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# Wood Degradation by Fenton's Reagents

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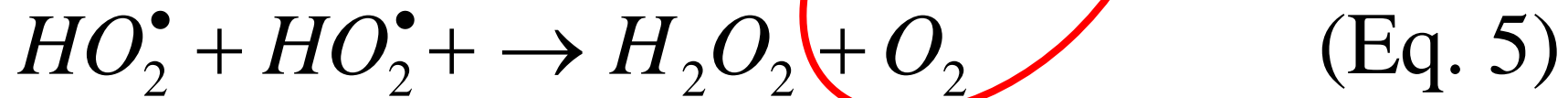
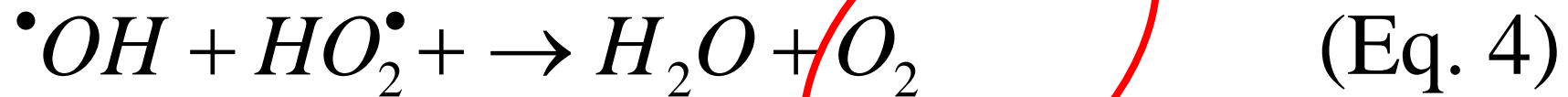
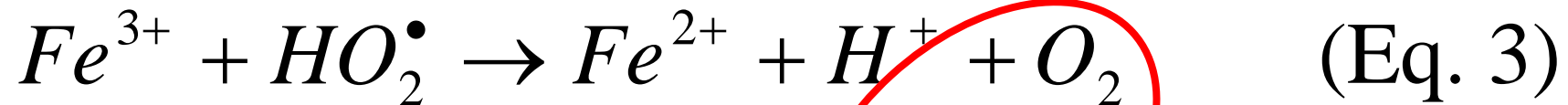
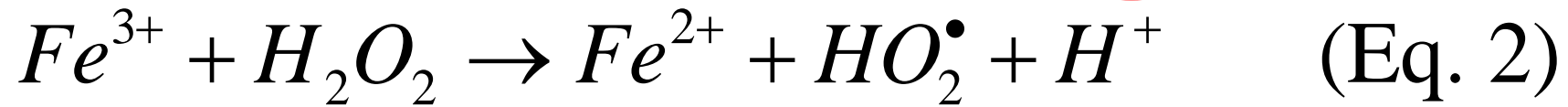
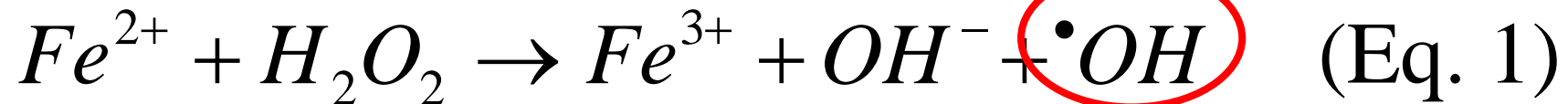
# Outline

- Introduction & objectives
- Materials and methods
- Results
- Conclusions

# Introduction & Objectives

- Wood fungal decay: brown rots - degrade cellulose but leave modified lignin
- endo-glucosidase (amorphous cellulose), but no exo-glucosidase (crystalline cellul.)
- main decay agent is Fenton's agents
- Low molecular weight phenolics act as chelators and
  - Enhance the production of OH radicals
  - Reduce FeIII (after Fenton reaction)

# Fenton Reaction



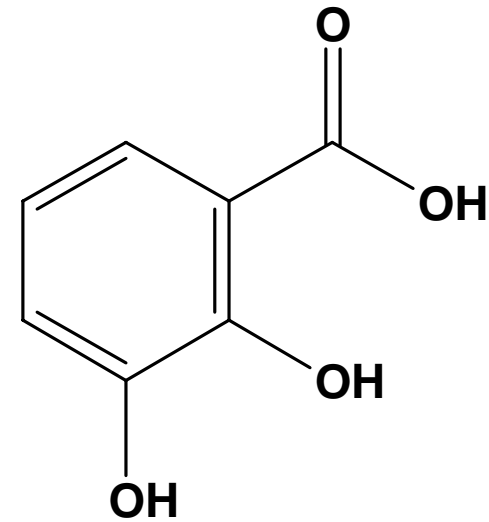
# Objectives

to explore the oxidation mechanism in brown rot decay by determining:

