

PRESERVATIVE TREATMENT FOR TIMBERS FOR AMMUNITION BOXES

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ABSTRACT

The efficacy of the 'hot and cold' bath process of treatment of 16 species of timbers used for manufacture of Service ammunition boxes with water soluble 'fixed' type preservatives has been investigated. The treatment involved immersion of timbers (pieces of size $20'' \times 5'' \times \frac{3}{4}''$) in boiling water for 15 minutes followed by immersion in the cold solution of the preservatives (Ascu-A, Ascu-B and Celcure) for 30 minutes and it gave in majority of cases good penetration and retention aimed at. The exceptions were the heart wood of Andaman padauk, chaplash and white chuglam.

INTRODUCTION

Insect infestation was detected in some of the ammunition boxes held in a Services installation. Since adequate facilities for pressure treatment of timbers recommended for the manufacture of the ammunition boxes are not available with the trade and with the Service stock-holding installations, it was considered of interest to examine how far the 'hot and cold' bath process of treatment with water soluble 'fixed' type of preservatives, such as, copper-chrome-arsenic composition (Ascu-A), copper-chrome-boric composition (Ascu-B), and acid-cupric-chromate (Celcure) can satisfy the needs of the situation and what should be the exact conditions of treatment of the timbers with the above preservatives. In a preliminary investigation it was observed that the 'hot and cold' bath process can give deep penetration of the preservative into the timber and should prove a satisfactory method of treatment in the absence of adequate facilities for pressure treatment. Further investigations showed that so far as Mango wood (pieces of size $20'' \times 5'' \times \frac{3}{4}''$) is concerned, initial treatment in boiling water for 10 minutes followed by subsequent immersion for 15 minutes in the cold solution of the preservative gave excellent retention.

In view of the general shortage of good quality timbers and also in view of the free and cheap availability of certain timbers in specific areas, 16 different species of timbers (see Table I) have been recommended for the manufacture of ammunition boxes. Any one among these 16 species of timbers can be used for the manufacture of Service ammunition boxes. Excepting for the work described above on Mango, there is no information particularly in relation to the periods of immersion in boiling water and solution of the preservative in regard to the various other timbers that have been recommended for the manufacture of ammunition boxes. It was, therefore, intended to provide the requisite information by acquiring supplies of different timbers and carrying out the treatment with water soluble 'fixed' preservatives, such as copper-chrome-arsenic composition (Ascu-A), copper-chrome-boric composition (Ascu-B) and acid-cupric-chromate (Celcure). Such an investigation, apart from its importance in the context of ammunition boxes, will provide results which can be applied for the treatment of other Service stores, such as, packing cases and timbers used for the building of body of vehicles.

MATERIALS AND METHODS

(a) *Timbers*

Sixteen species of timbers listed in Table 1 and recommended for the manufacture of ammunition boxes as per Specification No. IND/GS/733(b) were used for these studies. Both the heart-wood and sap-wood of these timbers were investigated. The moisture content of the timber pieces investigated were below 8—10 per cent.

(b) *Preservatives*

The preservatives used for this investigation were :

(i)	Copper-chrome-arsenic composition—(Ascu-A) 8% (solution in water)				
	Arsenic pentoxide	(As ₂ O ₅ .2H ₂ O)	..	..	.. 1 part
	Cupric sulphate	(CuSO ₄ .5H ₂ O)	..	..	.. 3 parts
	Potassium dichromate	(K ₂ Cr ₂ O ₇)	..	..	.. 4 parts
(ii)	Copper-chrome-boric composition—(Ascu-B) 12% (solution in water)				
	Boric acid	(H ₃ BO ₃)	..	..	.. 1.5 parts
	Cupric sulphate	(CuSO ₄ .5H ₂ O)	..	..	.. 3 parts
	Potassium dichromate	(K ₂ Cr ₂ O ₇)	..	..	.. 4 parts
(iii)	Acid-cupric-chromate (Celcure)—8% solution in water.				
	Cupric sulphate	(CuSO ₄ .5H ₂ O)	..	..	.. 1 part
	Potassium dichromate	(K ₂ Cr ₂ O ₇)	..	..	.. 1 part
	Acetic acid	(CH ₃ COOH)	..	..	.. Enough quantity to keep the ingredients in solution.

