



STAINING OF FINISHES FROM WATER-SOLUBLE WOOD EXTRACTIVES

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Introduction

Many wood species, such as redwood, western red cedar and Douglas-fir, contain natural chemical compounds known as extractives. These extractives have no significant effect on strength properties of the wood or on gluelines of plywood. Some extractives are colored in various shades of yellow, red and brown. Others are colorless. Among other properties, extractives help instill the natural color and beauty of wood.

The concentration of extractives may vary greatly between species, between trees and within a tree. For instance, the wood just inside the inner bark of a tree (sapwood) will normally contain few or no extractives while the extractive content of the inner part of a tree (heartwood) can be very high. Since the face veneers may come from different areas of a tree, it is not unusual for plywood to have considerable variation in extractive content.

Finish Discoloration

Extractives are soluble in various solvents such as water, alcohol and benzene. When a wood substrate containing water-soluble extractives is exposed to sufficient moisture, the extractives may

dissolve and migrate to the surface of the wood. This phenomenon can lead to discoloration (i.e., extractive staining) of finishes, especially light-colored finishes.

The moisture required to dissolve extractives may develop from the application of water-thinned finishes in conjunction with other sources of moisture already present in the environment or the wood. In this case, the discoloration may develop during or soon after application of the finish.

Extractive staining may also develop months after the finish is applied. For example, if water-soluble extractives are present in sufficient quantity but not enough moisture was present at the time of finishing to dissolve them, the extractives may still be dissolved by subsequent moisture from heavy dew, rain, or condensation. The moisture can wet and penetrate permeable latex or oil-based finishes. It then dissolves the extractives and allows them to leach out through the finish.

The intensity of extractive staining is frequently associated with the color of the wood. Darker colored woods often stain more heavily than lighter colored woods. However, its occurrence is difficult to predict. It may occur on one panel but not on another. Or it may even occur only on certain portions of a panel face.

Removal of Extractives from Discolored Surfaces

A good test to determine if extractives can be removed from a finished surface is to scrub the finish with a mild detergent solution using a soft bristle brush. Then rinse thoroughly with clean water. If this approach is effective, all discolored surfaces may be cleaned in a similar manner.

In some instances, the extractives will wash away during weathering and virtually disappear. This is normally the case if the staining is not heavy and it occurs during the beginning of the rainy season. When staining occurs at the end of the rainy season or during the summer, ultraviolet light and air may chemically alter the extractives so that they are no longer water-soluble. If this occurs, re-finishing may be necessary.

Finishing Recommendations

Whether the wood surface is new or has been previously finished, liberal application of a paintable water repellent to all exposed edges and ends prior to priming and/or topcoating will help to minimize the ingress of moisture into the wood.

New Wood

Extractive staining is most frequently associated with light-colored one-coat finishes. Discoloration of finishes from

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extractives is not as apparent when earth-tones or dark colors are used. The extractives may still migrate to the surface of the finish, but they are not as noticeable because they blend in with the finish color. Finishing with these colors is generally the simplest solution to avoid discoloration from extractives.

The best method for retarding extractive staining is to use a primer formulated to prevent the extractives from reaching the surface of the finish coat. One way of accomplishing this is to use a primer which forms a physical barrier (film) that blocks the migration of the extractives. High quality latex or oil-based primers may be so formulated. Another method is to use a stain-blocking latex primer that is formulated to chemically react with the extractives. This type of primer is often discolored by the water soluble extractives. However, if the primer is effective, the extractives should not discolor the topcoat.

To test the effectiveness of a primer in preventing extractive staining, select a small area of the primed surface that is most heavily discolored by extractives. Make sure that the primer is dry. Apply the topcoat to this area and allow it to dry. If discoloration of the topcoat

occurs, another prime coat may be required. If no discoloration of the test area is observed, proceed with application of the topcoat over the previously primed surface.

Previously Finished Wood

As discussed earlier, extractive staining may occur soon after application of a finish, or months later. If discoloration from extractives occurs over a previously finished surface, the solutions are similar to the procedures outlined under *New Wood*.

If using a darker color or earth-tone is satisfactory, select a small test area that is the most heavily discolored and apply the finish. If the appearance is satisfactory, proceed with application of the new finish.

If a lighter color is preferred, apply a stain-blocking primer to the test area. Then proceed according to the procedures outlined under *New Wood*.

Summary

For best overall protection, durability and general finish performance on plywood, one to two coats of acrylic latex primer formulated to prevent extractives from reaching the topcoat are recommended (consult finish manufacturer's recommendations). The topcoat should be compatible with the primer, preferably an all-acrylic latex formulation from the same manufacturer.

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