



## Unravelling Some of the Key Transformations in the Hydrothermal Liquefaction of Lignin

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### Abstract:

Hydrothermal liquefaction (HTL) is becoming an important process to convert biomass (e.g. pine wood, algae) to fuel and chemicals at an industrial scale.

Lignocellulosic biomass is an organic matrix of biopolymers i.e. cellulose, hemicellulose and lignin. Lignin valorization is particularly desirable because lignin is the most readily available renewable source of aromatics and is a major by-product of the paper and pulp industries. The complex structure of lignin contains aromatic units connected by linkages such as  $\beta$ -O-4,  $\alpha$ -O-4, 4-O-5, 5-5,  $\beta$ -5 and  $\beta$ - $\beta$  cross-links. Of these, the  $\beta$ -O-4 linkage predominates, accounting for over 50% of the cross-links. In addition, lignin also contains cinnamaldehyde and benzaldehyde terminal groups.

Using both experimental and computational methods, focusing on model compounds which characterized structure features of lignin (i.e.  $\beta$ -O-4 linkage and aldehyde end groups), we elucidate some of the reaction mechanisms that operate during the hydrothermal processing of lignin. We propose key reaction pathways and their connection to different structural features of lignin. Under neutral conditions, subcritical water was demonstrated to act as a bifunctional acid/base catalyst for the dissection of lignin structures. In a complex web of mutually dependent interactions, guaiacyl units within lignin were shown to significantly affect overall lignin reactivity.

### Biographical Statement of speaker:

Matthew Lui was born in Hong Kong. He obtained both his MSci and PhD from Imperial College London. From 2014, he has been a postdoctoral fellow for Prof. Thomas Maschmeyer at University of Sydney, where he carries out research on the catalytic valorization of biomass to fuel and chemicals.