IRG 39 Conference in Istanbul, Turkey

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Amine Oxides for Use in Wood Protection
Part III. Penetration Aids for Wood

Xiao Jiang/Lonza Inc. /May 25 - 29, 2008

Why Amine Oxides Are Attractive for Wood Protection

- **Fix to wood in the same way as quats to minimize leaching.**
- **Possess excellent dispersing power and strong surfactancy, eliminating the problem of phase separation in wood preservation formulations.**
- **Impart effective water repellency when treating with longer chain amine oxides.**
- **Enhance the uniform distribution and penetration of wood preservatives into the wood.**

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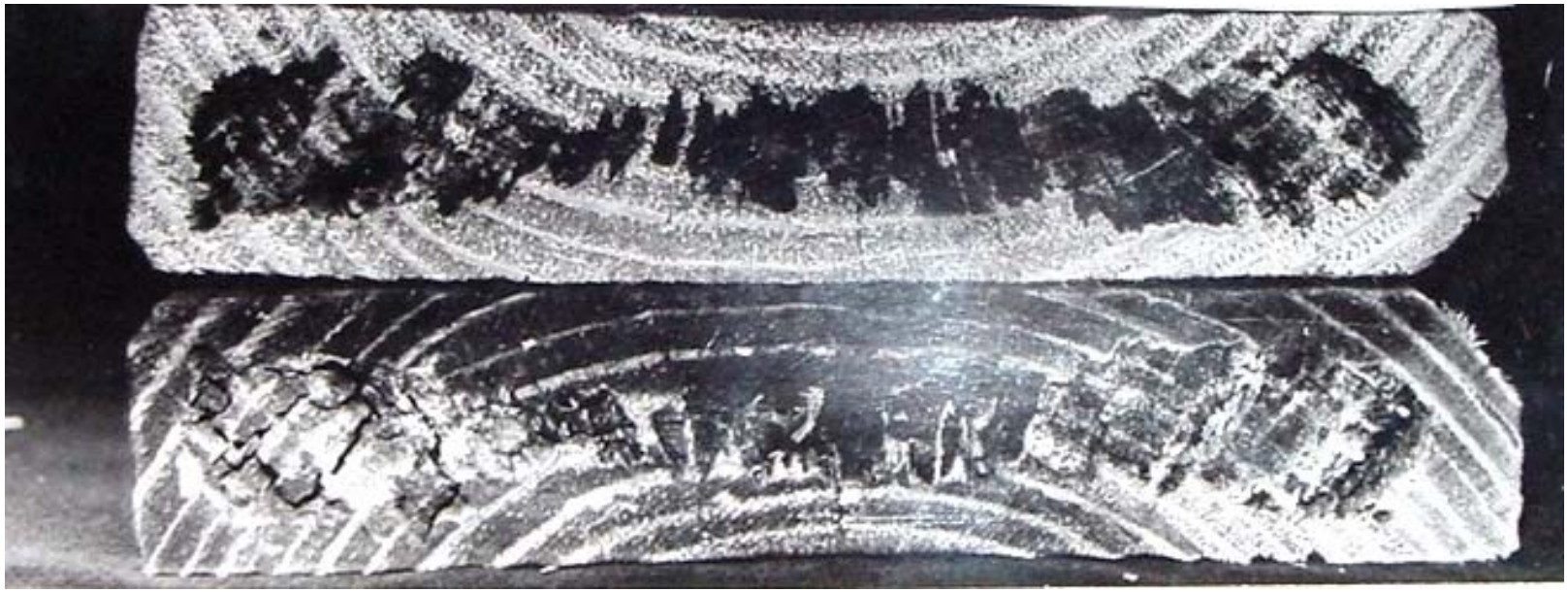
Importance of Penetration and Distribution

If wood is not well penetrated, it would be…



Objective

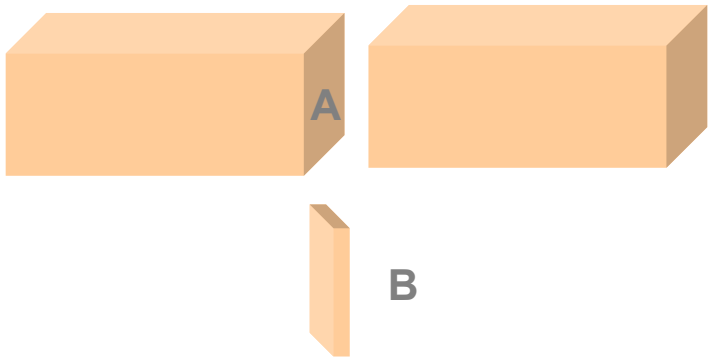
To enhance the uniform distribution and penetration of wood preservatives of quats and azoles into wood.

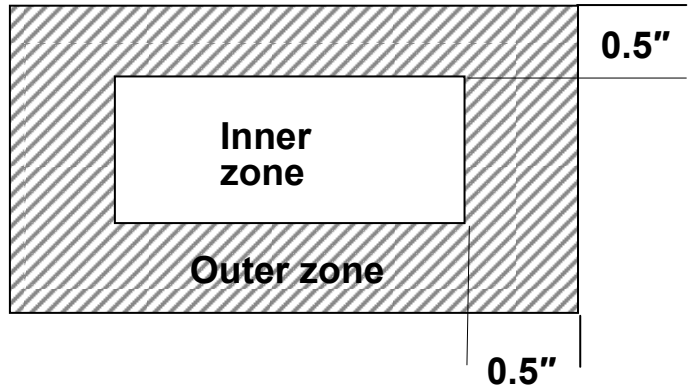
Materials and Methods (I)

