

DEFECTS IN WOOD FINISHING

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INTRODUCTION

Wood is commonly used in many areas either for indoor or outdoor applications. The desired appearance and a cleanable surface of the wood are usually the most significant factors for indoor application, while for wood outdoors, protection from water, sunlight and weathering are generally most important (Sonmez et al. 2009; Feist and Abdullah 2016). Wood finishing embellishes or protects the wooden material by application of a protective layer to the wood surface.

The ability of a wood surface to receive and hold a coating is determined by the natural characteristics of the wood species and the manufacturing process used (Budacki et al. 2007). Ozdemir et al. (2015) mentioned that the wooden substrate, humidity, moisture content of wood, temperature, environmental pollutants and microorganism are the several factors that affect the performance of any finishing. According to Dilik et al. (2015), good finishing also depends on some parameters used during finishing such as finishing types, surface properties, the number of layers used as well as the layer thickness used. The process of wood finishing usually starts with sanding or planing as a surface preparation (Williams 1999).

Most finishing jobs can be completed without any problem resulting in a perfect finish. However, sometimes quality of finishing can be badly affected due to lack of competency of production personnel and lack of quality controls. Any flaw or defect on the finished product could not only degrade its surface quality, but also lower its value in terms of price. Although some circumstances are beyond the control of the product's manufacturer, the responsibility is to determine and classify those problems. The objective of this paper is to provide a guideline for users or manufacturers in determining and classifying the defects of the finished products.

Type of defects

Quality control is an important step to determine whether a product passes or fails. Detecting and classifying the defects are important to decide whether the product can be readily marketed or might need some repair by the production line. Finishes defects might reduce the aesthetic value of a product that makes it less attractive (Kamal et al. 2017). The common defects in wood finishing, as explained by Brendan and Trevor (2021) are shown below. All photos of the finishing defects were provided by the Wood Finishing Laboratory, Forest Research Institute Malaysia (FRIM).

1) Wood surface defect



Probable causes:

Untreated wood surface defects, such as holes and dents can leave uneven marks on the final finish. This wood defect could be caused by careless handling, objects falling on the wood or natural occurrence.

Prevention/Solution:

Careful wood selection and handling are essential. If unavoidable, patching the defects with wood fillers and then sanding using sandpaper is necessary. Sequential sandpaper grit that can be used are P80 - P120 - P180 - P220 before finishing. Deeper holes or dents may require planing.

2) Orange peel



Probable causes:

Orange peel resembling the skin of orange might occur due to low quality or wrong type of thinner used, high lacquer viscosity, insufficient air pressure during spraying or spraying too close to the surface. These factors might cause poor atomization of the paint.

Prevention/Solution:

The lacquer must be diluted using the right type and amount of thinner to get the correct viscosity. Polyurethane lacquers should be diluted with polyurethane thinner, similarly to acid catalyst or nitrocellulose type lacquers. When using a spray gun, an appropriate spraying distance between the spray nozzle and the material surface is crucial. A high volume low air pressure (HVLP) spray gun typically needs to be held 15–20 cm from the product's surface.

3) Blooming/blushing



Probable causes:

Blooming or blushing is a whitish substance, bluish or milky haze appearance on the dried paint surface. It often occurs with polyester and nitrocellulose paints that dry quickly and are rarely observed in acid-catalyst paints. Blooming is caused by water-soluble substances, dissolved in water trapped inside the paint layers, migrating to the topcoat surface and then evaporates, leaving behind a hazy look. Blushing occurs inside the paint layer due to water condensation during the curing process.

Prevention/Solution:

Water in both of these types of defects might originate from the surrounding as well as from inside the wood. Therefore, the dryness of the wood must be sufficient (12%–18% MC) and avoid painting in high humidity conditions such as during rain or early in the morning. The preferred time is when the surrounding temperature is above 28°C. Blushing can also be prevented by adding a slow-drying thinner, also known as a retarder. A retarder provides adequate time for the moisture to escape before the paint dries.

4) Dribble



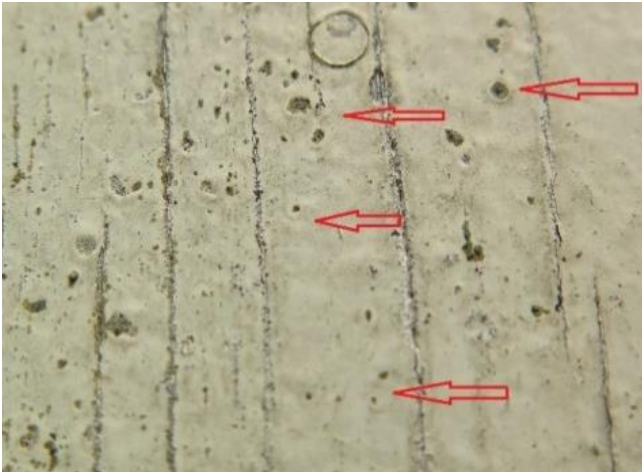
Probable causes:

Dribble happens because the paint or lacquer used is too viscous or too thick. When using a spray gun, the left and right movements of the spray that are too slow or too close to the surface causing the paint to thicken and accumulate. When using a brush or sponge, a large quantity of finish from the brush or sponge is not uniformly applied on the surface, leaving this mark once the paint dries.

