TREATMENT OF BANDARHOLA WOOD WITH CREOSOTE

M. A. Latif
B. C. De
S. R. Dasgupta

Bandarhola (*Duabanga sonneratioides*) heartwood was treated with 40 : 60 creosote petroleum oil mixture by the Lowry empty cell process using different schedules and the effects of varying pressure, treating time and final vacuum period on penetration and absorption were studied. This species, inspite of presence of tyloses in the vessels, was highly permeable to the preservative mostly along the grain. Transverse penetration from the surface was, however, low. The reason for higher permeability along the grain is attributed to the presence of numerous intervessel pits with perforated pit membranes. Increasing pressure and treating time increased penetration and absorption. At 82°C preservative temperature, saturation in absorption was reached in about 120 minutes. Final vacuum recovered about 25 per cent of the absorbed preservative, leaving the rest in the wood as net retention.

INTRODUCTION

Traditional wood having high natural durability and other desirable properties are becoming scarce and as such the use of alternative non-traditional woods has become very common. Bandarhola (*Duabanga sonneratioides*) is one such non-traditional timber species which is available in large quantity and is being used in an increasing rate in various types of light constructions. However, like most wood species of Bangladesh, it is not naturally durable and consequently its use in many cases results in economic loss to the users. It is highly susceptible to attack by borers and therefore it rapidly deteriorates causing damage even before it is put to use. Bandarhola when suitably treated would give increased life under service condition. It is, therefore, necessary to develop a treatment process to impart a high degree of protective power to Bandarhola against deterioration by fungi, termites

and borers. A study was, therefore, made using Bandarhola sawn wood to see the effect of treating pressure, treating time and the final vacuum period by the Lowry empty cell process.

MATERIAL AND METHOD

Two logs of Bandarhola were procured from the forests of Chittagong Hill Tracts. Stakes of 5 x 10 x 42 cm size were prepared from the heartwood of these logs and were planed and kiln dried between 14 and 16 per cent moisture content.

Some stakes were end-coated with a urea-formaldehyde resin prior to treatment to eliminate end penetration allowing the side penetration only.

Treatment of stakes were performed by the Lowry empty cell process with 40 : 60 creosote : light diesel oil mixture. In a typical treatment five stakes were immersed in preservative fluid in the pilot treating plant at 82°C preservative temperature throughout the treatment. Desired pressure was applied on the preservative by injecting compressed air into the cylinder. Treating time commenced from just after the desired pressure level was reached in the cylinder and ended when the pressure was released and the cylinder was emptied of preservative. At the end of the treatment a vacuum of 508 mm mercury was applied in the cylinder for the desired period to recover the excess preservative from the treated stakes.

In all treatments the stakes were weighed individually before and after the treatment. The difference between the initial and the final weights was the net retention/absorption of preservative.

The treated stakes were ripped lengthwise in both the thickness and the width directions to measure the depth of penetration of preservatives from the sides and the end of the stakes.

The effect of three factors, viz., pressure, treating time and final vacuum period were studied at 82°C preservative temperature. The experiment was designed to study the effect of one factor at a time keeping the other two factors constant in the following manner.

(a) Five levels of pressure, viz., 1.75, 3.50, 5.25, 7.00 and 8.75 kg/cm² were used separately with 60 minutes' treating time and 15 minutes' vacuum period.

(b) Five levels of treating time, viz., 60, 90, 120, 150 and 180 minutes were used separately with 3.50 kg/cm² pressure and 15 minutes' vacuum period.

(c) Vacuum periods of 0, 5, 10, 15 and 20 minutes at a vacuum of 508 mm of mercury were used separately after the charges were run with 3.50 kg/cm² pressure for 60 minutes.

Finally, a charge was run with 10.50 kg/cm² pressure for 120 minutes and at a final vacuum of 508 mm of mercury for 15 minutes. A retention of 286.74 kg/m³ generally suitable for marine piling was obtained (Hunt and Garratt 1967).

RESULTS

The results of the experiment in terms of net retention, its mean, standard deviation and coefficients of variation are shown in Tables 1 to 3.

Table 1. Retention of preservative in Bandarhola treated at various treating pressures at 80°C for 60 minutes followed by a final vacuum of 508 mm of mercury for 15 minutes

Pressure (kg/cm^2)	Mean retention (kg/m^3)	Standard deviation (kg/m^3)	Coefficient variation (%)
1.75	115.34	11.96	10.4
3.50	155.39	21.95	14.4
5.25	199.93	24.71	11.9
7.00	208.15	18.06	8.9
8.75	247.09	28.51	12.5

Table 2. Retention of preservative in Bandarhola after treatment for various treating times at 82°C and 3.50 kg/cm^2 treating pressure followed by a final vacuum of 508 mm of mercury for 15 minutes

Treating time (minutes)	Mean retention (kg/m^3)	Standard deviation (kg/m_3)	Coefficient of variation (%)
60	155.39	21.95	13.9
90	178.24	11.69	6.5
120	217.87	33.32	15.3
150	205.05	34.28	16.7
180	197.92	24.83	12.5