- Effect of the Fenton reaction on the wood strength
- Effects of LMW phenolics on  $\text{H}_2\text{O}_2$  decomposition to form hydroxyl radicals
- Effect of the Fenton reaction and a low molecular weight compound on mineralization of wood

# Materials and Methods

1. H<sub>2</sub>O<sub>2</sub> (35% aqueous solution)
2. Iron(III) sulfate hydrate
3. 2,3-Dihydroxybenzoic acid



2,3-Dihydroxybenzoic acid

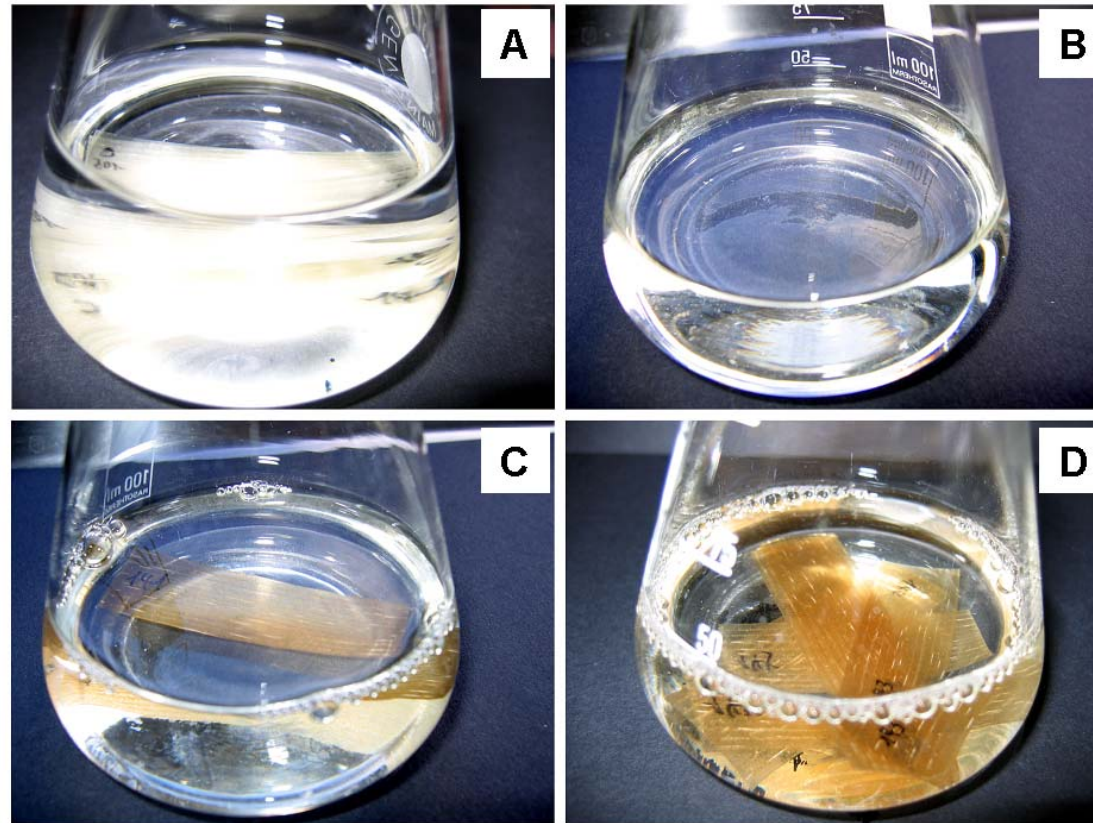
# Micro-tensile testing



- good relationship between depolymerization of cellulose and loss in tensile strength of thin wood veneers
- H<sub>2</sub>O<sub>2</sub> decay rate
- Strength loss of wood
- Gas production

