

IRG 40 Conference in Beijing, China

**Lonza**

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**Impact of an Antioxidant on the Efficacy of Quaternary Ammonium Compounds (Quats) and Triazoles – Seven Year Above-Ground Study**

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## Literature Review (1)

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- A hypothesis was proposed by Schultz and Nicolas that the extractives may protect heartwood by a dual mechanism – extractives have limited fungicidal activity, but are excellent antioxidants and protect wood against fungal-generated free radicals.
- The laboratory decay tests revealed that the antioxidant provided a synergistic effect to the organic biocides (Schultz and Nicholas, 1998, 1999 and 2001; Schultz and Nicholas, 2000 and 2002; Schultz et al. 2005).
- Schultz et al. started first field test in the mid 1990's to confirm the antioxidant concepts (Schultz et al., 2005 and 2006). The antioxidant was employed in the field study at fairly high retention levels (9.5 – 19.5 kg/m<sup>3</sup>).

## Literature Review (2)

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- Same research group began an above-ground lap joint test in Hilo, Hawaii in early 2000 for testing quat/antioxidant and propiconazole/ antioxidant (Schultz and Nicholas, 2008). The retention of the antioxidants was from 2.5 to 5.4 kg/m<sup>3</sup>.
- Although the antioxidant retentions were relatively low compared to previous studies, minimum usage of antioxidants for combinations with various biocides were not determined.

## Objectives

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- **To verify the synergistic effect of the low retention of the antioxidant (1 kg/m<sup>3</sup>), on the long term efficacy of quats and triazoles.**
- **To obtain efficacy data on possible commercial formulations.**

## Butylated Hydroxytoluene (BHT)

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- Relatively inexpensive.
- Environmentally friendly and Widely used in many food and personal care products.
- Approved by the US Food and Drug Administration (FDA) and listed on the Environmental Protection Agency's (EPA) non-food inerts list.

## Materials and Methods

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### Sample preparation in accordance with AWPA E16

- Southern yellow pine sapwood
- Pressure treatment
- Lap joint specimens were installed in the Saucier, Mississippi, USA test site.
- The Saucier plot is in a severe deterioration zone (AWPA Zone 5).

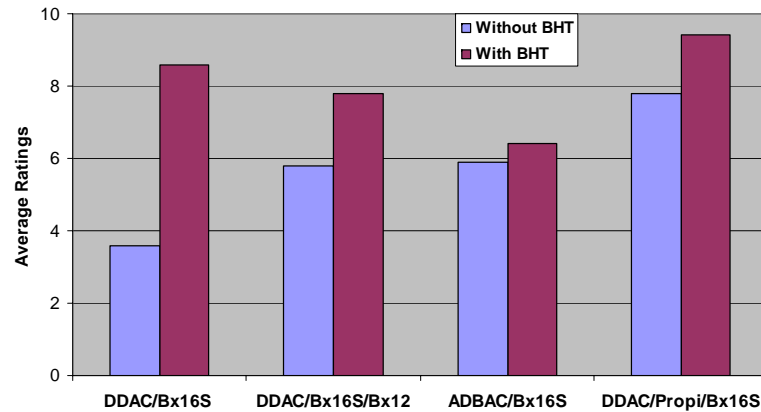


## Formulations Used in Lap Joint Test

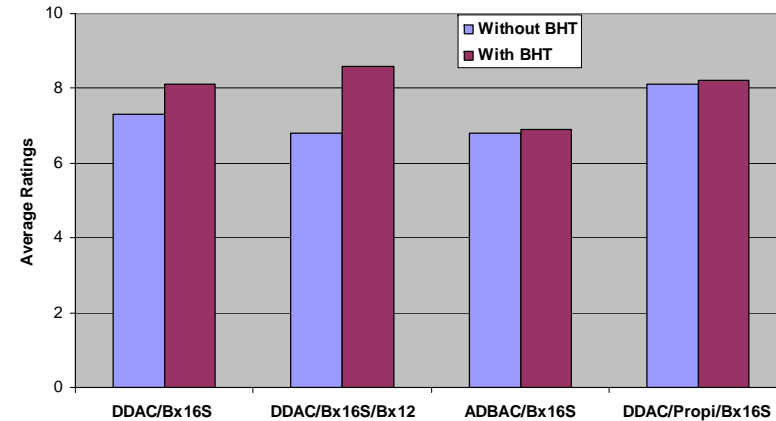
Formulations	No. of retention levels		No. of units
	With BHT	Without BHT	
DDAC/Barlox® 16S	3	3	30
DDAC/Barlox® 16S/ Barlox® 12	3	3	30
ADBAC/Barlox® 16S	3	3	30
DDAC/Barlox® 16S/propiconazole	3	3	30
Propiconazole/Barlox® 12/Barlox® 16S	3	3	30
Tebuconazole/Barlox® 12/Barlox® 16S	3	3	30
Cyproconazole/Barlox® 12/Barlox® 16S	3	3	30
BHT alone	1	1	20
SYP untreated controls	--	--	40

