
ABSTRACTS (MASTER THESIS)

**Production of deuterated aromatic compounds from lignin
by microwave catalytic reactions**

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Conversion of lignocellulosic biomass is emerging as one of the most important technologies for sustainable production of renewable fuels and chemicals due to its widespread availability, large quantity, non-competitiveness with food supply, potential as platform for green chemicals and high mitigation effects on GHG emissions. In conversion of lignocellulosic biomass, increase in conversion efficiency with low energy input is essential. Microwave heating is attractive for this purpose due to its rapid heating behavior toward the materials with high permittivity loss. In some chemical reactions, acceleration of reaction rate by microwave heating has been reported, and mechanisms for the phenomena have been discussed in terms of thermal and non-thermal effects. In this research, deuterated aromatic chemicals were produced from lignin by microwave catalytic reactions. The reaction efficiency was compared between microwave and conventional heating using the same reaction vessel and temperature profile.

Copper oxide /H₂O₂ reactions were applied to the degradation of lignin from Japanese cedar wood. It was confirmed that the microwave significantly accelerated production of vanillin compared with conventional heating.¹ When the reactions were carried out using deuterated solvents, incorporation of deuterium into vanillin was found. The yield of deuterated vanillin by microwave irradiation was slightly higher than that of non- deuterated vanillin. The promoting effects of vanillin formation was found both for deuterated and non- deuterated reaction systems. Acidolysis reactions with deuterated and non-deuterated solvents were also applied to lignins from Japanese cedar and *Eucalyptus globulus* wood, and incorporation of deuterium into the lignin monomers were found. The yield of deuterated diketone compound produced by microwave reactions were higher than that of non-deuterated vanillin but the differences between microwave and conventional heating was slight. The mechanism for deuteration and effects of microwave reactions on the aromatic monomer formation was discussed.

References

- [1] Qu, C., M. Kaneko, K. Kashimura, K. Tanaka, S. Ozawa and T. Watanabe, Direct production of vanillin from wood particles by copper oxide-peroxide reaction promoted by electric and magnetic fields of microwaves. *ACS Sustain. Chem. Eng.*, **5**, 11551-11557 (2017).