Pulmac zero-span paper tester  
Photo by Philip Evans

# Results: Effect of Wood Amount



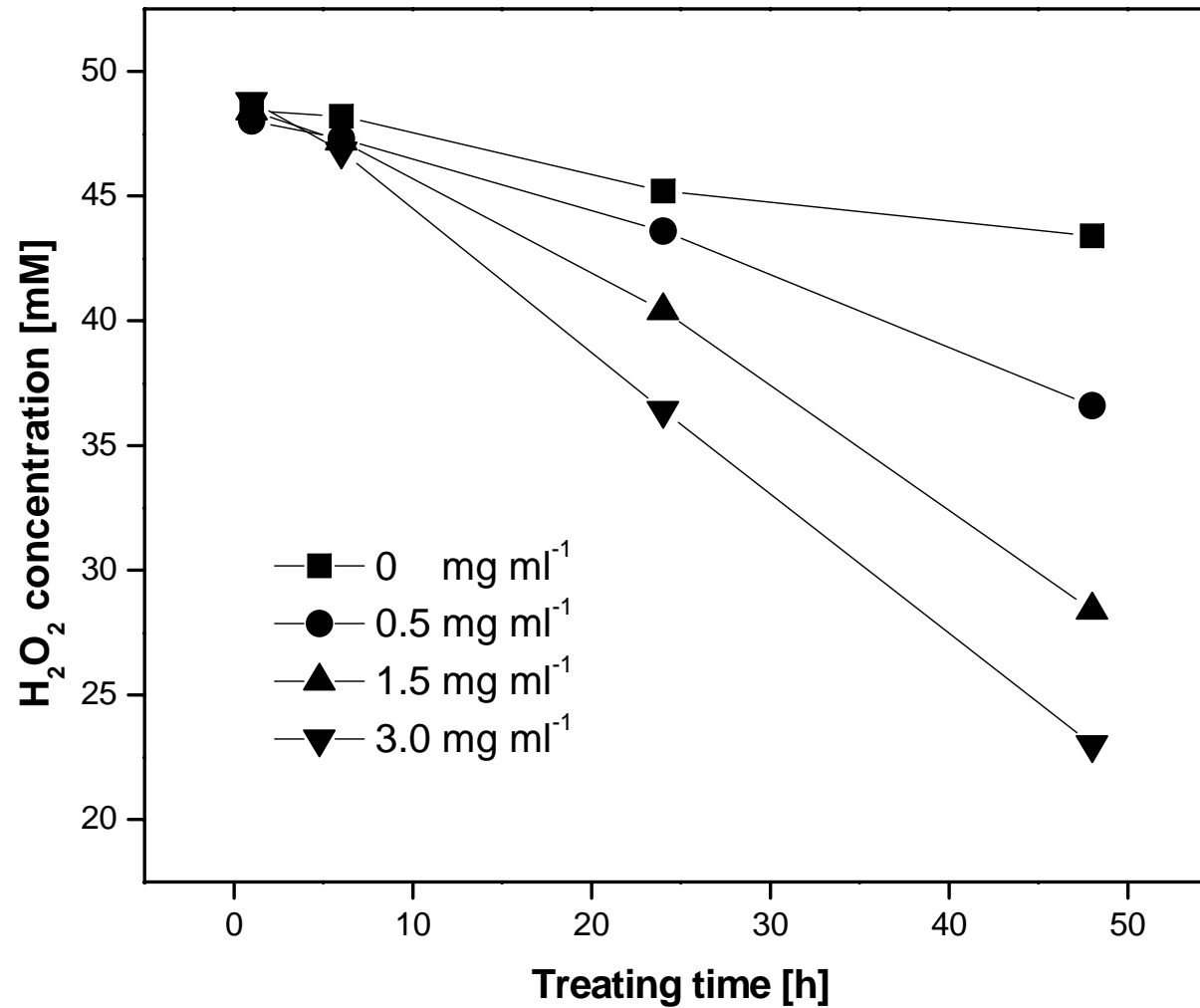
A: buffer

B: Fenton

C: Fenton +  $0.5 \text{ mg} \cdot \text{ml}^{-1}$  Wood

