The Distribution of DCOIT and a Fluorescent Tracer Dye in Southern Yellow Pine.

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Viance LLC is a joint venture between The Dow Chemical Company and Rockwood Holdings, Inc. focused on the wood protection industry. One of Viance's technologies, Ecolife™, uses a non-metallic preservative and stabilizer system based on 4,5-dichloro-2-octyl-4-isothazolin-3-one (DCOIT). The current method of assessing the penetration and distribution of DCOIT in wood is to use an AWPA (American Wood Protection Association) standardized fluorescent dye marker system. This study was undertaken to address questions that have been raised in the industry about this method.

The three objectives of this study were to make a qualitative assessment of the distribution and penetration of DCOIT relative to a fluorescent dye used as a proxy for DCOIT in pressure-treated wood, to determine the penetration of DCOIT relative to a Cu marker and to determine the penetration and distribution of DCOIT and dye on the sub-mm scale.

The distribution of DCOIT was evaluated using a Hitachi 3400 variable-pressure scanning electron microscope (SEM) equipped with a Thermo Scientific Noran System 6 energy-dispersive x-ray spectroscopy (EDS) system. Macro-scale fluorescence imaging of the marker dye was done with a Nikon D300 DSLR mounted on a copystand and two 6 W, 365 nm UV lamps. Micro-scale fluorescence imaging was done with an Olympus SZX12 stereoscope and a Nikon TE300 inverted microscope.

The samples were cut from a single nominal 2" x 4" x 10' southern pine (*Pinus spp.*) sapwood parent board (Table 1). Two adjacent samples were assigned to either a "high" or a "low" treatment and treated by Viance, LLC. The "high" treatment consisted of 3000 ppm DCOIT in combination with an elevated level of penetration marker and was used to ensure that the DCOIT could be detected and quantified by SEM-EDS. The "low" solution closely mimicked commercial treating solutions and consisted of 1000 ppm DCOIT and a corresponding lower level of penetration marker. Samples were either "fully" treated or "partially" treated. A standard full cell treatment cycle was used to simulate standard treating practices for the "fully" treated samples. The "partially" treated samples were prepared with a heavily modified treating cycle designed to simulate boards that have not been treated completely.

The study demonstrated that macro-scale UV fluorescence imaging and SEM-EDS had sufficient sensitivity and spatial resolution to successfully analyze the distribution of dye and DCOIT (Figure 1) and Cu penetration markers (Figure 2) in samples with elevated and normal levels of DCOIT. Likewise, the micro-scale fluorescence imaging and EDS were able to assess the DCOIT and dye distributions at a sub-millimeter scale (Figure 3). While the sample set examined was limited and the fluorescence imaging presented here is qualitative, three conclusions addressing the study objectives can be drawn with some confidence: 1) The UV tracer dye is a "conservative" penetration marker for DCOIT, i.e. DCOIT penetrates as well or better than dye; 2) DCOIT penetrates as well or better than the Cu marker; and 3) DCOIT is more uniformly distributed than the dye on the sub-millimeter scale, making the dye a conservative marker for DCOIT on both a macro and a micro scale.

Sample #	DCOIT (ppm)	Cu (ppm)	Dye (ppm)	Penetration
1	3000		2500	full
2	3000		2500	partial
3	1000		833	full
4	1000		833	partial
9	3000	CuO, 4000		full
10	3000	CuO, 4000		partial
15	-	-	-	control

Table 1. Sample set with DCOIT, Cu and dye levels and degree of penetration.

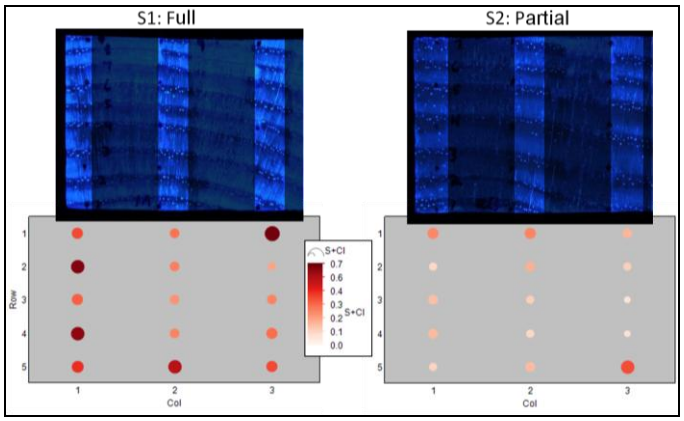

Figure 1. Comparison of dye by fluorescence imaging and S and Cl in DCOIT by EDS. The larger dot sizes and darker colors represent higher S and Cl loadings.

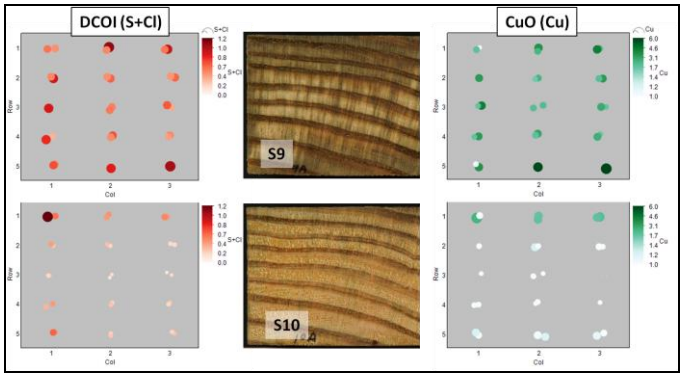

Figure 2. DCOIT and Cu by EDS for Sample 9 (full penetration) and Sample 10 (partial penetration).

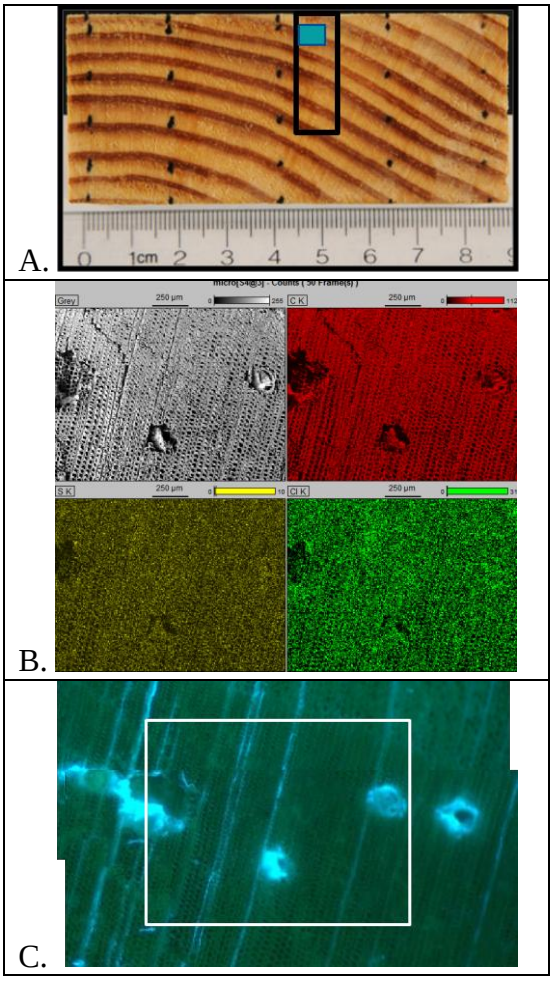

Figure 3. Distribution of dye and DCOIT on micro scale. A: Analysis area. B: Elemental maps (carbon, sulfur and chlorine). C: UV fluorescence.