- End-sealed wood blocks (2 x 3 x 10 in.)
  - Southern yellow pine
  - Douglas fir (incised)
- Pressure treatment
- Treating solutions
  - 0.5% of Barlox® 12 water solution
  - 0.5% of Carboquat® 250T water solution
  - 1000 ppm of propiconazole in a 1:1 water/IPA solution
  - 0.5% of Barlox® 12/ 0.5% of Carboquat® 250T in a water solution
  - 0.5% of Barlox® 12/ 1000 ppm of propiconazole in a water solution

Materials and Methods (II)

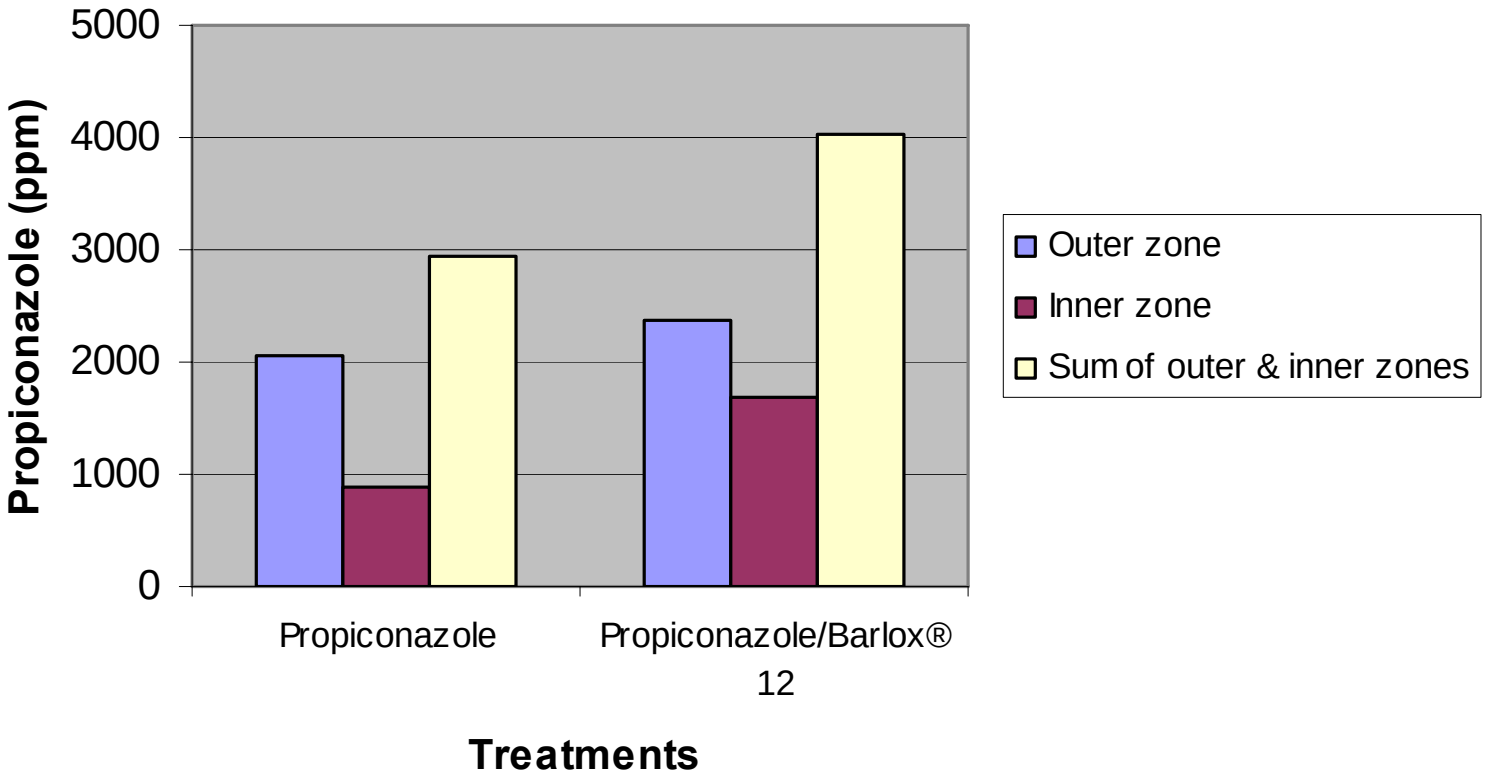
- Treated wood was air dried and ¼ ″ wafer was cut from the middle.
- Cutting surface A sprayed with the indicator of bromophenol blue (BPB).
- Wafer sample B was used for chemical analysis (GC for azole and HPLC for quat and amine oxide).