Retention aimed at 8.0—11.2 Kg/cu.m. (0.5—0.7 lbs/cu. ft.) in case of Ascu-B
4.8—8.0 Kg/cu. m. (0.3—0.5 lbs/cu. ft.) in case of Ascu-A and Celcure

(c) *Treatment*

In order to obtain the optimum conditions of treatment by which required retention of the preservatives in Kg/cu.m. (lbs/cu. ft.) can be obtained, the following preliminary work was carried out on the four types of timbers (i.e. heart woods of Andaman padauk, Sissoo, Kanju and White chuglam.)

(i) *Cold treatment* : 6 pieces of size 20" × 5" × $\frac{3}{4}$ " each of Andaman padauk, Sissoo, kanju and White chuglam were kept immersed in cold solution of preservatives (i.e. Ascu-A 8%, Ascu-B 12% and Celcure 8%) for six hours separately. The hold up was calculated and expressed as Kg/cu. m. (lbs/cu. ft.) of the timber. The results are given in Table 2. From these results it appears that soaking for six hours in cold preservative solution does not give the required amount of preservative in the timber pieces.

(ii) 'Hot and cold bath' process of treatment: 6 pieces of size 20" × 5" × $\frac{3}{4}$ " of each type of timbers were kept immersed in boiling water for 15 minutes, 30 minutes and 90 minutes separately and immediately transferred to a bath containing cold preservative solution after blotting out the liquid adhering the surface of the timber pieces. These timber pieces were kept immersed in the cold solution of the preservative for 15 minutes, 30 minutes and 45 minutes separately. The results are given in Tables 2 and 3. From the results it appears that immersion of timbers in boiling water for 15 minutes followed by immersion in the cold solution of preservatives for 30 minutes gave good penetration and retention of the preservative as was aimed at. This was, however, not true with Andaman padauk (heart-wood) wherein the increase in period of immersion in preservative solution from 30 minutes to 96 hrs. did not prove advantageous.

After finding out the optimum conditions of treatment, all the sixteen types of timbers were treated (heart-wood and sap-wood separately) with the three preservatives, mentioned above and their hold up Kg/cu. m. (lbs./cu. ft.) was calculated. The results are given in Tables 4 and 5.

(d) Penetration of preservative solutions

0.5% solution of diphenyl carbazide (in 50 : 50 water and isopropyl alcohol) was applied on the cut surfaces of the treated timber pieces. The colour of the surface changed to reddish brown as per penetration of the preservative. This was classified into three groups: (i) complete penetration (P), (ii) partial penetration (PP) and (iii) poor penetration (SP). This test is purely qualitative and gives approximate idea of penetration as per Indian Standard Specification IS : 401—1954.

DISCUSSION

Results in Table 4 indicate that the heart-wood of Mango, Hollock, Chickrassy, Jamun, Kokko, Kanju, Champ, Salai, Sissoo, Aini, Mundani and Benteak can be satisfactorily treated by 'hot and cold' bath process of treatment as they absorb more than required amount of preservative. The preservative solution has completely penetrated or partially penetrated in all the timbers mentioned above except in the case of Hollock, Kokko, Champ and Benteak, though these have shown satisfactory retention of preservative. The heart-wood of Andaman padauk, Chaplash, Jack and White Chuglam are refractory to treatment, as the hold up is less than that required under the specification and the penetration of preservative is also poor. In case of these timbers increasing the period of immersion from 30 minutes to 96 hrs did not prove advantageous. The sap-wood of all the timbers investigated (Table 5) show satisfactory retention of preservatives. The extent of penetration is also satisfactory except in the case of Jamun, Kokko and Benteak.

A summary of the results obtained for 'hot and cold bath' process of treatment (i.e. immersion of timbers in boiling water for 15 minutes followed by immersion in cold preservative solution for 30 minutes) have been tabulated in Table 6 which shows the response to treatment and penetration by various species of timbers with all the three types of preservatives. From this Table it appears that the sap-wood and heart-wood of all the timbers investigated are easily treatable by 'hot and cold bath' process of treatment except the heart-wood of Andaman padauk, Hollock, Chaplash, Jack and White chuglam.