Table 3. Retention of preservative in Bandarhola after treatment at 82°C and 3.50 kg/cm^2 treating pressure for 60 minutes treating time and various final vacuum periods at a vacuum of 508 mm of mercury

Final vacuum period (minutes)	Mean retention (kg/m^3)	Standard deviation (kg/m^3)	Coefficient of variation (%)
0	184.55	23.23	12.6
5	169.49	26.11	15.3
10	144.82	9.31	6.3
15	155.39	21.94	13.9
20	156.51	17.30	11.1

DISCUSSION

It was observed that Bandarhola was highly permeable to the preservative mixture. The sapwood was more easily treated than the heartwood. Sawn Bandarhola timber could be treated with very mild schedules of Lowry empty cell process. The stakes could be penetrated through and through with a pressure as low as 1.75 kg/m^3 for 60 minutes but the penetration appeared to be mottled and scattered throughout the stake. The intensity of treated spots in the wood was increased with the increase of either treating pressure or treating time or both. The increase of intensity of penetrated spots with more severe treating schedules indicates that the penetration occurs in a stepwise manner. The refractory woods are penetrated using severe treating schedules. Because of althrough penetration the side penetration could not be distinguished from the end penetration.

In order to determine the extent of the penetration through the end some treatments were carried out with stakes of size 5 x 10 x 130 cm. These stakes were also found to be thoroughly penetrated and distinction could not be made between the side and the end penetration.

Thereafter some charges were run with stakes which were end-coated with a urea formaldehyde resin before treatment to seal the end of the pores completely. It was found that penetration in these stakes occurred only through the sides of the stakes and it was only 1.25 cm deep from the surface.

It, therefore, appears that the althrough penetration of Bandarhola wood was the result of the end penetration and occurred mostly along the grain.

It is found that tyloses in the vessels do not have any resisting effect on the movement of preservative probably because they are not thick enough to be an obstruction for preservative to move (Pearson and Brown 1932). In the present study variation in penetration could not be ascertained quantitatively due to scattered but althrough penetration of preservative.

The net retention of preservative increased with increasing pressure and treatment time. It may be seen from Table 1 that any amount of net retention obtained at 8.75 kg/cm^2 about 50 per cent of which was obtained at 1.75 kg/cm^2 pressure and about 75 percent at 3.50 kg/cm^2 pressure, 80 per cent at 5.25 kg/cm^2 pressure and 90 per cent at 7.00 kg/cm^2 pressure. This increasing trend of net retention indicates the existence of a relationship between the net retention and the treating pressure. An investigation in this aspect is necessary.

It is observed from Table 2 that the treatment for 120 minutes gave the maximum net retention. The net retentions exhibit a linear relationship with the square root of treating time upto the treating time of 120 minutes and beyond this level this relationship does not exist. 120 minutes' treating time (Petty 1975) can be considered as a saturation time for Bandarhola. This signifies that at 82°C preservative temperature, the saturation in absorption of preservative in Bandarhola heartwood can be attained in 120 minutes' treatment at any treating pressure, until the theoretically maximum retention was obtained. The easy adaptibility of this species to preservative treatment can be noticed from the fact that a schedule of treatment

containing 10.50 kg/cm² pressure for 120 minutes and final vacuum for 15 minutes is able to achieve a retention of 286.75 kg/m² which is about 50 per cent of the theoretically possible maximum retention in Bandarhola.

Table 3 shows that the final vacuum is highly effective in recovering excess absorbed preservative from the treated wood. This can be understood from the fact that about 75 per cent of the excess absorbed preservative can be drawn out of the treated wood in 5 minutes and almost all excess preservative in 10 minutes. Table 3 also shows that the excess absorbed preservative amounts to 25 per cent of the gross absorbed preservative. This proportion between gross and net retention of preservative is likely to be independent of treating pressure and treating time.

As mentioned earlier, variation in penetration could not be ascertained quantitatively due to mottled but through and through penetration. Variation in net retention was ascertained and expressed as standard deviation and coefficient of variation of net retention. Variation in net retention as appears from Tables 1 to 3 is not large and its range agrees well with the permeable nature of Bandarhola.

CONCLUSION

Bandarhola heartwood is highly permeable to 40 : 60 creosote and light diesel oil mixture in respect of penetration and retention. Higher treating pressure and treating time are highly effective in increasing penetration and retention.

For higher retention the treating pressure and not the treating time should be increased. Treatment time longer than 120 minutes does not increase net retention.

About 25 per cent of gross retention can be recovered. A 10 minutes' vacuum period is sufficient to draw out almost all excess preservative.

REFERENCES

Hunt, G. M. and Garratt, G. A. 1967. Wood Preservation ; Third edition, McGraw–Hill Book Company Inc. New York. 417 pp

Pearson, R. S. and Brown, H. P. 1982. Commercial Timber of India, Govt. of India, Central Publication Branch, Calcutta, Vol 1. 598 pp

Petty, J.A. 1975. Relation between immersion. time and absorption of petroleum distillation in a vacuum-pressure process ; Holzforschung 29(4) : 113-118

Dr. M. A. Latif, Divisional Officer, B. C. De, Research Assistant and S. R. Dasgupta, Senior Research Officer, Forest Research Institute, Chittagong, Bangladesh