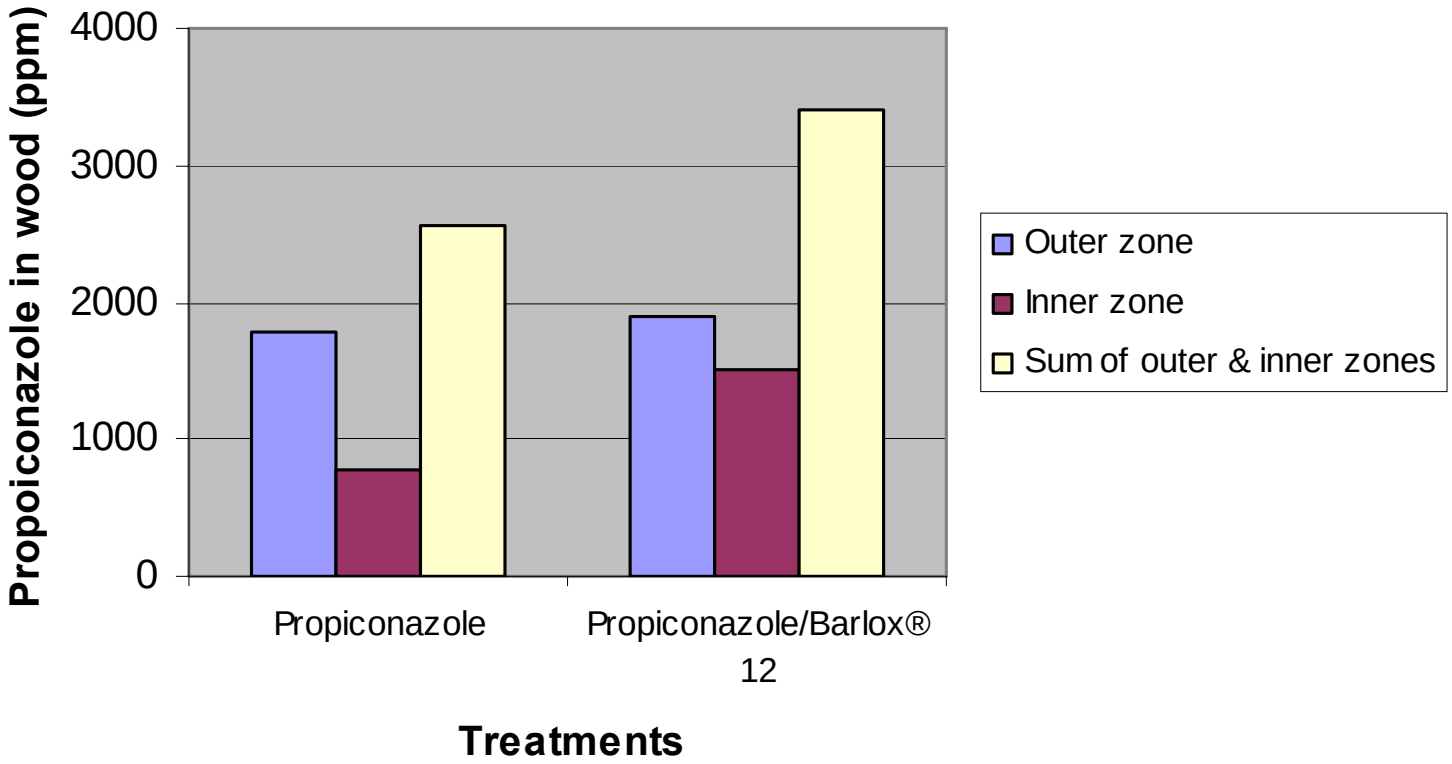


Cross section wafer B

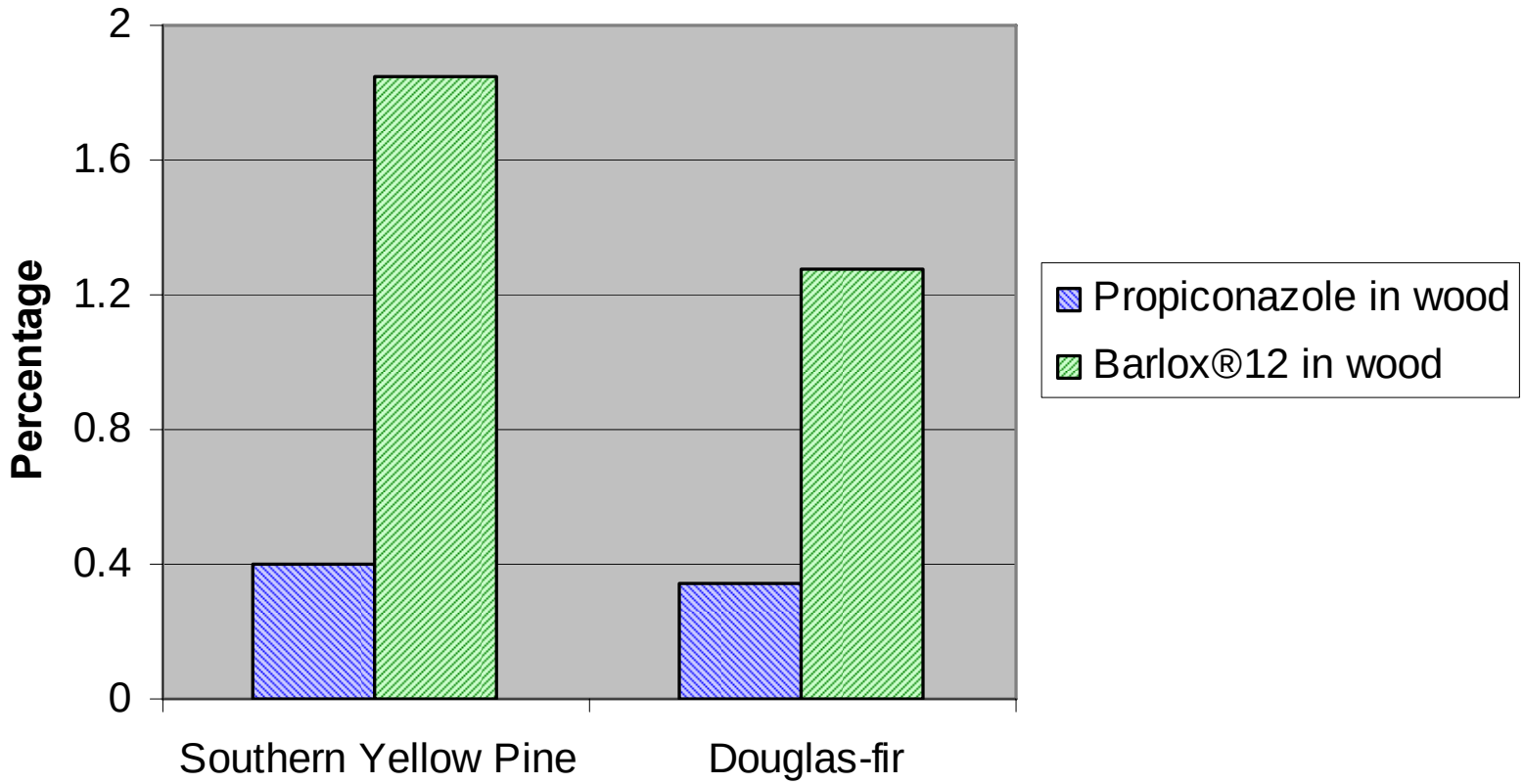
Results and Discussion – Propiconazole Concentration in Wafer B Isolated from Treated SYP Blocks