CONCLUSION

The 'hot and cold bath' treatment of timbers with water soluble 'fixed' type of preservatives such as Ascu-A, Ascu-B and Celcure can be recommended for the treatment of timbers intended for the manufacture of ammunition boxes. As far as sap wood are concerned the method of treatment appears to be very satisfactory. It also holds good for most of the heart-wood except that of Andaman padauk, Chaplash and White chuglam when hold up of preservative (Kg/cu.m) is taken into consideration. The heart-wood of few timbers (i.e. Hollock, Jack, Kokko, Champ, Benteak) though easily treatable, show poor penetration of the preservatives. The treatment is simple and involves steeping the timber pieces in boiling water for 15 minutes followed by immersion in cold preservative solution for 30 minutes.

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TABLE I

DIFFERENT SPECIES OF TIMBERS

1. Mango	<i>Mangifera indica.</i>
2. Andaman Padauk	<i>Pterocarpus dalbergioides.</i>
3. Hollock	<i>Terminalia myriocarpa.</i>
4. Chaplash	<i>Artocarpus Chaplasha.</i>
5. Jack	<i>Artocarpus integrifolia.</i>
6. Chickrassy	<i>Chukrasias tabularis.</i>
7. Jamun	<i>Engenia Jampolana.</i>
8. Kokko	<i>Albizzia lebbek.</i>
9. Kanju	<i>Holoptolea integrifolia.</i>
10. White Chuglam	<i>Terminalia bialata.</i>
11. Champ	<i>Miohelia champaea.</i>
12. Salai	<i>Boswellia serrala.</i>
13. Sissoo	<i>Dalbergia sissoo.</i>
14. Aini	<i>Artocarpus kirsuta.</i>
15. Mundani	<i>Acrocarpus fraxinifolius.</i>
16. Benteak	<i>Lagerstroemia lanceolata.</i>

REFERENCE

1. U. S. PATENT 2, 381, 049 to R. N. HAMMOND, April 7, (1945).

TABLE 2

SHOWING THE RETENTION AND PENETRATION OF PRESERVATIVES BY DIFFERENT TYPES OF TIMBERS

Timbers (20" × 5" × ¾")	Reten- tion/ Penetra- tion	Preservative Treatments					
		Ascu-A		Ascu-B		Celcure	
		Cold* Soaking	Hot &** Cold Treatment	Cold* Soaking	Hot &** Cold Treatment	Cold* Soaking	Hot & **Cold Treatment
Andaman- Padauk	Reten- tion Kg/Cu.m	1.90 (0.119)	1.66 (0.104)	1.01 (0.063)	1.65 (0.103)	1.89 (0.118)	1.36 (0.085)
	Penetra- tion.	SP	SP	SP	SP	SP	SP
Sissoo	Reten- tion Kg/Cu. m	2.19 (0.137)	6.42 (0.401)	2.03 (0.127)	8.65 (0.503)	2.91 (0.182)	5.17 (0.323)
	Penetra- tion	SP	P	SP	P	SP	P
Kanju	Retention Kg/Cu. m	4.5 (0.284)	13.98 (0.874)	4.62 (0.289)	14.7 (0.919)	3.01 (0.188)	9.47 (0.592)
	Penetra- tion	SP	P	SP	P	SP	P
White chuglam	Reten- tion Kg/Cu. m	3.07 (0.192)	3.86 (0.241)	3.00 (0.191)	15.25 (0.956)	1.63 (0.102)	8.30 (0.519)
	Penetra- tion	SP	P	SP	P	SP	P

Figures in bracket indicate lbs/Cu. ft. Each figure is an average of 6 replicates.

Retention aimed at :— (Ascu-A) = 4.8—8.0 Kg/Cu. m (0.3—0.5 lbs/Cu. ft).

(Ascu-B) = 8.0—11.2 Kg/Cu. m (0.5—0.7 lbs./Cu.ft).

Celcure = 4.8—8.0 Kg/Cu. m (0.3—0.5 lbs/cu.ft.).

P = Complete Penetration of Preservatives, SP= Poor Penetration of Preservatives.

*Soaked in cold Preservatives Solution for 6 hours without initially boiling in water.

