



Short Communication

Finishing studies on polyurathene (PU) and shellac coats on teak and deodar surfaces

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Abstract

The present study stresses that the softwood and the hardwood have different properties and require the distinctive finishing application. In this study, two finishes Polyurethane (PU) and Shellac have been used on two species, i.e., softwood Deodar and hardwood Teak. The study is based on the coat thickness of the finish. The samples were analysed after applying the finishing material on daily basis. The observations revealed no significant increase in coat thickness up to first three coats, after wards the thickness increases gradually. However, in polyurethane application, this phenomenon is not observed. In polyurethane, the thickness increase is observed to be gradual from the first coat.

Keywords: Polyurethane, Shellac, Softwood, Hardwood, Teak, Deodar, Coat thickness.

Introduction

Wood finishes enable in getting a good appearance and they protect surfaces, and also provide a clean surface of wood and its products^{1,2}. However, from a technical point of view, protection and durability of the finish are more important for wood use in outdoor and indoor conditions. When selecting a finish, one should consider appearance, protection, durability³ and clean ability and effect of bulk and surface properties of wood on application of finish and its performance.

There are two principal aspects that increase the necessity of application of finish on surface of wood – dimensional stability and aesthetics⁴. Wood needs to be sheltered from changes in atmospheric humidity, microorganisms, insects, dirt and surface wear, and from mechanical damage of its surface. Therefore, the functional aspect of finishing should take into account all these factors in the service life of a product and choose coatings appropriately^{5,6}. Aesthetics is another aspect of finishing. Wood in its naturally-occurring form and colour of ten needs to be decorated, tainted for a more appealing look. Sometimes a suitable finish may improve the surface look manifolds. Defects have to be covered for a better look, and inferior grade timbers can be correctly processed to look like superior grade timber. No coating is entirely moisture proof. As there is no way of completely keeping moisture out of wood that is exposed for prolonged periods of high RH. At this point, type of substrate on which the finish coat has been applied also affects the finish performance significantly. As wood is exposed to varying RH conditions, it absorbs or desorbs moisture depending on the RH. A coating that is effective at excluding moisture merely slows absorption or desorption of moisture.

Materials and methods

The broad scopes of this study was to analysis the effect of different finishes in the finishing of the wood surface on samples of Deodar and Teak. A total of 60 sample planks of Teak and Deodar were taken for the study with a dimension of 15 X 9 X 1 cm³ Deodar, 15 X 7 X 1.5 cm³ Teak. They were oven dried and treated in the humidity chamber. Sanding was done for all 10 samples each with sand papers of 60, 80, 100 and 120 grit size. 30 samples were made for each species. The dimension data for all the samples were recorded. All the samples were placed in the humidity chamber for conditioning at 35°C and 30% R.H. Water level was always maintained in the humidity chamber.

Out of the 30 samples of teak, 10 samples were coated with Polyurethane (PU), 10 samples were coated with Spirit Shellac, and 10 were kept as control; same was done for Deodar. The Polyurethane applied was prepared by diluting poly urethane with turpentine oil in the proportion of 10 ml of Turpentine oil for every 50 ml of Polyurethane.

The samples coated with Polyurethane 3 coats were applied by spray gun for even application of the coat and placed in sun for drying. Coat thickness was measured in samples after each coat. 10 samples of each species were coated with 6 coats of Spirit Shellac. The Spirit Shellac applied was prepared by mixing 60 g (grams) of Shellac in 1liter of Spirit and placing it in sun. Proper care has been taken so that shellac should not be applied when the weather is cloudy. Coat thickness was measured in samples after each coat. This was done to study the increasing coat thickness. After application of the finish, coat thickness was measured for all the samples. 10 samples of each species were

kept as control. The samples are then placed in the humidity chamber again at elevated humidity levels, i.e., at 35°C and 85% R.H. At this elevated humidity moisture has been taken by the coat applied. Then moisture uptake of the coat in hardwood and softwood has been calculated to compare the difference. Weights were taken for all the samples continuously for 3 days after placing the samples at elevated relative humidity and then taken at a gap of 3 days, 5 days, 7 days, and 15 days.

Results and discussion

PU (Polyurethane): Figure-1 shows the comparison of thicknesses of PU coatings on the samples of Teak and Deodar.

Table-1: Average coat thickness after each coat of polyurethane on the samples of Teak and Deodar.

No of coats	Teak (µm)	Deodar (µm)
1	25.45	36.00
2	31.80	54.25
3	38.85	76.50

Rajput et al.⁷ reported 60-70 µm thickness for bio-based PU coatings on wood panels. In the present study, the thickness of PU on the softwood (Deodar) is 76 µm against 39 µm on teakwood (after 3rd coat).

