

SURFACE QUALITY OF SOME MALAYSIAN SPECIES AGAINST NATURAL WEATHERING

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ABSTRACT

Outdoor exposure performance of timber plays an important role in determining the life expectancy of structures. During the natural weathering process, timber being exposed to the outdoor would undergo both of the photo-degradation and photo-oxidation degradation. This paper discusses the behaviour of some Malaysian hardwood species after outdoor exposure for a certain period of time. Changes to the timber surface are shown, and it may be used as a guide for future finishing and maintenance work.

INTRODUCTION

Research on timber are sustaining with endless improvements in technology such that many new and improved products are being introduced to the market. These technologies are developed from progressive research efforts in meeting perpetual market demands. The natural beauty of timber that exhibits unique aesthetic values as well as the current trend in utilizing green material due to increasing environmental awareness have caused the demand to increase even more.

Timber is still favored for interior or outdoor applications. Products such as gazebo, decking, building materials and garden furniture are often exposed directly to the rigor of weather. Weather refers to the state of the atmosphere with respect to wind, temperature, cloudiness, moisture and pressure (NOAA National Weather Service 2009). Since timber is a hygroscopic material, it is important to protect its surface when exposed to weather.

This paper highlights the effect of weathering on the surface quality of some Malaysian hardwood species namely keranji, balau, keruing, dark and light red meranti. It shall explain the results obtained for timber samples exposed at FRIM weathering site on pre-weathering and finishing performance. The study also evaluates the properties after exposure of several months or years to the weather.

Preweathering of timber

Preweathered timber refers to timbers that have been exposed to weather before finishes is applied on the surface. When timber is being exposed to weather, chemical and physical changes can occur on its surface and cause weakening of the coating-wood interface (Arnold et al. 1992). The phenomena of photo-chemical degradation are initially manifested by colour changes, followed by loosening of timber fibers, and gradually eroding the timber surface (Williams & Feist 1999). The major elements causing physical and chemical degradation include the combined effects from ultraviolet light, relative humidity, heat, environment pollutants and certain micro-organisms.

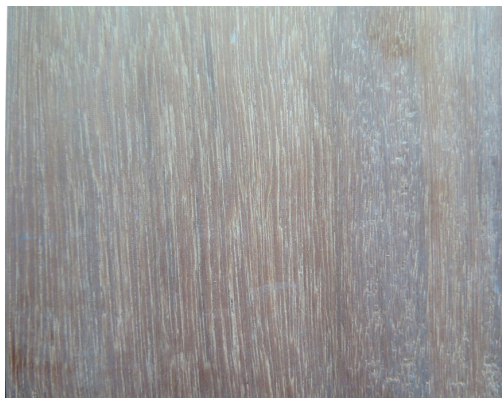
The service lives of a wide range of finishing products on different substrates were reported to decrease due to short term preweathering of timber substrate prior to finishing (Williams &

Feist 1994). Timbers that have been preweathered for several months will negatively affect the adhesion and service life of finishing (Feist 1988). The duration for preweathering of timber under tropical climate should be limited so as to avoid severe checks and cracks that could cause undesirable penetration of liquid (Anwar et al. 2005). The ability of timber surface to hold any paint is related to natural factors such as anatomical structures, timber species and the exposure conditions. According to Hiziroglu et al. (2008), timber without finishes would crack and fade within 4 weeks under direct exposure to the Malaysian weather. The color of timber after being exposed for several months would eventually change to greyish tone (Figure 1).

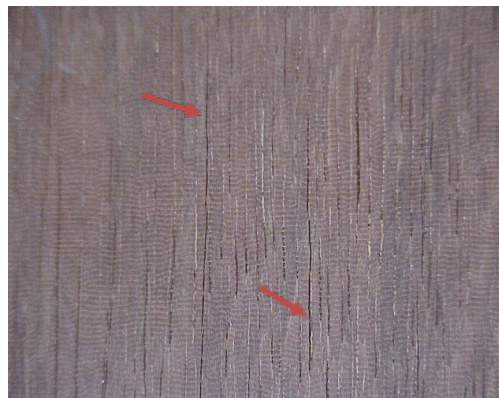


Figure 1 Colour changes for keruing after 16 weeks of exposure to natural weathering

The surface of timber would start to crack after about 1 week exposure to weather. Figure 2 and 3 show the effect of preweathering for keranji and balau. By extending the exposure duration of the unfinished timber under outdoor condition can lead to cracks. The size of the cracks would also gradually increase with time.



