

## **Withering Windows** by Philip D. Haisley, Jr., AIA

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Wood windows offer a warm, elegant style and a handcrafted look that compliments our island living. Although the insulating value of wood is not required in Hawaii, the aesthetics and historical associations of painted or natural wood make it a popular choice for windows, particularly in residential construction.

You might expect your windows to be as durable as the other nonstructural elements of your home or office. They should be, if they are properly designed and manufactured, given the proper preservative treatment and protective coating, and properly installed and maintained.

In recent diagnostic work, far more extensive, rapid and serious decay than expected in relatively new wood windows was observed - enough to merit a note of caution to designers, builders and users of wood windows.

Manufacturers like Pella have produced high quality wood windows for many years, decades in fact, and have created an image of wood windows as a highly desirable prestigious product. Several new manufacturers have come into the wood window market in the recent years, introducing less expensive products. Unfortunately, extensive problems with the factory primed or factory finished exterior surfaces of some of these manufactured wood windows are beginning to show. Severe decay in windows has been observed within two years of installation, in spite of design specifications that comply with industry standards.

Of the known varieties of decay fungi, most of them live in Hawaii, and are eager to move in with you and your wood! To survive and grow, a decay fungus needs food, moisture, air and moderate temperatures. The cellulose in wood is just fine as food for the fungi, and the range of temperatures suited to fungi is about the same as it is for humans. For fungi to thrive, the moisture content of the wood must be above the fiber-saturation point, or about 28% to 30%. For wood to maintain that level of moisture, a water source is necessary as wood will reach an equilibrium moisture content below that required to sustain decay fungi even in humid conditions.

The industry standards for manufactured wood windows are published by the National Wood Window and Door Association (NWWDA). Recent observations suggest that some manufacturers may not always faithfully follow these standards. Even though they meet current design and industry standards, some of the preservative treatments in current use may not provide enough margin of error to take up the slack. There may soon be a new treatment standard from the American Wood Preservative Association (AWPA) which can be specified to help enforce compliance. This is the first time that AWPA is establishing a non-pressure treatment standard. The new standard should be similar to the NWWDA treatment standard, but will provide more detailed testing requirements for checking compliance. The new standard is still in draft form, but it may be published in AWPA's Book of Standards as early as August 1996.

Protection against decay begins with the choice of wood, and appropriate chemical treatments. Most manufacturers use Ponderosa Pine, Western Pine, or other fine grained white pine for their windows. Pine is almost entirely sapwood and, while it accepts treatment readily, it offers very little intrinsic decay resistance. Windows made from more decay resistant species like cypress, mahogany and teak are available, but at a substantially higher cost. If a species like pine is used, a good preservative treatment is imperative. The industry standards for preservative selection and treatment procedures, and the tests for preservative efficacy, water-repellency and penetrability are established in NWWDA Standard I.S.4-94.

NWWDA does not dictate the chemical formulation to be used by manufacturers, but it does keep a list of formulations that have been tested and approved. A recent study suggests that the approved chemicals and their application methods vary widely in effectiveness, and that more effective chemicals may be needed.

The study, directed by wood treating chemical manufacturer Chemical Specialties, Inc. (CSI) and presented this year at the International Research Group on Wood Preservation of Stockholm, Sweden, compares the effectiveness of five active ingredients on wood L-joint samples exposed to five years of weathering near London and Hilo. (Interestingly, among the other observations of the study, it was found that exposure to the elements for one year in Hilo produced decay equivalent to that of five years at the Wisconsin or London test sites.) Two of the preservatives tested are used in formulations approved by NWWDA for use on windows: TBTO (tributyltin oxide) and IPBC (iodo-propynyl carbamate). Penta (pentachlorophenol), and two new chemicals developed by CSI (RH-893 and RH-287) were also tested.

The most widely used of the NWWDA-approved formulations are based on the compound IPBC, marketed under the name "Polyphase". IPBC has been in common use since the late 1980's when the Environmental Protection Agency imposed strict limitations on the use of Penta, which until then, was by far the most widely used preservative for millwork. Though Penta is no longer used, CSI included it in its tested formulations as a standard for comparison.

IPBC proved far less effective than Penta in the CSI tests. However, most wood window manufacturers use IPBC based treatments and do not offer alternative treatments. The formulation which emerged from the test data as being clearly superior was a one percent solution of RH-287, an isothiazolin formulation that is not registered for use in the United States. While the manufacturer is not pushing for registration of RH-287, there are other promising chemicals being registered, such as tribuconizol, which may offer an improvement over IPBC.

In the CSI Hilo tests, 97.4% of the samples dip treated with a 1% solution of RH-287 were found to be sound after five years, while only 17.5% of the samples dip treated with a 1% IPBC solution were still sound. While the 1% solution of IPBC proved less than satisfactory in the field tests, 0.50% and 0.75% concentrations of IPBC are NWWDA approved. The lower concentrations were even less effective in the test.

A second NWWDA-approved chemical commonly used for treating wood windows is TBTO (tributyltin oxide). TBTO has been found to break down after prolonged exposure to the acids in wood! TBTO should be avoided if a preservative with a long lasting effect is desired.

