Group : Homogeneous Catalysis and Biomimetic Synthesis
Project : **Synthesis of Artificial Library of Lignin Oligomers**
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Keywords. Organic Synthesis, Biopolymers, Lignin

Introduction. Lignin is the most common component in vascular plants and it is considered to be the most abundant aromatic substance in nature. Studying and developing strategies for the catalytic modifications and selective degradation of lignin polymer to value-added materials needs appropriately functionalized lignin model compounds including dimers, trimers, and small oligomers. The predominant structural feature of lignin biopolymer is a complex network of different types of linkage including ether, esters bond, and C-C bonds. Therefore, access to different model compounds containing β-O-4, β-5, β-β, and other linkages is crucial for the valorization of lignin biopolymer to aromatic raw materials. The formation of the lignin polymer in the plants belongs to the enzymatic oxidative coupling reaction of phenols via generating phenoxy radicals followed by coupling these radicals together according to certain rules forming macromolecules via the polymerization process (such as LEGO, Figure 1) .

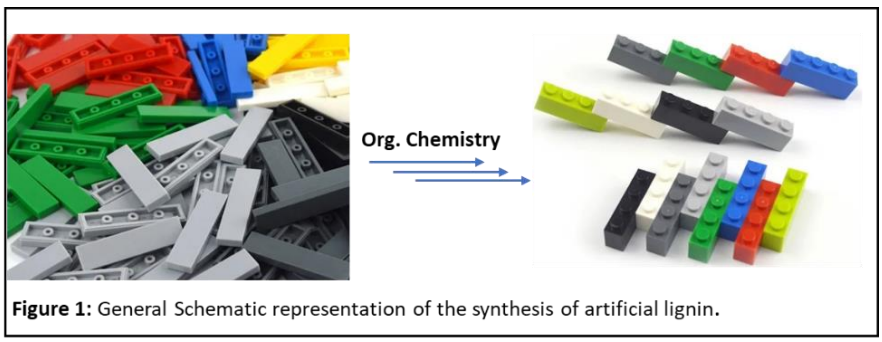
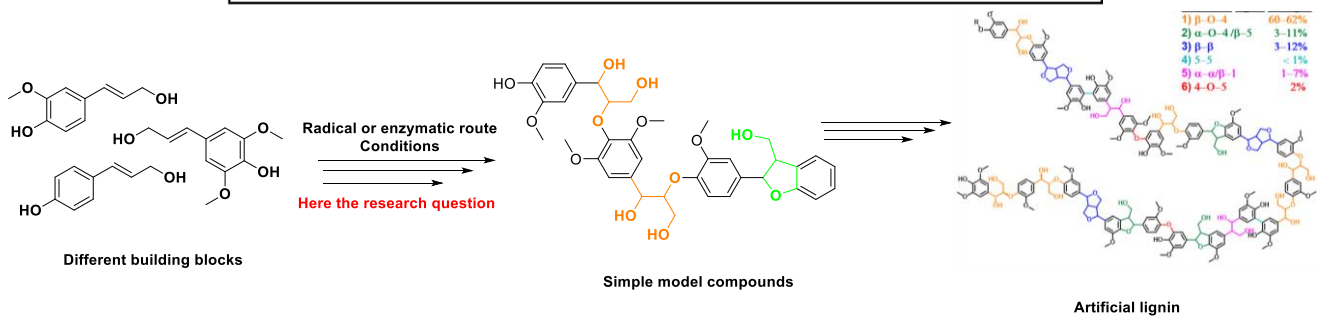


Figure 1: General Schematic representation of the synthesis of artificial lignin.



Goal. The main goal of the project is the study of selective synthesis of several oligomers of lignin varying subunit compositions aiming to reduce the complexity of working with the nature lignin biopolymer itself. The work will include multistep synthesis of protected and non-protected building blocks, their biomimetic coupling (radical reactions), isolation and characterization of obtained product by NMR (including 2D-NMR). Further optimization of reactions to achieve high selectivity and yield will be performed. The functionalized lignin model compounds will be synthesized using a concise route (max. 5 steps per building block).

Techniques to be used: Organic synthesis, work under inert atmosphere, use of analytical and preparative HPLC, LC-HRMS, GC-MS, NMR (^{1}H, ^{13}C, 2D-NMR techniques).

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