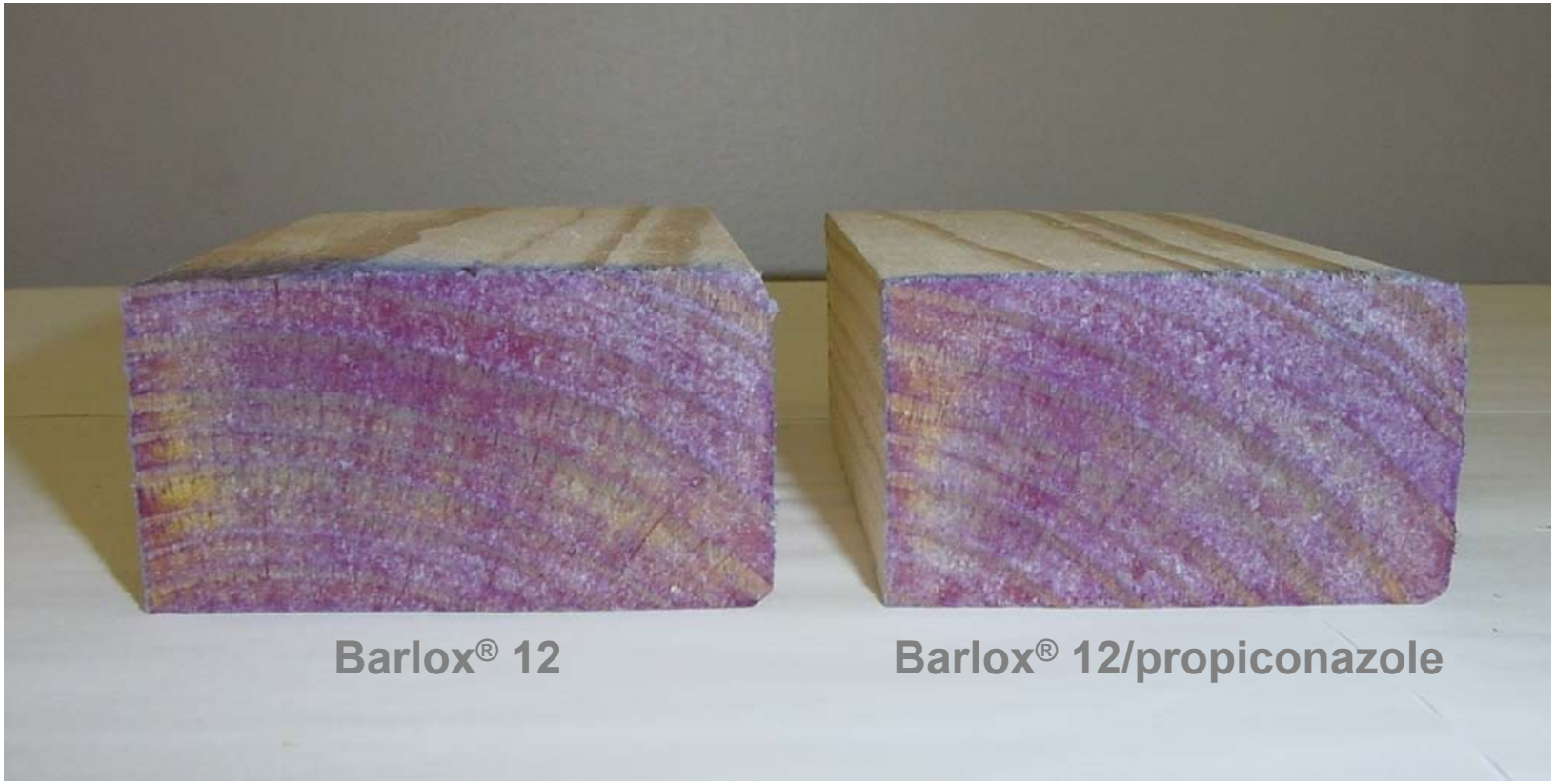
Results and Discussion – Propiconazole Concentration in Wafer B Isolated from Treated Douglas fir Blocks



