

## Renewable N-containing chemicals from biomass

Dr. Ning YAN

(Assistant Professor, Department of Chemical & Biomolecular Engineering,  
National University of Singapore, 117585, Singapore)



2018年6月28日(木) 17:00–18:00

創成科学研究棟5階 大会議室

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Current manufacturing of nitrogen-containing chemicals are associated with multiple step transformation and high-energy consumption, which might be an opportunity for biomass valorization. Along this line, the concept of “shell biorefinery” has been proposed and developed. A number of nitrogen-containing chemicals, such as amino sugars, amino alcohols, pyrrole, furan derivatives, and liquefied chitin have been produced directly from chitin or chitin derivatives. Whether any of these new routes would be commercially viable not only depends on the overall process efficiency, but also depends on the cost of chitin. At present, the purification of chitin from crustacean shells is environmentally unfriendly and economically ineffective, which requires the establishment of revolutionary fractionation strategies. In addition, development of alternative methods to introduce amine functionalities into lignocellulosic materials and their derivatives are necessary to produce a broad spectrum of nitrogen-containing compounds. Various sugar processing strategies are able to generate a range of mono- and polyoxygenates, with hydroxyl, carbonyl and carboxylic groups being ubiquitous functionalities in biomass intermediates. These chemicals represent a host of oxygenated compounds that could open the door, via well-designed amination strategies, to cyclic and straight-chain monoamines, diamines, aminols, amides, amino acids, etc. Amination reactions have been well studied in homogeneous catalysis but very limited studies have been conducted using heterogeneous catalysts. We target to convince the audience in the talk, via recent progresses from our group and others, that this is an underestimated area with substantial research opportunities.

Dr. Ning Yan holds the position of Assistant Professor at Department of Chemical & Biomolecular Engineering, National University of Singapore (NUS) as a principal investigator and Visiting Associate Professor at Institute of Catalysis, Hokkaido University. He joined NUS in 2012 as Assistant Professor after his three years of post-doctoral work in Swiss Federal Institute of Technology, Lausanne (EPFL), Switzerland. His research interests include sustainable chemistry & engineering, biomass conversion & renewable carbon resource utilization, and advanced catalysis (metal catalyst at nano, subnano, and single-atom scales). He was awarded ACS Sustainable Chemistry & Engineering Lectureship Award in 2018 and RSC Environment, Sustainability and Energy Early Career Award in 2017. He has been elected as the Associate Editor of RSC Advance from Sep. 2015 to present.

問合せ先: 触媒科学研究所 古川 森也 (furukawa@cat.hokudai.ac.jp 011-706-9162)