# Lap Joints Treated with Quat-Based Formulations at Year 7

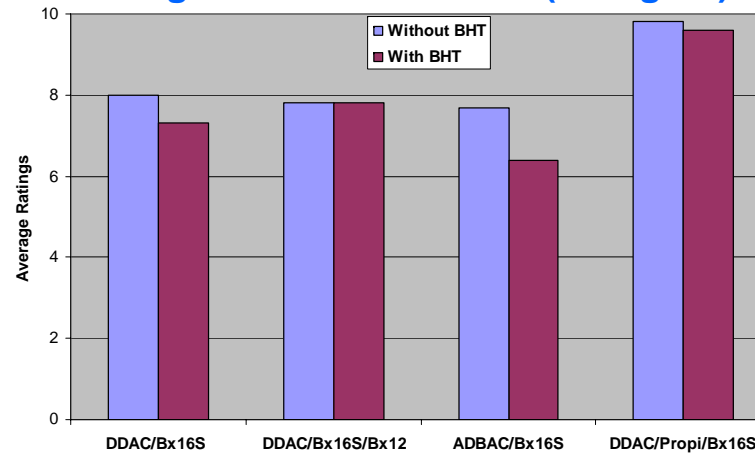
**Low Retention of Quat (0.4 kg/m<sup>3</sup>)**