D: Fenton +  $3 \text{ mg} \cdot \text{ml}^{-1}$

# Results: Effect of Wood Amount

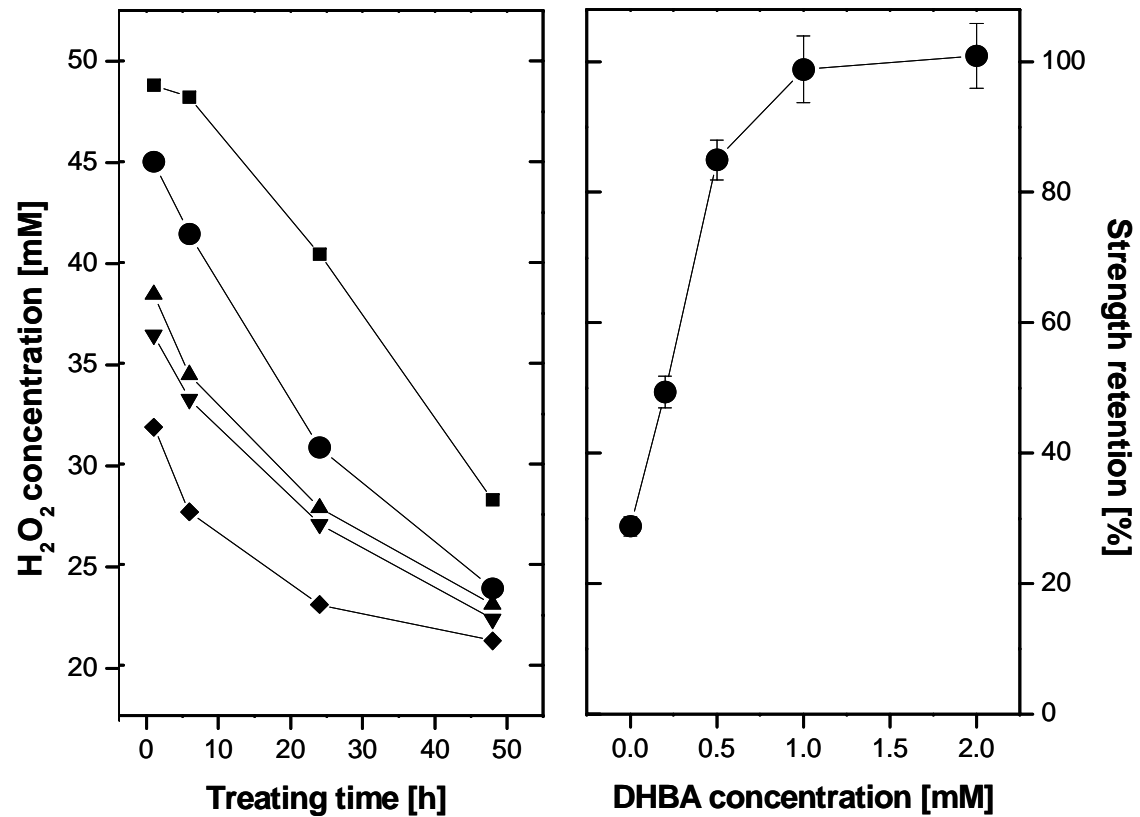


50mM  $H_2O_2$   
0.2mM Fe(III)

