Use of ionic liquids for the efficient chemical conversion of biomass and polymers

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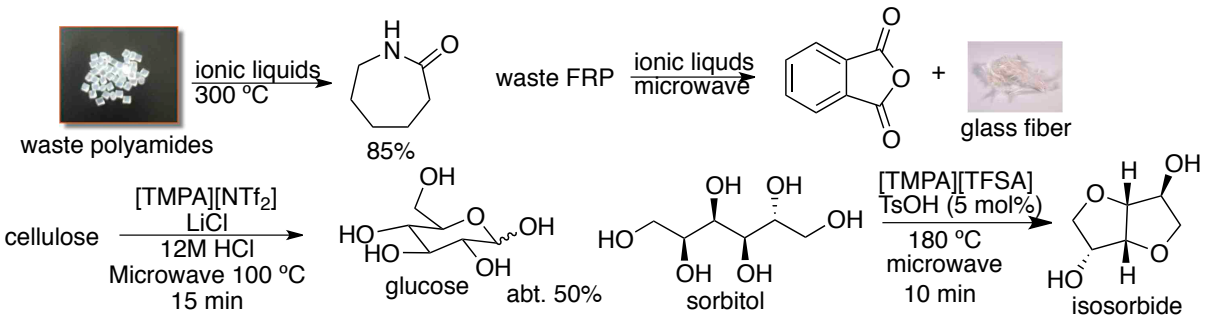
Ionic liquids are recognized as a unique organic solvent and applied to use as an electrolyte and a green reaction solvent. We focused on their non-volatility and less-flammability as a suitable properties for their use at high temperature. Chemical conversion of polymers and biomass usually requires such high temperature conditions. Thus, we thought that use of ionic liquids for such purpose would open a new methodology. In this presentation, we show our recent results on plastic and biomass conversion to useful chemical feedstock by the reaction in ionic liquids.

Polyamides such as nylon 6 were readily converted to caprolactam, corresponding monomer, by treatment with [PP13][NTf_2] at 300 ºC.[1] Caprolactam was isolated in good yield after direct distillation procedure. Extraction was also useful for the isolation of the lactam when hydrophilic ionic liquids were used. Unsaturated polyesters and fiber-reinforced plastic using unsaturated polyester were also converted its monomer by treatment with [TMPA][NTf_2] under microwave irradiation conditions.[2] Glass fiber and phthalic anhydride were readily recovered. The ionic liquids were useful in several times and purified by treatment with charcoal and alumina column.

Cellulose was important biomass and its conversion to glucose and its derivatives has been of interest in sustainable chemistry. Some ionic liquids dissolves cellulose, however, isolation of the products such as glucose remained as a problem. We focused on hydrophobic ionic liquids as the reaction media because simple water-organic solvent extraction was expected to achieve separation. We used [TMPA][NTf_2] for the conversion of cellulose but no reaction progressed if no additives were used in the reaction. Use of LiCl and HCl in [TMPA][NTf_2] progressed an efficient conversion of cellulose, and glucose was isolated in about 50% after the reaction.[3] With our methodology, isolation of glucose was readily achieved by simple extraction method. We recently developed a new rapid conversion of sorbitol to isosorbide in [TMPA][NTf_2] under microwave irradiation.[4]



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