	59	13	20	24	39	42	57
Copper-chrome	19	14	10	19	75	79	12	15	19	47	58	68
	21	19	17	16	50	49	14	25	24	39	76	62
Untreated control	12	15	15	15	70	70	6	9	8	21	25	69
	13	9	9	20	45	45	11	11	20	36	31	65
Untreated control	14	17	24	26	52	52	22	22	25	33	40	..
	19	14	14	24	57	58	21	35	30	55	49	84

N.B.—Two readings against each exposure are given for two directions North and South respectively of exposure.

Tent 4—Both the outer as well as the innerfly of the outerfold were untreated. This served as control for tents 1—3.

Tent 5—A Service tent was used. The outerfly of the outerfold was dyed mineral khaki and the innerfly of the outerfold was made of blue *dosuti*. Both the inner and outerfly were untreated.

In tents 1—4, the outerflies of the outerfold were of olive-green shade and the innerflies of the outerfolds were of blue shade.

Plan of exposure—One set of tents 1—5 was pitched at Kanpur (hot-dry climate) and the other, at Bombay (hot-humid climate). The tents were pitched in the East-West direction so that one half of the outerfly was exposed to the North and the other half to the South. The exposure was started on 20 August 1962 at Kanpur and Bombay, and continued for 12 months. Samples were drawn from each tent initially and thereafter bimonthly and subjected to the following tests:

Breaking strength—Samples were conditioned at 21°C and 65—75 per cent R.H. and were broken warp-wise (4 in. × 6-5/8 in.) between grips in a Goodbrand cloth testing machine, in which the test piece was stretched at a constant rate of 18 inches per minute. The results are given in Tables 1 and 2.

Meteorological data—The average monthly values for maximum and minimum temperatures, relative humidity (R.H.) and total monthly rainfall during the period of exposure at Kanpur, are graphically represented (Fig. 1).

RESULTS AND CONCLUSION

Tables 3-4 give the average percentage loss of breaking strength as a result of 12 months exposure of the outerfly and the innerfly. The data were statistically analysed.

The results reveal that in the case of outerflies of the outerfold, both urea-formaldehyde resin treatment and copper-chrome treatment provide significant protection against deterioration. The two treatments are equally efficacious.

In the case of innerfly of outerfold, urea-formaldehyde resin treatment is significantly better than untreated control at both the sites (Table 4).

The copper-chrome process can be employed in lieu of urea-formaldehyde resin treatment if facilities for baking the fabric at 150°C are not available and the greenish colour imparted to the fabric by this process is not objectionable. Both treatments are equally economical.

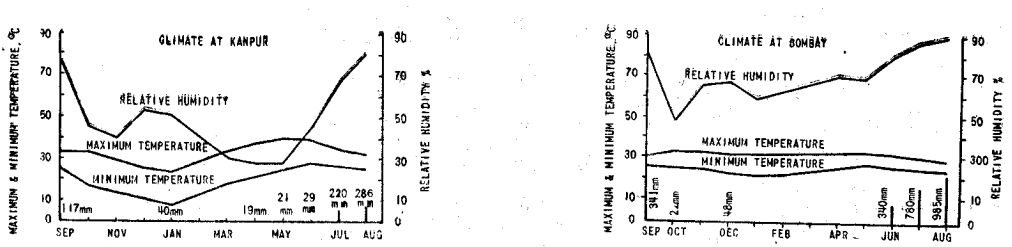

Fig. 1—Climatic data for Kanpur & Bombay for the period Sept., 1962 to Aug., 1963 The figures at the top of the vertical bars represent the total monthly rainfall).

TABLE 3

AVERAGE PERCENTAGE LOSS IN THE BREAKING STRENGTH OF THE OUTERFLY DURING 12 MONTHS OF EXPOSURE

Treatment	Kanpur	Bombay
Urea-formaldehyde resin	27·04 *	45·25 *
—do—	27·80	46·58
Copper-chrome	28·92	35·16
Untreated (control)	57·71 *	65·50 *
Existing tent (control)	49·92	64·50

*Figures within brackets do not differ significantly among themselves.

TABLE 4

AVERAGE PERCENTAGE LOSS IN BREAKING STRENGTH OF THE INNERFLY DURING 12 MONTHS OF EXPOSURE

Treatment	Kanpur	Bombay
Urea-formaldehyde resin	16·75	11·75
Untreated (control)	33·19	32·76
—do—	33·74	33·25
—do—	28·18	17·75
—do—	30·91	24·91

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