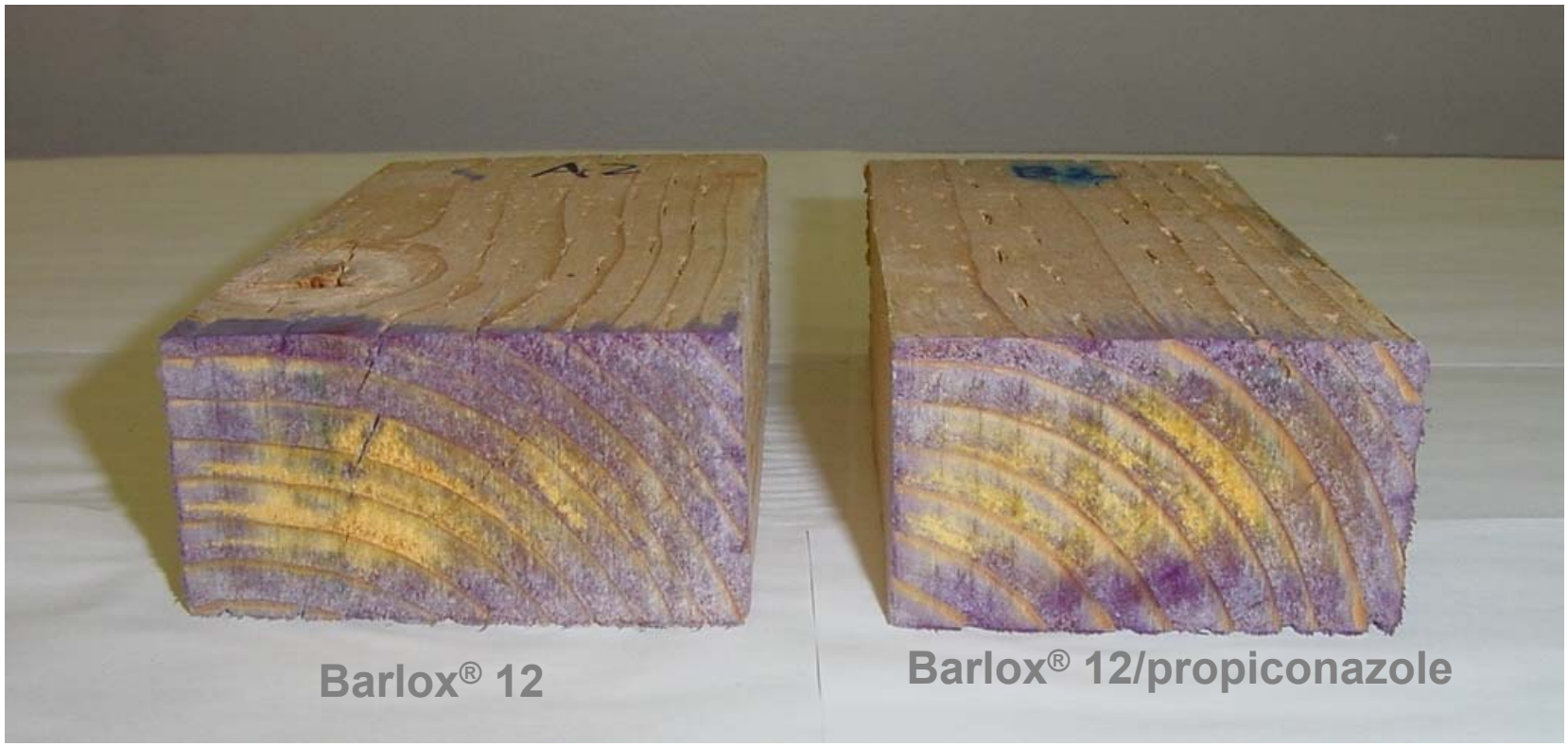
Propiconazole and Amine Oxide Concentration in Wafer B Isolated from Wood Blocks Treated with Azole/Amine oxide



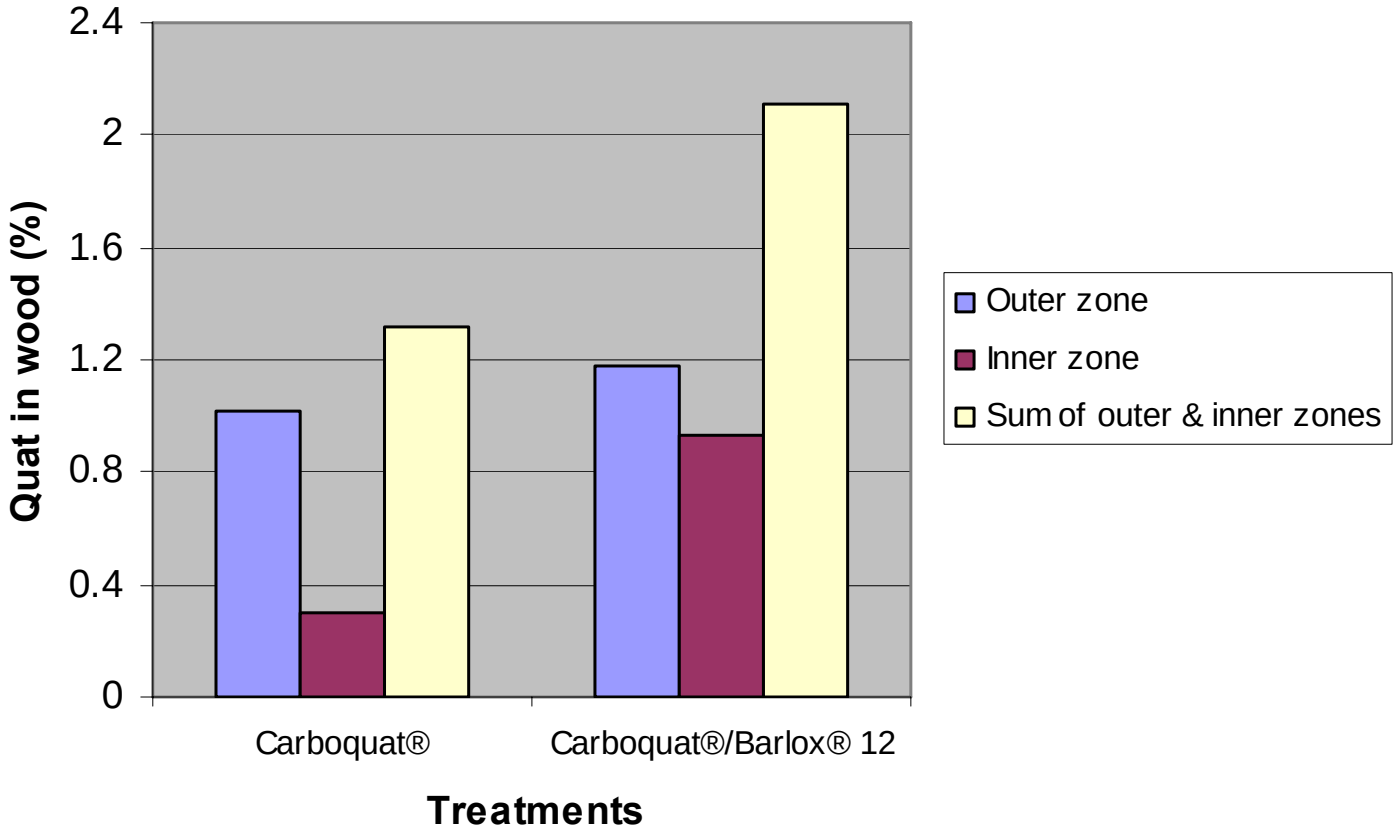
Azole/Amine Oxide Treated SYP Sprayed with BPB Indicator