Control surface - Week 0



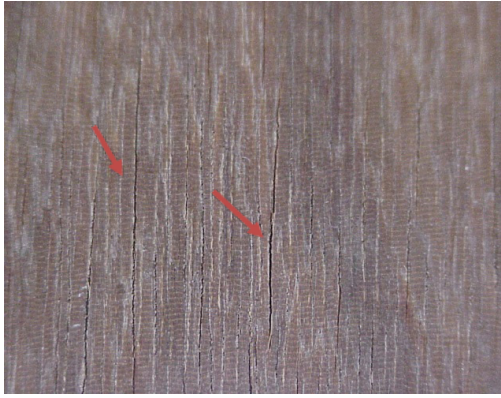
Week 1



Week 2



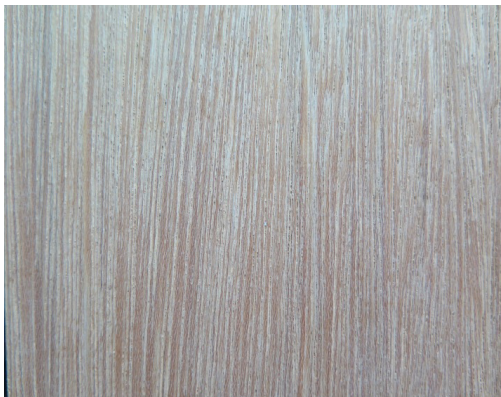
Week 3



Week 4

Figure 2 Effect of preweathering on unfinished keranji

Note: Arrows show cracks on timber surface



Control surface



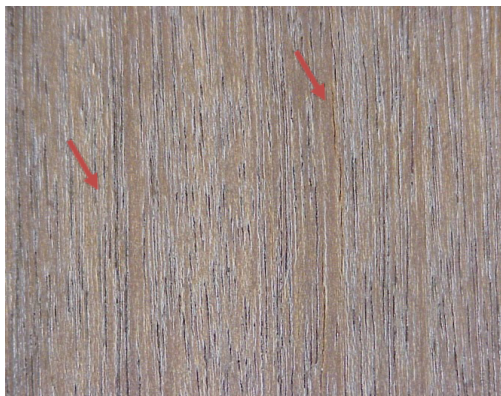
Week 1



Week 2



Week 3



Week 4

Figure 3 Effect of preweathering on unfinished balau

Note: Arrows show cracks on timber surface

In general, the bigger the crack, the more finishes would be required to cover the surface. The effect of preweathering such as cracks can be seen clearly when the timber surface are coated (Figure 4 and 5). Defects from preweathering will increase the usage of coatings required during application because the coatings could penetrate into the cracked surface before it can be distributed evenly on the full surface. This will ultimately increase the cost of finishing.