Prevention/Solution:

Finishes should be diluted with a solvent adequately or as prescribed by the manufacturer so that it is not too viscous or too thick. Carefully apply the paint on the surface for a uniform result. If using a spray gun, makes sure the final viscosity is correct, the air pressure is enough and the spray nozzle is not too close to the surface. Make sure the previous layer has dried before the subsequent layer is applied.

5) Pinholes



Probable causes:

Pinholes occur most frequently in relatively larger pored woods such as rubberwood, oak and mahogany. It happens when air is trapped in the pores of the wood surface while being sprayed and turns into pin-pricked size holes after the finish dries. Wood or ambient temperature that is too high might cause the air inside the wood to escape and be trapped just under the finish layer. High temperature also causes the solvent to dry too quickly and leaving behind a boiling-like effect.

Prevention/Solution:

The use of pore filler for wood with a large pore size is encouraged. Applications can be made parallel to the grain, then perpendicular to the grain, and let it dries before the topcoat is applied. If lacquer is to be used, vinyl sealer or shellac is suitable as they do not re-dissolve easily when the subsequent layer of lacquer is applied. Avoid spraying when the wood or ambient temperature is too high. If using an infra-red lamp for drying make sure the heat is moderate.

6) Wrinkling



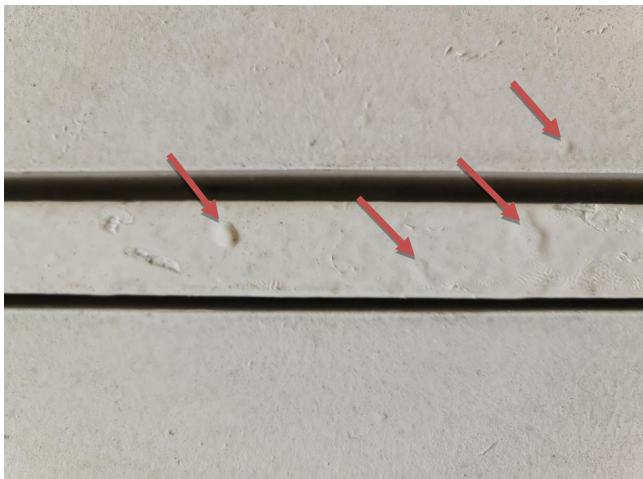
Probable causes:

Wrinkling usually happens in thick layer finish. Topcoat that is applied without allowing the primer to dry sufficiently might cause this problem. The dried topcoat then shrinks giving the effect of wrinkling. It can also occur when the exposed surface of the finish dries quicker than the underlying coat.

Prevention/Solution:

Finishing should be made layer by layer and not with a single thick application to avoid wrinkling. Make sure any previous layer of primer or finish has sufficiently dry before applying subsequent layer.

7) Blisters



Probable causes:

Blisters cause the bonding between the finish layer and the affected wood surface become loose. Trapped moisture, temperature changes or combination of both might be the main reasons. It also indicates that the wood or filler used, if any, was excessively wet prior to painting or spraying.

Prevention/Solution:

Thoroughly dry the wood before painting or spraying finishes. An acceptable moisture content (MC) is between 12%–18%. Avoid painting or spraying work during raining, especially for outdoor applications. Exposing wet paint to high humidity environment or water should also be avoided.

8) Patches of liquid



Probable causes:

Patches of liquid is caused when wet finish is exposed to water. The source of water might come from rainwater, leaked water pipe or comes from water curtain in a spray booth.

Prevention/Solution:

This problem can be prevented by covering the newly painted surface from any water drop or splash. Make sure the spray booth works well so that water does not splash up on the wet finish.

9) Chalking



Probable causes:

Chalking is caused by weathering of finish due to excessive exposure to moisture and UV rays. The “chalk” results from the deteriorated pigments and binders. Low-quality finish may also be the cause. Some chalking is desirable because it allows the finish to self-clean. However, if it is too severe, repainting is needed.

Prevention/Solution:

Use high quality certified finishes for a longer durability. This is most important when it involves outdoor applications where deterioration agents such as UV rays and moisture cannot be avoided.

