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Oral 5.05 - The Chemical Interactions between Phenolic Resin and Wood Studied by Liquid-State NMR Spectroscopy

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ABSTRACT

Wood modification with thermosetting resins is an increasingly popular method aiming to expand the number of applications for readily available plantation timber (Hill 2006). Phenol urea formaldehyde (PUF) resin is impregnated into the timber, which is dried, and subsequently heat cured (Kupfernagel *et al.* 2021, 2022). This treatment renders the raw material dimensionally stable and imparts the ability to withstand wood destroying fungi and insects. The mode of action in doing so is typically considered a passive modification, but covalent bonds between the PUF resin and wood might form at low abundance. Since these covalent bonds are rare and structurally similar to linkages that occur in wood itself, a high-resolution method is required to accurately observe the formation of new bonds. In the current study we used liquid-state ¹H-¹³C-heteronuclear single quantum coherence (HSQC) NMR experiments to identify chemical bonds in modified and unmodified wood with high accuracy. This method has been used in the past to detect even rare covalent bonds in modified wood. During the sample preparation, a ball-milled wood powder is dissolved in DMSO-d₆, which yields a viscous gel that can be handled like a liquid in solution-state NMR experiments (Yelle *et al.* 2008, Kim & Ralph 2010). Lime and poplar samples, that were previously compared in anti-swelling efficiency tests, have been used for the NMR analysis (Kupfernagel *et al.* 2023). While the same kind of covalent bonds are formed in different timbers, their abundance was shown to be significantly different, which could be due differences in the chemical composition of the two wood species.

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