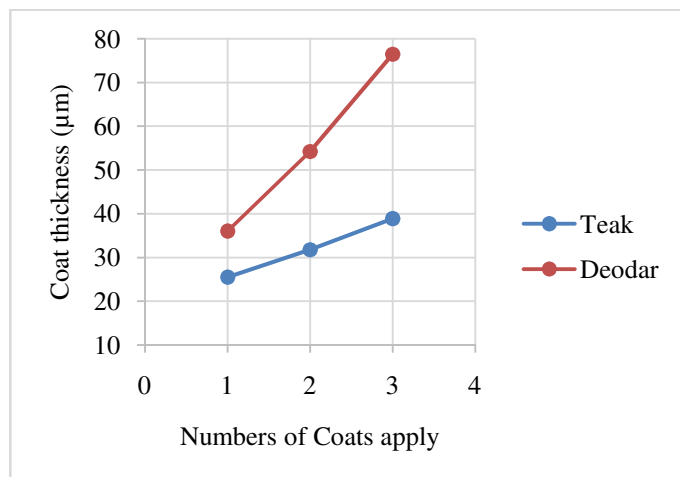


Figure-1: Average coat thickness of PU finish after each coat on the samples of Teak and Deodar.

Shellac: Figure-2 shows the comparison of thicknesses of shellac coatings on the samples of Teak and Deodar.

In case of polyurethane as a coating, when the two species are compared, it is observed that the coat thickness gradually increases in both the species as the number of coats increases, shown in Figure-1. This increase is greater in Deodar as compared to Teak. Similar results are observed in case of shellac as a coating from Figure-2.

Table-2: Average coat thickness after each coat of shellac on the samples of Teak and Deodar.

No of Coats	Teak (µm)	Deodar (µm)
2	10.9	20.45
3	15.95	25.55
4	20.4	31.45
5	25.25	40.4
6	31.25	53.75

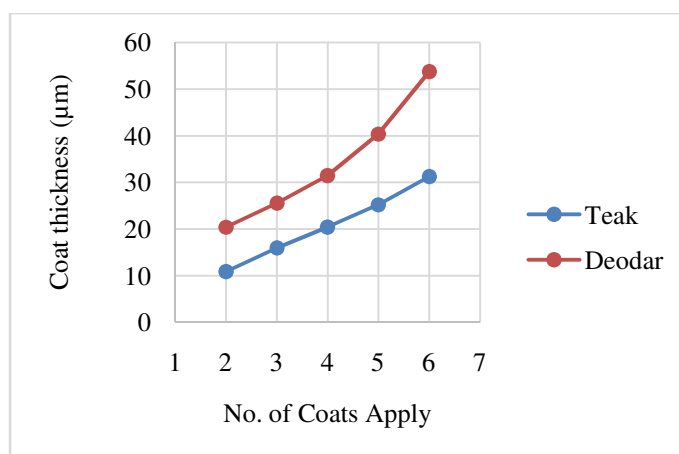


Figure-2: Average coat thickness of Shellac finish after each coat on the samples of Teak and Deodar.

Now in case of Teak and Deodar, PU has shown higher thickness in comparison to shellac sustaining varying nature of coating. Besides this, deodar has shown a tremendous increase in coating thickness, which cannot be attributed through coating and is rather suggestive of the surface phenomenon of a hardwood and a softwood.

It is evident that after planning hard teak surface does not contain raised grain, which is always present in softwoods. This is due to the variability of earlywood (springwood) and latewood fibers.

It is visually evident that in case of teak samples, the thickness is almost similar in both the coatings. In case of Deodar, it is seen that there is a considerable difference on average thickness of coating. Interestingly, the three coats of PU give a much thicker coat on Deodar compared to the six coats of shellac used.

Table 1 and 2 indicate that the coating thickness is always higher on Deodar (softwood). This observation can be attributed to the fact that Teak is a ring porous hardwood and Deodar is a non-porous softwood. Hence it is expected that any deposition in liquid or semi liquid form on the surface of the porous wood may percolate into the wood. Thus the higher thickness on the

softwood is not surprising. The average thickness obtained on chestnut and pine surfaces for two coats of an acrylic varnish containing polyurethane were about 55 μm and 66.5 μm which was attributed to the greater volume of voids in pine⁸.

Percent Change of coat thickness: PU: The percent changes in coat thickness of after each coat, average calculated percentage changes are shown in Figure-3 (Table-3).

Table-3: Percent changes in coat thickness after each coat of polyurethane on the samples of Teak and Deodar.