10) Yellowing



Probable causes:

Yellowing is yellowish patches that normally occurs in oil type paint. It happens when the finish is exposed to sunlight and rain for a long time. Also, it might be caused by ammonia and sulfur compounds in the surroundings.

Prevention/Solution:

Use weatherproof paint and avoid using cleaning agent that contains ammonia and sulfur during cleaning.

11) Color fading



Probable causes:

Color fading happens due to finished surface being exposed to excessive sunlight, or the substrate contains active chemicals, or the surface was cleansed using strong chemical agents.

Prevention/Solution:

For external use, make sure the finish used is formulated for outdoor application. If doing some cleaning, do not use strong chemical cleaners.

12) Cracking



Probable causes:

Paint cracking can happen when poor quality finish is used, i.e., finishes with low adhesive content or poor film forming materials. Excessive use of hardener makes the finish layer becomes brittle and loses its flexibility. Oily wood surface, sanding until the surface becomes too smooth, and unsuitable wood filler can also cause adhesion failure, and they in turn cause cracking.

Prevention/Solution

Use quality certified finishes by choosing an established brand. Follow the manufacturer's recommendations and guidelines for a correct mix. Make sure the wood surface is free of elements that might cause adhesion failures. Do not sand wood surfaces to be too smooth, such as using P1000 grit sandpaper prior to paint spraying.

13) Peeling/Flaking**Probable causes:**

Peeling occurs due to adhesion failure between the wood surface and the finishing. This failure is caused-by moisture, dimensional changes and aging of the wood. Some oily woods such as keruing make this problem more likely to occur.

Prevention/Solution:

Make sure the wood surface is clean of oil, wax or moisture. Use the right primer for a good bonding, and finish with a good quality topcoat. Wood products should be finished as soon as they are installed. In the production of wood products, if possible, the bark-side of the wood, should be facing outwards.

CONCLUSIONS

These are guidelines that any manufacturer should follow in order to categorize and rectify defects. Finishes defects and their severity should be determined and overcome by implementing an effective quality control program. This should include selecting quality control methods and defects inspection. According to Hong (2016), providing training and experience to the workers can ensure a good quality of the products. It is essential to identify the root cause of the defect, and undertake rectification procedure to ensure that the products are defect-free and of high quality.

REFERENCES

- BUDAKCI M, GURLEYEN L, CINAR H & KORKUT S. 2007. Effect of wood finishing and planing on surface smoothness of finished wood. *Journal of Applied Sciences* 7(16): 2300-06.
- BRENDON F & TREVOR P. 2021. Coating Failure Defects. <https://www.ppcoatings.co.uk/wp-content/uploads/2016/06/Coating-Failure-Defects.pdf>. Accessed 2021 August 5.
- DILIK T, ERDINLER S, HAZIR E, KOÇ H & HIZIROGLU S. 2015. Adhesion strength of wood based composites coated with cellulosic and polyurethane paints. *Advances in Materials Science and Engineering* 2015(1): 1–5.
- FEIST WC & ABDULLAH AA. 2016. Wood: Finishes and Coatings. Reference Module in Materials Science and Materials Engineering. doi:10.1016/B978-0-12-803581-8.01980-9.
- HONG CH. 2016. Investigation of Defects in New Buildings in Malaysia. [Bachelor Degree of Science]. Kuala Lumpur: Universiti Tunku Abdul Rahman. 94 p.
- KAMAL K, QAYYUM R, MATHAVAN S & ZAFAR T. 2017. Wood defects classification using laws texture energy measures and supervised learning approach. *Advanced Engineering Informatics* 34: 125–35.
- OZDEMIR T, TEMIZ A & AYDIN I. 2015. Effect of wood preservatives on surface properties of coated wood. *Advances in Materials Science and Engineering* 2015: 1–6.
- SONMEZ A, BUDAKCI M & BAYRAM M. 2009. Effect of wood moisture content on adhesion of varnish coatings. *Scientific Research and Essays* 4(12): 1432–37.
- WILLIAMS RS. 1999. Finishing of wood. *Wood handbook: wood as an engineering material*. Madison, WI: USDA Forest Service, Forest Products Laboratory. p. 15.1–37.

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Defects in wood finishing can degrade its surface quality and also lower its value, and consequently its selling price. This paper describes the defects in wood finishing and addresses the probable causes and solutions to overcome them. The guidelines in determining the defects are described to decide whether the finished products can be readily marketed or might need some repairs. The common defects in wood finishing include wood surface defects, orange peel, blooming and, etc. The condition of the wood prior to finishing, the process of the finishing and environmental effects may be the probable causes of the defects. The prevention and solution based on the probable causes are suggested to overcome the defects. It is essential to identify the causes of the defect and undertake a rectification procedure to ensure that the products are defect-free.

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