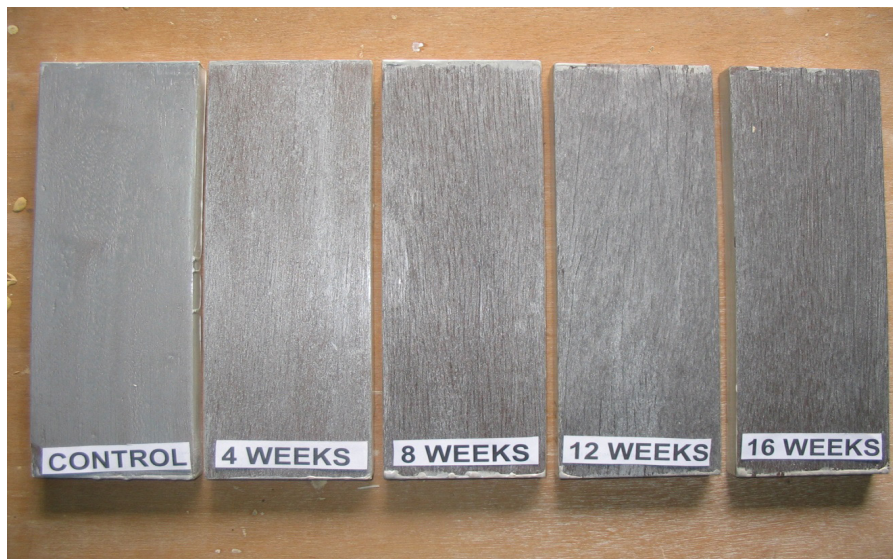


Figure 4 Primer coat applied on keruing timber surface



Figure 5 Undercoat applied on keruing timber surface

Timber and its finishes

Timber finishes are susceptible to degradation when exposed outdoors as a consequence to various weathering conditions, mainly by light, heat, water and oxygen. The selection of an exterior timber finish would depend on the extension of protection required. Application of finishes on timber is important for its durability and good performance (William et al. 1996). Timber finishing for exterior applications can be divided into two general categories: 1) opaque coating, such as paints and solid-color stain, and 2) natural finishes, such as water repellents, water repellent preservatives, oils, and semi-transparent penetrating stains (Cassens & Feist 1991). Finishes can be applied by brushing, roller, spray or dipping method. For optimum performance, the application guidelines recommended by the product manufacturer should be followed.

Degradation of timber caused by weathering can be controlled by following the good practices in selection and application of exterior timber finishing. Among the good practices include application of one (1) layer of coating so that the degradation caused by ultraviolet light, relative humidity, heat, environmental pollutants and fungus during assembly can be reduced. After installation, another 2–3 layers of coatings should be applied to prolong the service life of timber. Cassen and Feist (1991) suggested timber surface should be painted within 2 weeks after installation if weather permits.

FRIM has allocated two sites to carry out the weathering performance of finishes for research. The types of weathering sites available are i) the open space ii) under the tropical forest canopy. For the open space site, the effect from weathering will be the main factor for evaluation on the quality of samples. As for the site under the tropical forest environment, the resistance of the sample against fungal infestation and damages from relative humidity are the two main parameters for assessment.

A study on the effect of weathering for some of Malaysian timber species has taken place, and it is still in progress. The unfinished and finished timber samples are being exposed at the open space site. The surface quality of the samples such as the surface roughness and the coating properties are determined and monitored periodically for up to 5 years. The effect of weathering on timber samples is evaluated every six month. Figure 6 shows the uncoated and coated timber samples exposed at the FRIM weathering site.



Figure 6 Uncoated and coated timber samples are being exposed at FRIM weathering site

Figure 7 shows the effect of weathering for unfinished and finished timber samples (from left to right: balau, light red meranti, dark red meranti, keranji and keruing). The colour of unfinished timber samples completely changed to grey after 6 months of outdoor exposure. For the finished samples, the colour faded and the intensity of colour varied according to the type of finishes applied. After one year of outdoor exposure, finish type B began to peel off and this caused rainwater and dew to penetrate into the timber. At the same time, the timber surface tended to crack more than finish type A. The development of various defects like peeling, cracking, flaking and loss of adhesion would depend mainly on the formulation of the finishes (Vink et al. 1995, Forsthuber et al. 2013). It is recommended that refinishing of wooden materials should be conducted every 1 to 2 years for outdoor exposure to ensure the quality of their surface is always maintained.