No of Coats	Teak (μm)	Deodar (μm)	%change
1	25.45	36	41.45
2	31.8	54.25	70.60
3	38.85	76.5	96.91

In case of polyurethane coating, in both the species the coat thickness is gradually increasing but the thickness is more in deodar samples as compared to teak samples. This can be

attributed to the presence of pores in the hardwood species and absence of the same in the softwood deodar samples⁸.

Shellac: When shellac is applied as a coat, it is observed that there is no or least increase in coat thickness upto the first three coats. Afterwards when more coats are applied it leads to gradual enhancement of coat thickness.

Table-4: Percent changes in coat thickness after each coat of shellac on the samples of Teak and Deodar.

No of Coats	Teak (μm)	Deodar (μm)	%change
2	11	20	87.61
3	16	26	60.19
4	20	31	54.17
5	25	40	60.00
6	31	54	72.00

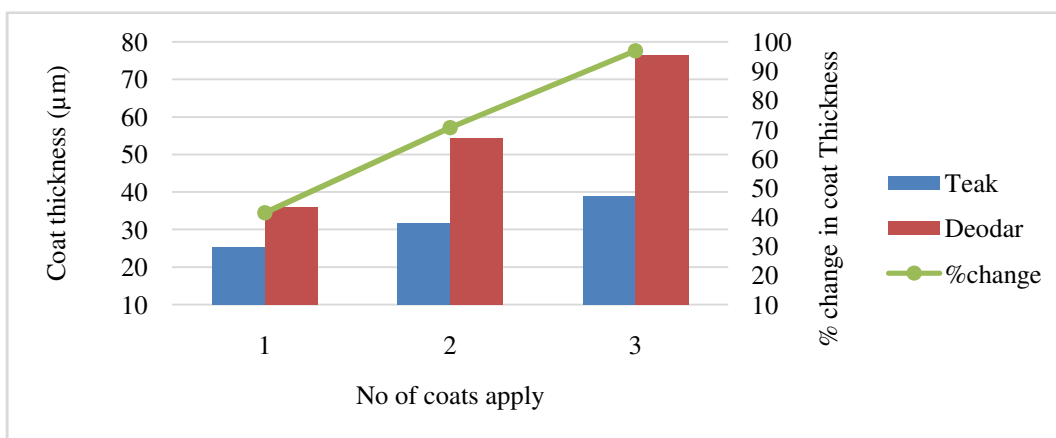


Figure-3: Percent change in coat thickness with each coating of PU finish.

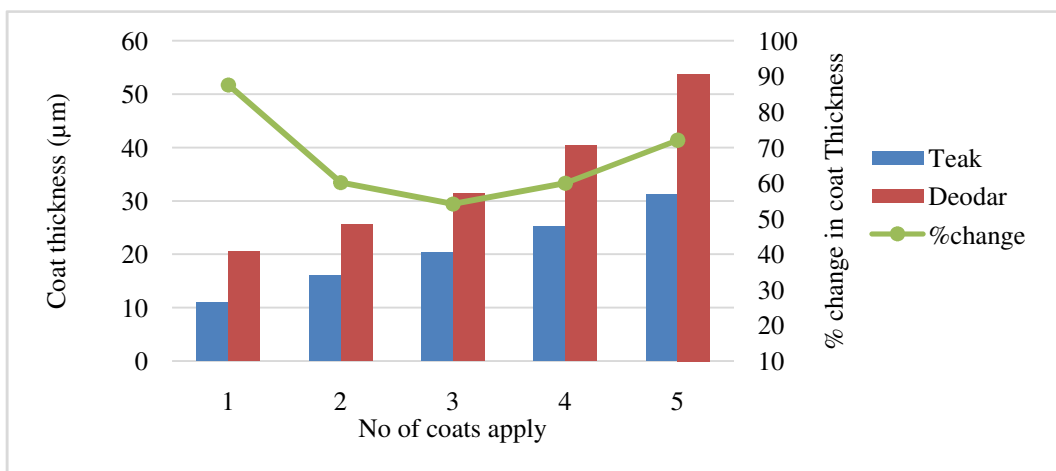


Figure-4: Percent change in coat thickness with each coating of Shellac finish.

Conclusion

In case of polyurethane as a coating, it is observed that the coat thickness is gradually increasing in both the species as the number of coats increases. This increase is greater in Deodar as compared to Teak. When shellac is used as a coating material, the coat thickness is gradually increasing in both the species as the number of coats increases.

When shellac is applied as a coating material, it is observed that there is no or least increase in coat thickness upto the first three coats. Afterwards when more coats are applied it leads to gradual enhancement of coat thickness.

In polyurethane coating, in both the species the coat thickness is gradually increasing but the thickness is more in deodar samples. This can be attributed to the presence of pores in the hardwood species and absence of the same in the softwood deodar samples.

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