**Before Soaking in cold Preservatives Solution, the timber pieces were maintained in boiling water for 15 minutes.

TABLE 3

SHOWING THE RETENTION OF (ASCU-B) BY HOT AND COLD PROCESS OF TREATMENT FOR VARIOUS PERIODS OF BOILING.

Time of boiling the timber pieces in water	Immersing the timber pieces (20" × 5" × 3") in cold Preservatives Solution of AscU-B Retention Kg/cu. m.		
	15 mts	30 mts	90 mts
15 minutes	22.18 (1.386)	22.30 (1.394)	25.54 (1.596)
30 minutes	22.42 (1.401)	22.800 (1.425)	28.51 (1.782)
45. minutes	22.880 (1.430)	22.800 (1.425)	31.79 (1.987)

Figures in bracket indicate lbs/cu. ft. Retention aimed at :

(AscU-B) 8.0—11.20 Kg/cu. m (0.5—0.7 lbs/cu. ft.). Each figure is an average of 6 replicates.

TABLE 4

SHOWING THE RETENTION (KG./CU. M) AND PENETRATION OF PRESERVATIVES BY DIFFERENT TYPES OF TIMBERS (HEART-WOOD ONLY)

Timber Species (Heart-Wood)	AscU-A		AscU-B		Celcure	
	Retention of preservatives in Kg/Cu. m.	Penetration	Retention of preservatives in Kg/Cu. m.	Penetration	Retention of preservatives in Kg/Cu. m.	Penetration
Mango	14.40 (0.90)	P	49.28 (3.08)	P	20.00 (1.25)	P
Andaman padauk	4.64 (0.29)	SP	5.12 (0.32)	SP	14.32 (0.27)	SP
Hollock	8.64 (0.54)	SP	14.08 (0.88)	PP	8.64 (0.54)	SP

TABLE 4—*contd.*

Timber Species (Heart-Wood)	Ascu-A		Ascu-B		Celcure	
	Retention of Preservatives in Kg/Cu. m.	Penetration	Retention of Preservatives in Kg/Cu. m.	Penetration	Retention of Preservatives in Kg/Cu. m.	Penetration
Chaplash	5.60 (0.35)	SP	6.08 (0.38)	SP	4.64 (0.29)	SP
Jack	4.80 (0.30)	SP	5.60 (0.35)	SP	5.73 (0.36)	SP
Chickrassy	6.72 (0.42)	PP	10.24 (0.64)	P	6.08 (0.38)	PP
Jamun	22.40 (1.40)	P	29.12 (1.82)	P	16.64 (1.04)	P
Kokko	7.52 (0.47)	SP	9.12 (0.57)	SP	6.08 (0.38)	SP
Kanju	20.32 (1.27)	P	29.60 (1.85)	P	20.16 (1.26)	P
White-chulgam	6.40 (0.40)	SP	7.52 (0.47)	SP	4.80 (0.30)	SP
Champ	6.72 (0.42)	SP	8.16 (0.51)	SP	6.72 (0.42)	SP
Salai	9.28 (0.58)	P	12.48 (0.78)	P	10.24 (0.64)	P
Siasoo	6.40 (0.40)	P	8.00 (0.50)	P	5.12 (0.32)	P
Aini	9.60 (0.60)	SP	15.68 (0.98)	PP	11.20 (0.70)	PP
Mundani	10.40 (0.65)	P	16.32 (1.02)	P	9.68 (0.60)	P
Benteak	5.60 (0.36)	SP	8.64 (0.54)	SP	5.76 (0.36)	SP

Figures in bracket indicate lbs./Cu. ft. Each figure is an average of 6 replicates.

P=Complete penetration of preservatives. PP=Partial penetration of preservatives. SP=Poor penetration of preservatives.