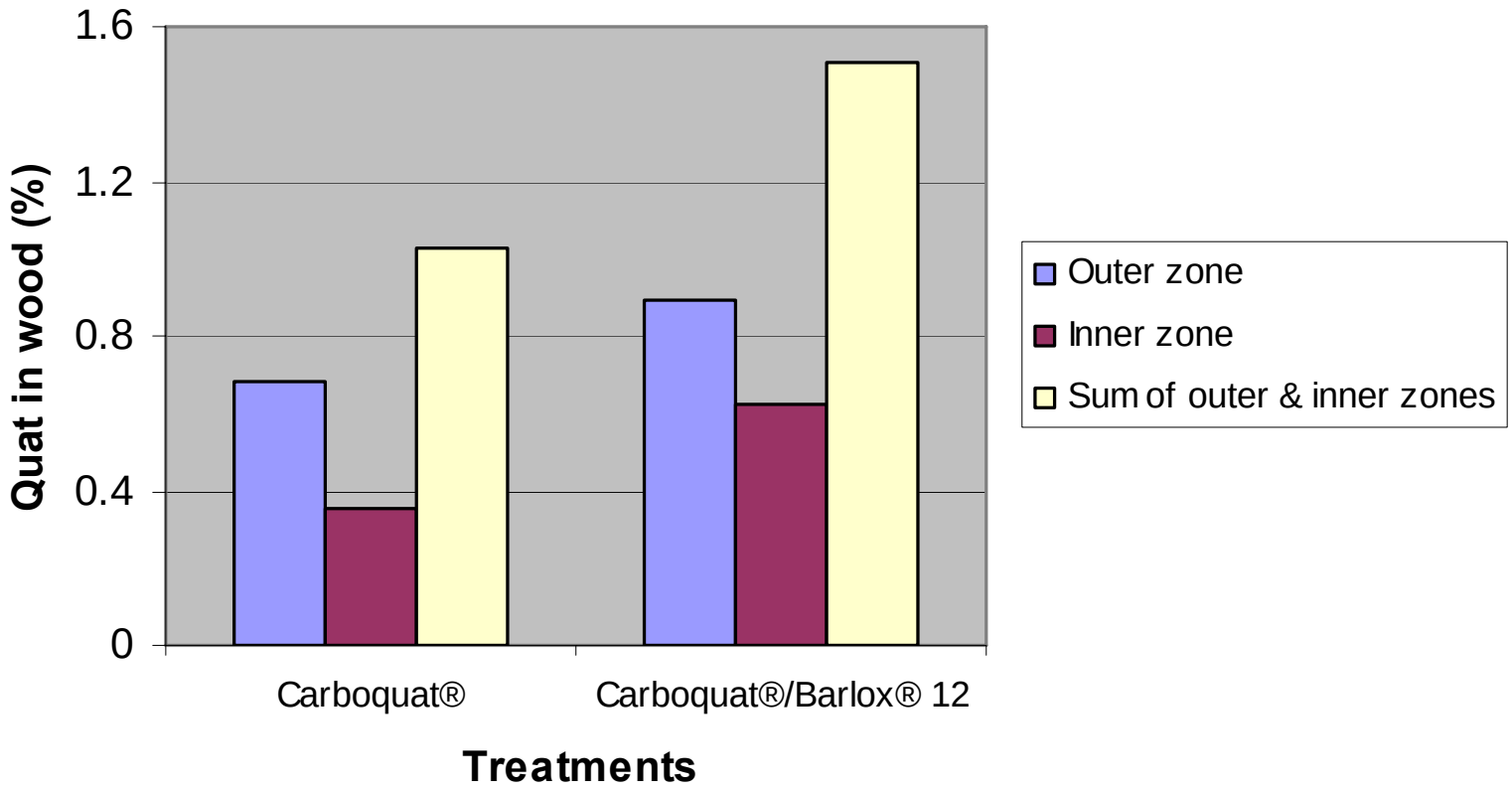
Azole/Amine Oxide Treated Douglas fir Sprayed with BPB Indicator