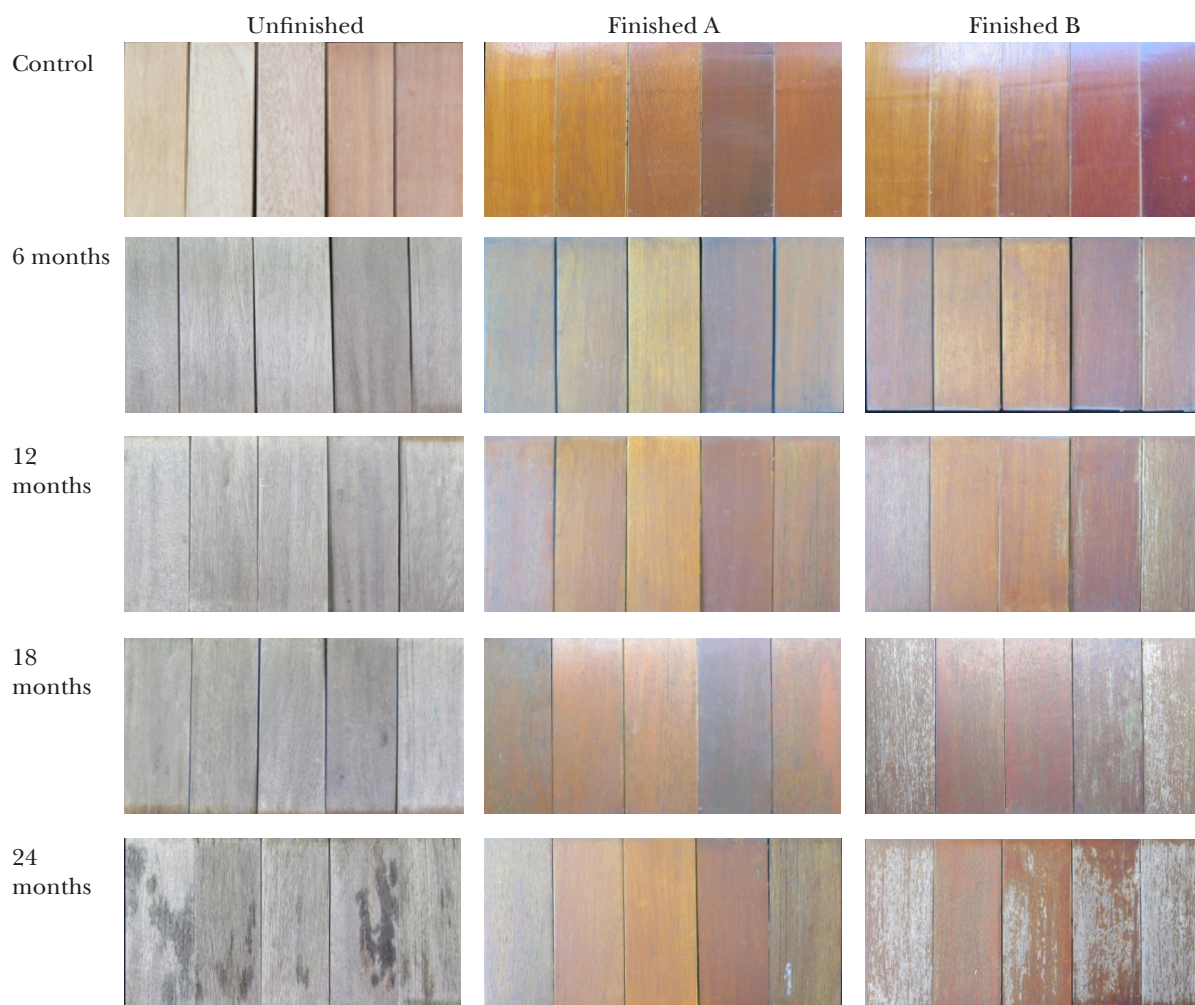


Figure 7 The effect of weathering for unfinished and finished timber samples
(Left to right: balau, light red meranti, dark red meranti, keranji and keruing)

CONCLUSION

The general perception on the finishing of timber often is that it is only meant for aesthetic purpose without realizing that the main function is for protection against weathering. The surface quality of timber can influent the coating performance and its service life. Preweathering of timber, even for a short duration, can reduce the surface quality. As such selecting and choosing the correct finishing is important. This will ensure the service life of timber to be extended with minimal maintenance.

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