ANNUAL RING CONTRAST ENHANCEMENT WITHOUT AFFECTING X-RAY DENSITOMETRY STUDIES

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In photographing tree rings or in viewing them under a microscope it is often useful to increase contrast between cell walls and voids. This has been accomplished in several ways. Douglass (1941) described the technique of making a razor-blade cut on an increment core or block of wood at approximately 30° to the wood grain and positioning the light source so that light is reflected from the sides of the cell walls rather than shining deep into voids. Eisendrath (1938) described a technique for increasing contrast by applying powdered anthracene to wood surfaces. This material fluoresces visibly under an ultra-violet light source, thus increasing the contrast between anthracene-filled lumina and cell walls.

A technique described by Larson (1959) and illustrated again by Worrall (1970) has been used for a number of years by the Faculty of Forestry, University of British Columbia to increase contrast between earlywood and latewood on wood samples measured on the Addo-X tree-ring measuring instrument. In this technique, the highly reflective levigated alumina is applied to the wood surface.

Recently, annual ring density studies were conducted on some of these same wood samples at the Western Forest Products Laboratory using the technique of X-ray densitometry. A problem was encountered in that the levigated alumina particles absorbed the X-radiation, so that erroneous density values were produced. Attempts were made to chemically remove the levigated alumina, but these efforts were not successful. However, it was discovered that zinc oxide functions equally well for the purpose of increasing contrast for viewing and it can be easily removed from samples using dilute acetic acid. Acetic acid was chosen because it is a naturally occurring organic acid in most wood species and it would have a minimal hydrolytic action on hemicellulose components, due to its pH range of 2.4 to 3.4. Also, since acetic acid is volatile, unlike mineral acids such as sulfuric, it would tend to be removed as the sample dried to equilibrium moisture.

The procedure is as follows: the zinc oxide-coated cores are submerged in a glass tray containing 10 percent acetic acid at ambient temperature for 30 minutes. The cores are then washed twice with distilled water. The procedure can be repeated, if stubborn particles of zinc oxide remain.

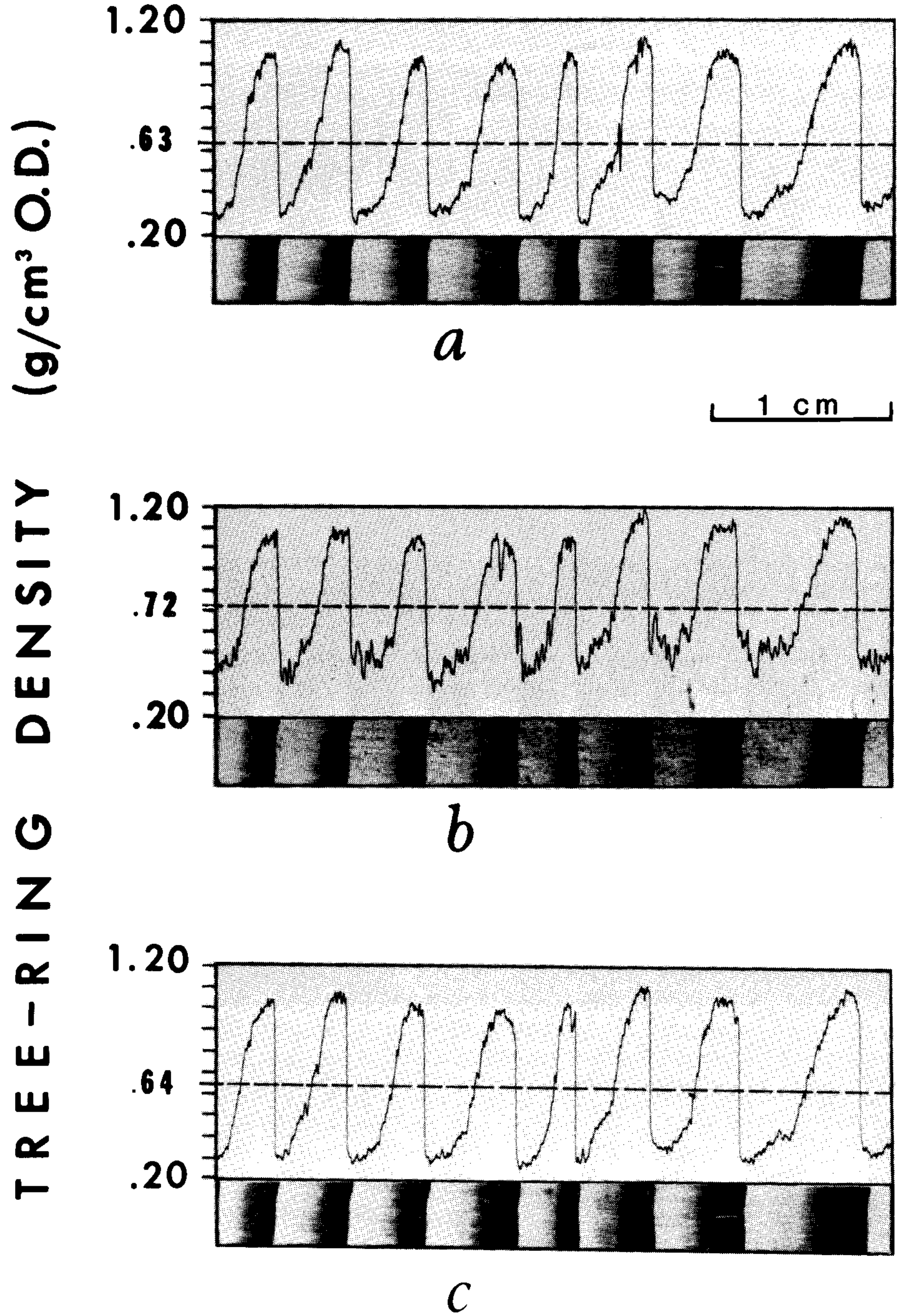

Figure 1. Radiographs and intra-ring density profile strip-chart recordings of a Douglas-fir core: *a*, before application of zinc oxide; *b*, with zinc oxide applied; and *c*, after removal of the zinc oxide. The specific gravity, as measured by X-ray densitometry, is 0.63 g/cm^3 for *a*, 0.72 g/cm^3 for *b*, and 0.64 g/cm^3 for *c*.

Alternatively, the core samples can be submerged in an ultrasonic bath of 10 percent acetic acid for one minute, followed by the distilled water rinse. This latter procedure ensures that the glue bond between core sample and wooden holder is not broken due to prolonged water immersion.

The effectiveness of this technique is illustrated (Figure 1) by showing a radiograph and densitometer traces of a wood sample in three stages: (a) before treatment; (b) treated with zinc oxide; and (c) after removal of the zinc oxide.

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