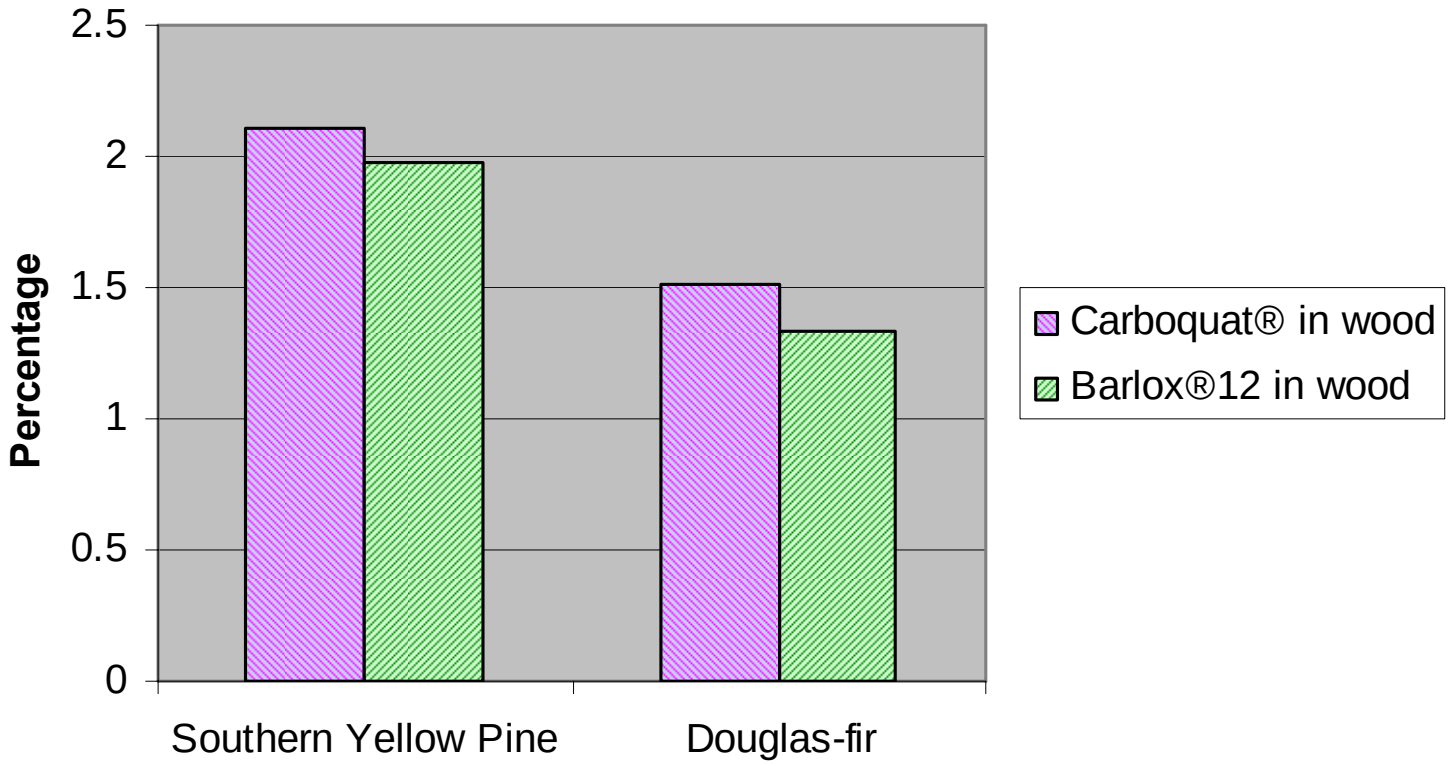
Results and Discussion – Quat Concentration in Wafer B Isolated from Treated SYP Blocks



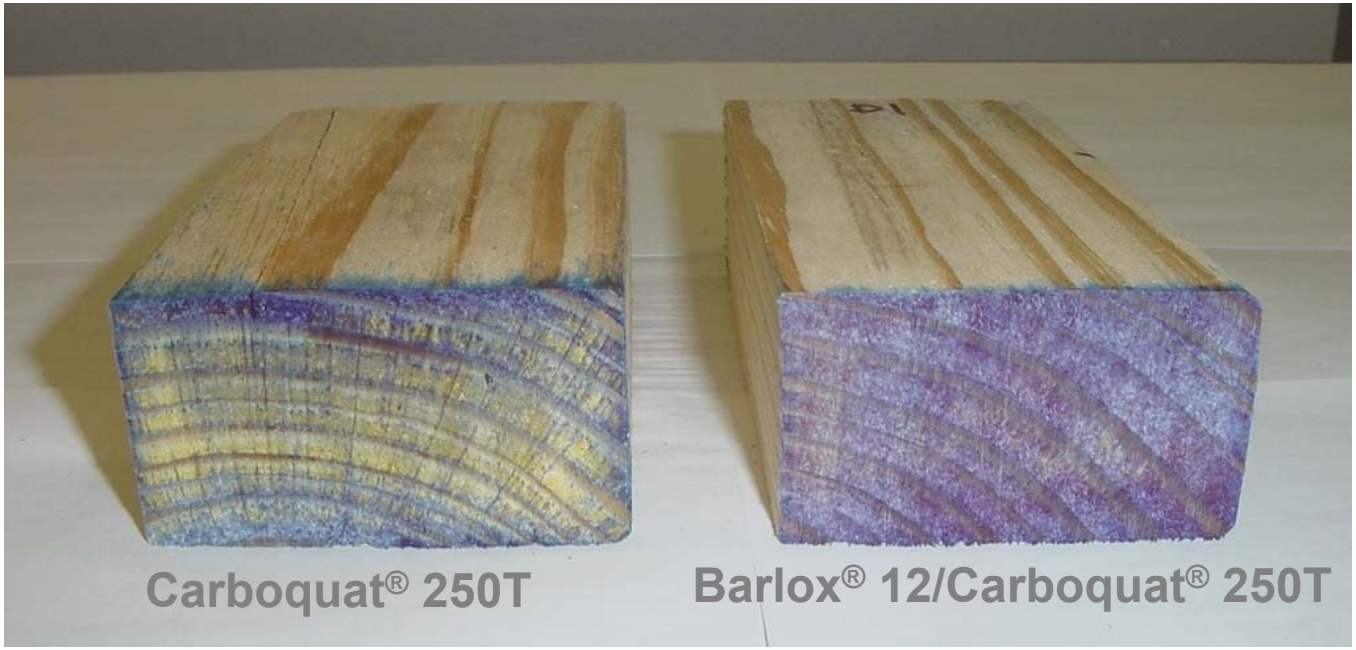
Results and Discussion – Quat Concentration in Wafer B Isolated from Treated Douglas fir Blocks