**Medium Retention of Quat (0.8 kg/m<sup>3</sup>)**

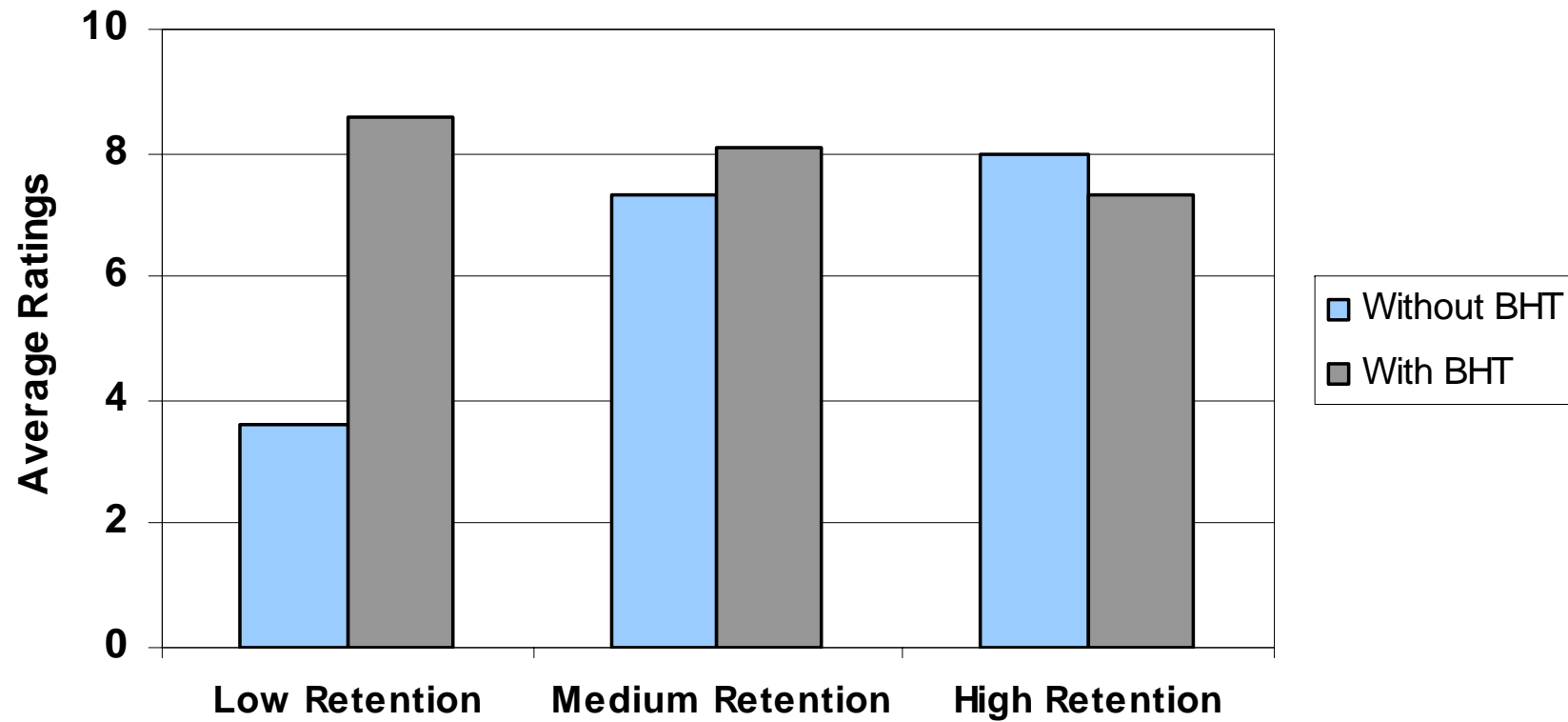


**High Retention of Quat (1.2 kg/m<sup>3</sup>)**



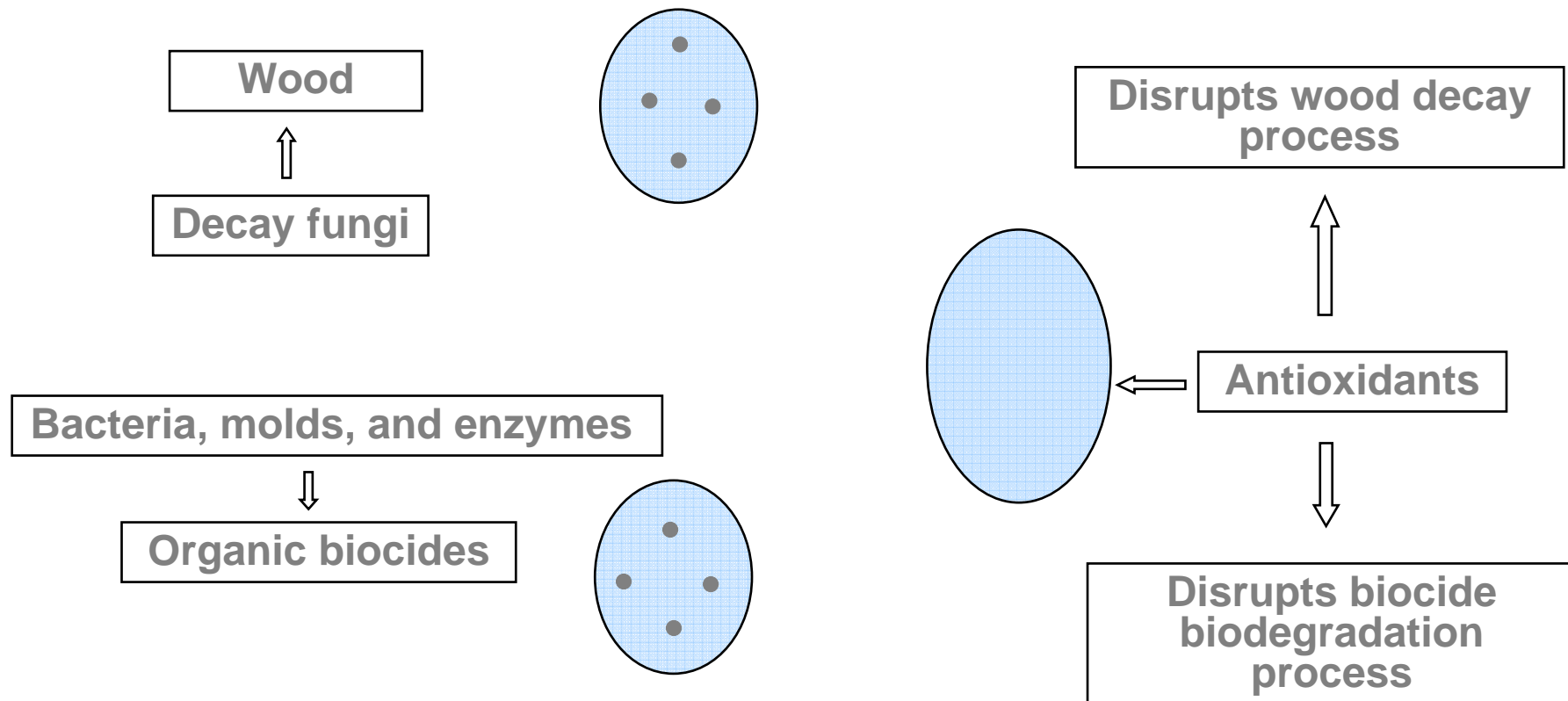
## BHT Effect on Formulation of DDAC/Barlox<sup>®</sup> 16S