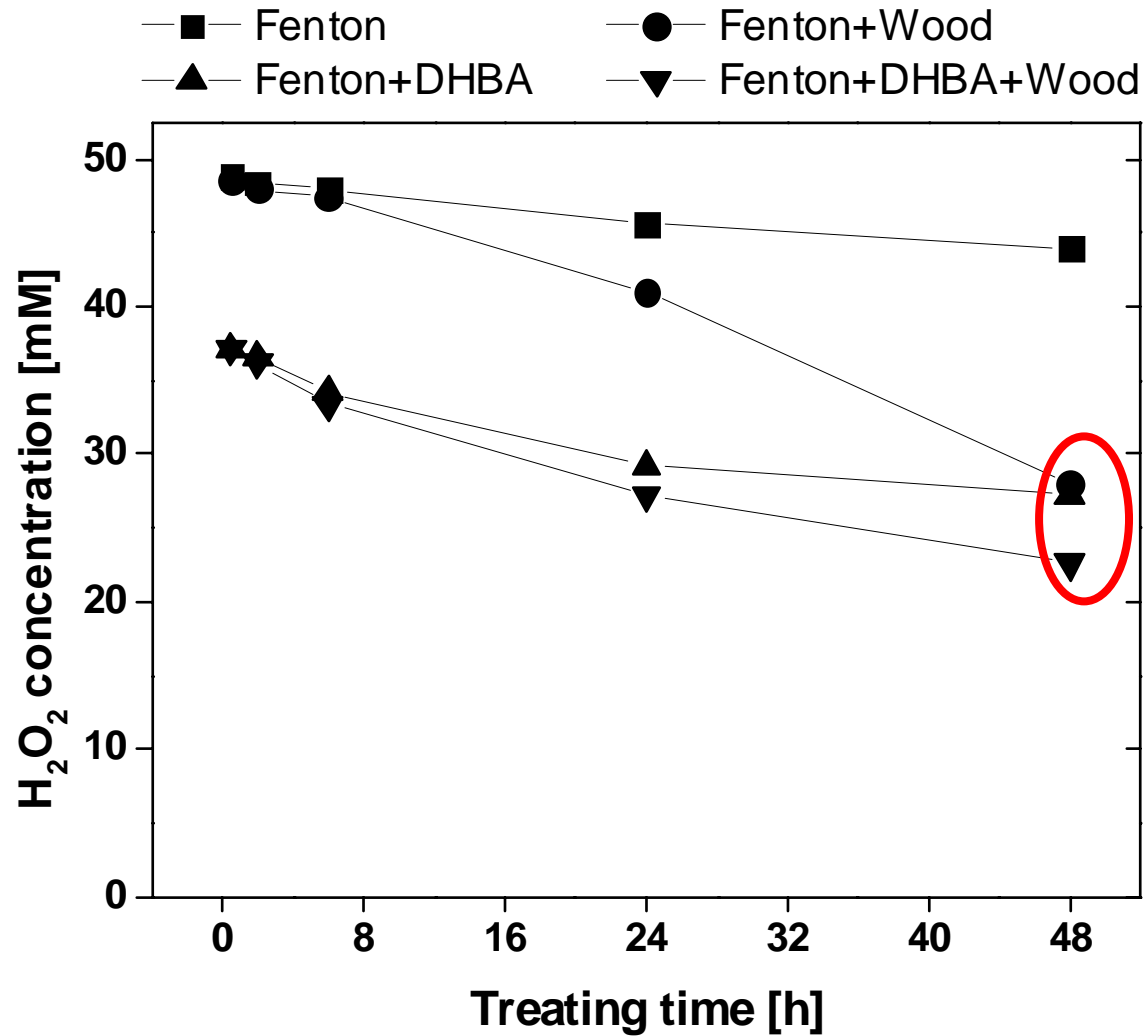
# Results: Effect of DHBA

50mM H<sub>2</sub>O<sub>2</sub>  
0.2mM Fe(III)