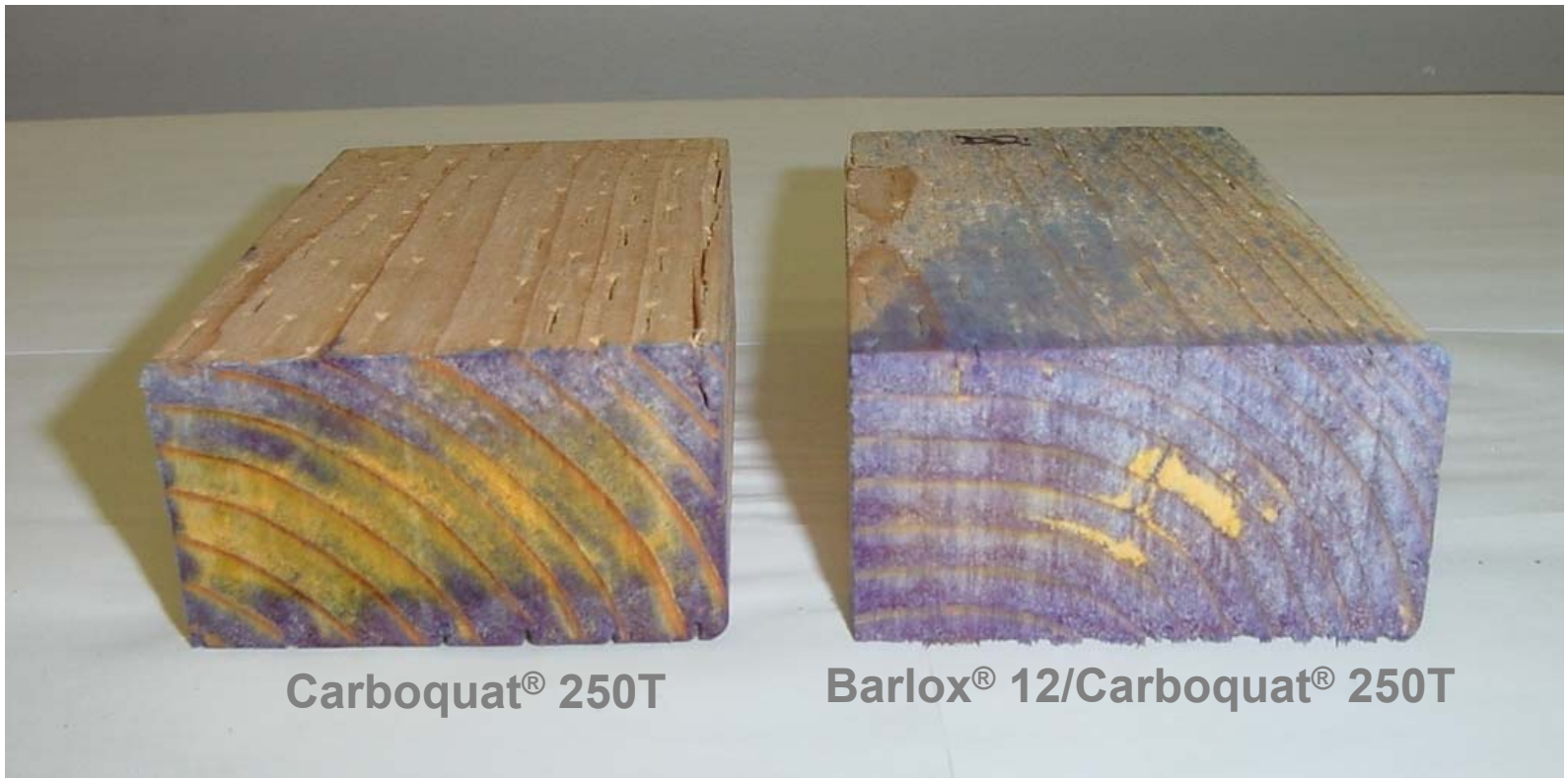
Quat and Amine Oxide Concentration in Wafer B Isolated from Wood Blocks Treated with Quat/Amine oxide



Quat/Amine Oxide Treated SYP Sprayed with BPB Indicator



Quat/Amine Oxide Treated Douglas fir Sprayed with BPB Indicator



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Proposed Mechanism for Improving Penetration of Quat in Wood with Amine Oxide

Penetration is inversely related to the fixation rate.
Fixation is slowed down by competing same sites for reaction.

Fixation reaction of quat in wood **Favored by alkaline condition**

$$Wood\text{-}CO_2H + R_2N(CH_3)_2CO_3H/CO_3 \longrightarrow Wood\text{-}CO_2 - [R_2N(CH_3)_2] + H_2O + CO_2$$

Fixation reaction of amine oxide in wood **Favored by acidic condition**

$$Wood\text{-}CO_2H + RN(CH_3)_2 \rightarrow O \longrightarrow Wood\text{-}CO_2 - [RN(CH_3)_2OH]$$

Conclusions

- **Amine oxide significantly improved the penetration and distribution of the quat and azole in SYP and Douglas fir.**
  - **For amine oxide/azole treatment**

    37% ⇧  **88%** ⇧  **in pine**

    33% ⇧  **95%** ⇧  **in Douglas fir**

  - **For amine oxide/quat treatment**

    60% ⇧  **210%** ⇧  **in pine**

    57% ⇧  **120%** ⇧  **in Douglas fir**

- **Core retention of quat or azole in the presence of amine oxide was observed to be on par with outer zone retention of quat or azole in the absence of amine oxide.**
- **It was confirmed by chemical analysis that the actives (propiconazole and quat) penetrated as far as Barlox® 12 in the treated wood.**

Contact info

Thank you for your time!

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