The CSI study also compared the standard three minute dip treatment with a double vacuum treatment. While both treatment methods are approved by the NWWDA and considered by NWWDA to be comparable, the study suggests that the vacuum treatment is far more effective, producing three times the preservative retention. However, very few window manufacturers use the vacuum treatment method.

Termites are also a concern with regard to wood windows. Windows are on the surface of the structure, where they would be among the first wood surfaces encountered by swarming termites. The light from the windows attracts the swarmers, increasing the number of potential breeding termites in contact with the wood. The cracks between adjacent frame members and between the stops and the glass are just the sort of "crannies" that termites like and need as a place to start their colonies. Moist, partially decayed wood, if it is available, is the ideal environment for starting their families.

Most manufacturers include chlorpyrifos (Dursban) in their preservative formulations to keep out the bugs. IPBC plus chlorpyrifos is Tribucide 2, a clear preservative formulated and used by

Honolulu Wood Treating Company primarily to treat trim and millwork. Tribucide 2 is normally used as a pressure treating chemical, which will result in far higher retentions than the minimums accepted by NWWDA.

While the preservative treatment of the wood has a profound effect on the durability of the wood, the method of manufacture also plays a significant role. Proper shapes, joints, adhesives and fasteners can improve watertightness. Window frames with horizontal butt joints are far more likely to experience decay than those with vertical butt joints or mitered joints. Many manufacturers offer aluminum or vinyl exterior cladding, which lets the wood show on the inside while offering improved protection to the exterior. The extruded aluminum cladding will be more durable than the sheet metal clad type.

The best manufacturers glue wood joints, or set them in sealant to keep moisture away from vulnerable end grain. Keeping the water out of the glazing pocket is also important; placing a bead of silicone sealant against the wood on both sides of the glass, or wrapping the glass edge with butyl tape will minimize the amount of water that gets into the wood joints.

Windows should be protected from the elements until they are installed and painted. Be sure painters don't leave unfinished edges (especially top and bottom edges). Proper flashing and building felts between the window and the exterior wall will create and maintain watertight conditions around the window. Never allow direct contact of bare wood with concrete, plaster, or exterior finish systems. Slope horizontal surfaces to direct water away from the wood. Lastly, deep overhangs over windows can help keep the water away from the windows, prolong the life of finishes, and minimize moisture related problems.

Wood of all types requires maintenance, particularly here in Hawaii with its high ultra-violet radiation, salt air and frequent rains. Maintain wood windows with regular painting - at least every five years, and use a paint which forms a good film such as an enamel or a varnish. Ensure that the paint laps onto glass, providing a seal between the glass and the wood.

NWWDA publishes a two page flyer on the "Care and Finishing of Wood Windows" which can be provided to every new home owner.

Though there was little cause for concern in the past, we may need to become more picky and inquisitive to steer around the window decay problems that are beginning to crop up. It will be difficult to change the treatment procedures that are used, but we can press the window manufacturers to use the best available chemicals in their treatments, the most effective procedures for their applications and for increased testing and rapid approval of more effective chemicals when they become available.

We might try to use windows that treated by the double-vacuum method. We can ask window manufacturers if they are Hallmark Certified by NWWDA, meaning they are inspected and policed by the association and look for a manufacturer with a local presence, or a responsive service and technical staff that will come to the jobsite to help resolve problems. We can examine details and the specifications, and select higher quality products. We can advise our clients that a slightly higher cost will be more than justified by improved long term performance. We can advise the "other" window manufacturers that we didn't select their products because of these concerns. And we can provide wide overhangs to keep the rain away, when they can be integrated with the design intent.

Notes on Chemicals:

**NWWDA APPROVED FORMULATIONS**

(active ingredients in proprietary formulations which qualify for NWWDA Hallmark Certification Program)

**Bis (Tri-N-Butyltin) Oxide (TBTO)**  
**3-Iodo-2-Propynyl Butyl Carbamate (IPBC)**  
**Copper-8-Quinolinolate**  
**2-(Thiocyanomethylthio) Benzothiazole (TCMTB)**

**CSI TEST FORMULATIONS**

**n-octyl isothiazolin-3-one (RH893)**

proprietary chemical developed by CSI

**4,5-dichloro-n-octyl isothiazolin-3-one (RH287)**

proprietary chemical developed by CSI

Far outperformed the other preservative treatments tested by CSI

Manufacturer has not registered it for use in US, and has no plans to.

**pentachlorophenol (PCP)**

The standard wood preservative treatment from 1938 to mid 80's. EPA restrictions limited use, imposing stricter precautions after learning it is a dermal sensitizer, causing burns. Use outlawed in Canada after 1989.

**iodo-propynyl-butyl carbamate (IPBC)**

Iodine base fungicide, started as a mildewcide for paint. "Troysan Polyphase" developed by Troy Chemical Corp. Tested and incorporated by Kop-Coat (Koppers Co.) in Timbertreat, Woodtreat and NP-1 products. Still standard millwork preservative treatment.

**tributyltin oxide (TBTO)**

Breaks down after prolonged contact with acids which naturally occur in wood. Most manufacturers will no longer make TBTO.

**triazole**

may be registered soon for use in USA

supposed to be better than IPBC (per Alan Poreston at CSI)

**chlorpyrifos**

should be added to formulation for termite resistance