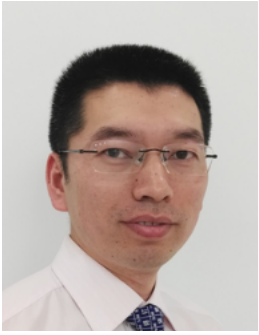
Cleavage/cross-coupling strategy for converting lignin into high value-added compounds



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The conversion of renewable resources into higher value-added organic chemicals is becoming more and more important for our society's future sustainable development. Lignins, being the second abundant organic carbon renewable resources on Earth, have traditionally been treated as waste in the pulp and paper industry. Among the three types of ether linkages in lignins, the 4-O-5 linkage diaryl ether bond is the strongest, while the β-O-4 linkage bond is the most abundant. Selective cleavage of these linkages holds potential to yield smaller, processable bio-based aromatic polymeric materials and compounds [1]. Additionally, there has been a long synthetic interest in coupling reactions with aryl ethers via C(Ar)–O bond cleavage. Up to date, cleavage of model compounds containing 4-O-5 and β-O-4 ether linkages has produced alkanes (such as cyclohexanes) and oxygen-containing compounds (including phenol, cyclohexane, cyclohexanone, and cyclohexanol) [2]. Herein, we present a cleavage/cross-coupling strategy for lignin valorization aimed at generating high value-added nitrogen-containing compounds from lignin degradation.

In this presentation, we will discuss the direct formal cross-coupling of 4-O-5 linkage model compounds, diaryl ethers, with amines [3] and ammonia [4]. This cleavage/cross-coupling strategy aims to produce valuable nitrogen-containing derivatives. Additionally, we applied this strategy to β-O-4 ether linkage model compounds, successfully generating benzyl amine [5]. Recently, we achieved depolymerization of six different sources of native lignin under redox-neutral conditions, eliminating the need for additional oxidants, bases, and transition metals [6].

References

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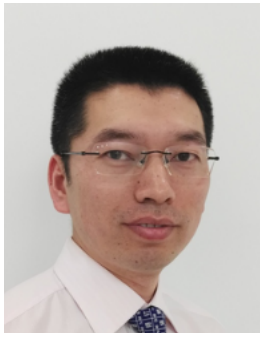

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BIO

Prof. Dr. Huiying Zeng received his Ph.D. degree in 2013 from the State Key Laboratory Elemento-Organic Chemistry, Nankai University. He did postdoctoral research at McGill University (Canada) in the group of Prof. Chao-Jun Li from 2013 to 2015. He has been a professor at the State Key Laboratory Applied Chemistry, Lanzhou University since 2016. Since 2020, he has promoted to young Cheungkong Scholars professor and CuiYing Scholar professor. He won the Thieme Chemistry Journals Award (2021), Gansu Leading Talent (2021), Gansu Young Professor Achievement Award (2020) and Merit Postdoctoral Fellowship (Canada, 2013). His research interests are mainly focused on lignin valorization, and exploring photo-induced transition-metal and photosensitizer-free new chemical reaction.