Green polymers – photo-reusable polymers using dynamic bonds to lignin based polymers

Kei Saito[a,b]

[a]*School of Chemistry, Monash University, Clayton, VIC Australia*
[b]*JST, PRESTO*

Reversible polymers represent a relatively new class of materials that possess bonds capable of reversibly connecting and disconnecting monomers in response to stimuli such as heat or light. These reversible bonds can be used to construct a recyclable polymer via polymerization and depolymerisation, on demand. Photo-chemical reactions, on the other hand, are considered to be greener synthetic pathways because photons do not leave residues, they can be conducted at ambient temperature, and often in the solid-state. Using the green chemical principles, our reversible-polymer designs centre on a biologically-inspired mechanism. Thymine, one of the nucleic acid bases of DNA, has the propensity to reversibly photo-dimerize in the solid-state. Our research exploits this reversible dimerisation to develop novel reversible polymers using di-thymine monomers. The design and synthesis of various di-thymine monomers, determination of monomer crystal structures, and characterization of the photoproducts using NMR, UV-vis, GPC, and other polymer characterisation techniques will be discussed in the presentation.
Catalytic "chemical" depolymerisation of lignin will also be discussed. A new lignin chemical depolymerisation was developed using redistribution mechanism with phenols and copper catalysts under mild condition in water. The advantage of the technology is not just producing oligomers as a source of aromatics but also producing monomers for thermoprocessable lignin based polymers.

Corresponding author e-mail: kei.saito@monash.edu

Author Biography: Dr. Kei Saito is currently a Senior Lecturer at the School of Chemistry, Faculty of Science, Monash University, Australia and also a JST PRESTO researcher. He received his BEng. (2000), MEng. (2002) and Ph.D. (2004) degrees from Waseda University, Tokyo, Japan. He is a member of the ARC Research Hub for Processing Lignocellulosics into High Value Products (PALS) and a Fellow of the Royal Society of Chemistry (UK).

Name: Dr. Kei Saito, FRSC
University/Institute: Monash University
Research Interest: My research interests are in developing new green synthesis and production methods for novel sustainable/environment benign polymeric materials.