- 0 mM DHBA
- 0.2 mM DHBA
- ▲— 0.5 mM DHBA
- ▼— 1.0 mM DHBA
- ◆— 2.0 mM DHBA

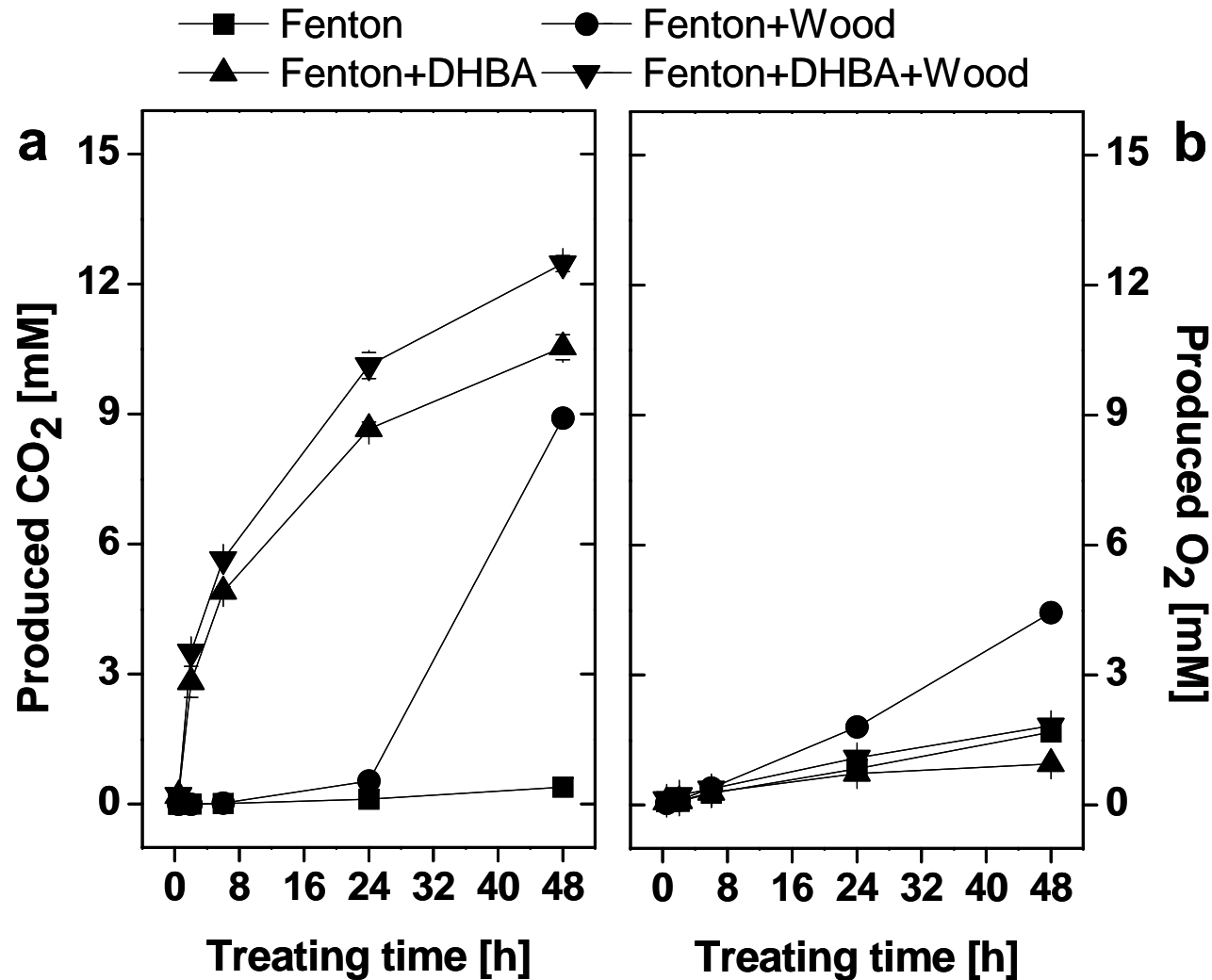


# Effect of treatment – H<sub>2</sub>O<sub>2</sub> concentration



50mM H<sub>2</sub>O<sub>2</sub>  
0.2mM Fe(III)  
1.0mM DHBA  
1.5 mg·ml<sup>-1</sup>

# Gas production



50mM H<sub>2</sub>O<sub>2</sub>  
0.2mM Fe(III)  
1.0mM DHBA  
1.5 mg·ml<sup>-1</sup>

# Conclusions

- Wood itself may drive Fenton reaction
- Addition of DHBA causes faster decay of  $\text{H}_2\text{O}_2$ , but reduces the strength loss
- Wood degradation produces  $\text{CO}_2$
- Addition of DHBA produces  $\text{CO}_2$  more and faster due to its mineralization

# Acknowledgements

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**Thanks for your attention!**