Retention aimed at : Ascu-A and Celcure—4.8—8.0 Kg/Cu. m. (0.3—0.5 lbs./Cu.ft.),

Ascu-B 8.0—11.2 Kg/Cu. m. (0.5—0.7 lbs./Cu. ft.),

TABLE 5

SHOWING RETENTION (Kg/Cu.m.) AND PENETRATION OF PRESERVATIVES BY DIFFERENT TYPES OF TIMBERS
(SAP WOOD ONLY)

Timbers Species (Sap-wood) (24" × 6" × 1/4")	Ascu-A		Ascu-B		Celcure	
	Retention of Preserva- tives in Kg/Cu. m.	Penetra- tion	Reten- tion of Preserva- tives in Kg/Cu. m.	Penetra- tion	Reten- tion of Preserva- tives in Kg/Cu. m.	Penetra- tion
Mango	26.88 (1.68)	P	43.52 (2.72)	P	29.12 (1.82)	P
Andaman Padauk	15.68 (0.98)	P	17.60 (1.10)	P	22.40 (1.40)	P
Hollock	9.44 (0.59)	PP	17.28 (1.08)	P	8.64 (0.54)	SP
Chaplash	12.80 (0.80)	P	19.68 (1.23)	P	17.12 (1.07)	P
Jack	7.84 (0.49)	SP	16.80 (1.05)	PP	29.12 (1.82)	P
Chickrassy	11.84 (0.74)	P	16.64 (1.04)	P	11.04 (0.69)	P
Jamun	8.96 (0.56)	SP	11.52 (0.72)	SP	13.12 (0.82)	P
Kokke	10.72 (0.67)	SP	17.76 (1.11)	PP	8.80 (0.55)	SP

TABLE 5—*contd*

Timbers Species (Sap wood) (24"×6"× $\frac{3}{4}$ ")	Ascu-A		Ascu-B		Celcure	
	Retention of Preservatives in Kg/Cu. m.	Penetration	Retention of Preservatives in Kg/Cu. m.	Penetration	Retention of Preservatives in Kg/Cu. m.	Penetration
Kanju	42.00 (1.50)	P	35.36 (2.21)	P	31.84 (1.99)	P
White chuglam.. ..	20.64 (1.29)	P	30.24 (1.89)	P	18.40 (1.15)	P
Champ	13.28 (0.83)	P	19.52 (1.22)	P	14.56 (0.91)	P
Salai	23.04 (1.44)	P	32.80 (2.05)	P	17.28 (1.08)	P
Sissoo	7.68 (0.48)	P	8.96 (0.56)	P	5.92 (0.37)	P
Aini	10.56 (0.66)	SP	14.88 (0.93)	PP	10.40 (0.65)	PP
Mundani	14.88 (0.93)	P	13.12 (0.82)	P	10.72 (0.67)	P
Benteak	9.12 (0.57)	SP	7.84 (0.49)	SP	5.12 (0.32)	SP

Figures in bracket indicate lbs/Cu.ft. Each figure is an average of six replicates.

P=Complete Penetration of Preservatives. PP=Partial Penetration of Preservatives.

SP=Poor Penetration of Preservatives.

Retention aimed at : Ascu—A and Celcure : 4.8—8.0 Kg/Cu. m (0.3—0.5 lbs/Cu. ft.).

Ascu—B—8.0—11.2 Kg/Cu. m (0.5—0.7 lbs/Cu. ft.).

TABLE 6

SHOWING THE RESPONSE TO TREATMENT AND PENETRATION BY VARIOUS TYPES OF TIMBERS WITH THREE TYPES OF PRESERVATIVES*

Timbers	Sap-Wood		Heart-wood	
	Response to treatment	Penetration	Response to treatment	Penetration
Mango	a	P	a	P
Andaman Padauk	a	P	b	SP
Hollock	a	PP	a	SP
Chaplash	a	P	b	SP
Jack	a	PP	a	SP
Chickrassy	a	P	a	PP
Jamun	a	SP	a	P
Kokko	a	SP	a	SP
Kanju	a	P	a	P
White chuglam	a	P	b	SP
Champ	a	P	a	SP
Salai	a	P	a	P
Sissoo	a	P	a	P
Aini	a	PP	a	PP
Mundani	a	P	a	P
Benteak	a	SP	a	SP

Each figure is an average of eighteen values and three preservatives.

Legend :—

a—Easily treatable. b—Refractory to treatment. P—Complete Penetration of Preservatives.

PP—Partial Penetration of Preservatives. SP—Poor Penetration of Preservatives.

*Preservatives investigated 1. Asc—A. 2. Asc—B. 3. Celcure.