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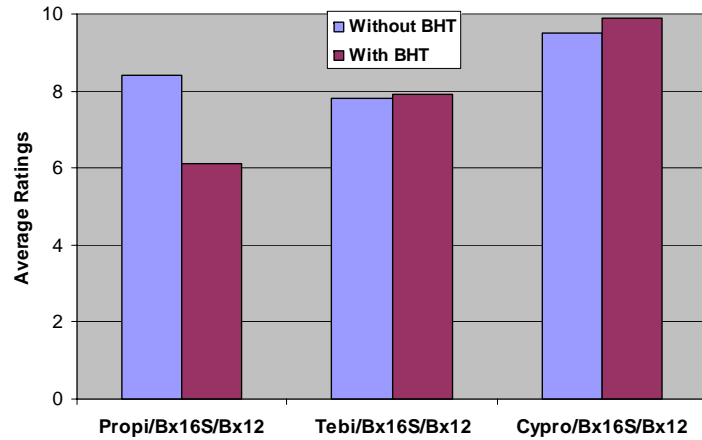
# Proposed Antioxidant Mechanism

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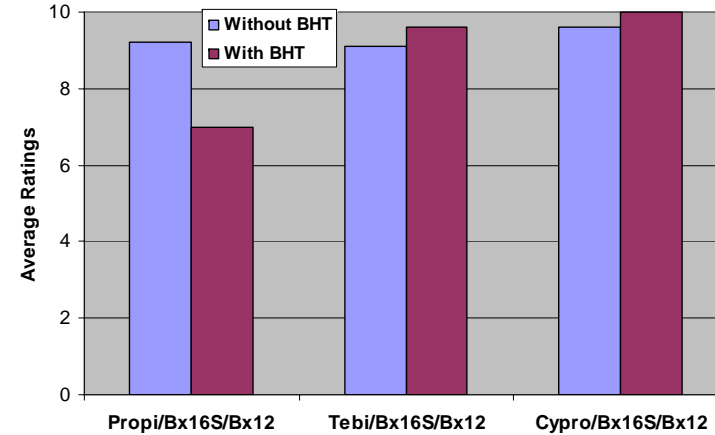


# Lap Joints Treated with Triazole-Based Formulations at Year 7

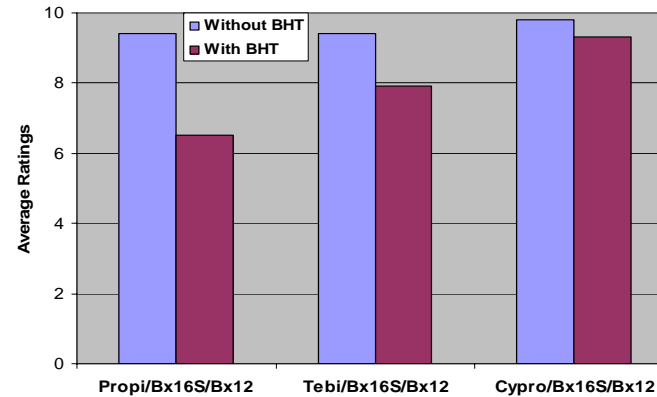
**Low Retention of Azoles (0.016 kg/m<sup>3</sup>)**



**Medium Retention of Azoles (0.032 kg/m<sup>3</sup>)**



**High Retention of Azoles (0.048 kg/m<sup>3</sup>)**



## Conclusions (1)

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- BHT appears to have a positive effect on formulations containing quats, and this favorable effect was more pronounced for lower retention treatment.
- The impact of BHT on the formulation of DDAC/Barlox<sup>®</sup> 16S at the low retention level was found to be most significant.
- For tebuconazole- and cyproconazole-based formulations, the addition of BHT yielded a slight performance improvement.

## Conclusions (2)

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- For propiconazole-based treatments, BHT at 1 kg/m<sup>3</sup> exhibited a negative effect on the efficacy.
- Future studies are necessary to determine the correlation between the amount of the antioxidant and the retention of quats or triazoles and to optimize the ratio of antioxidant to quats or to triazoles.

## Contact Info

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**Thank you for your time!**

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