

Material Design and Degradation Engineering for Plastics and Textile Recycling

Hiroshi Uyama

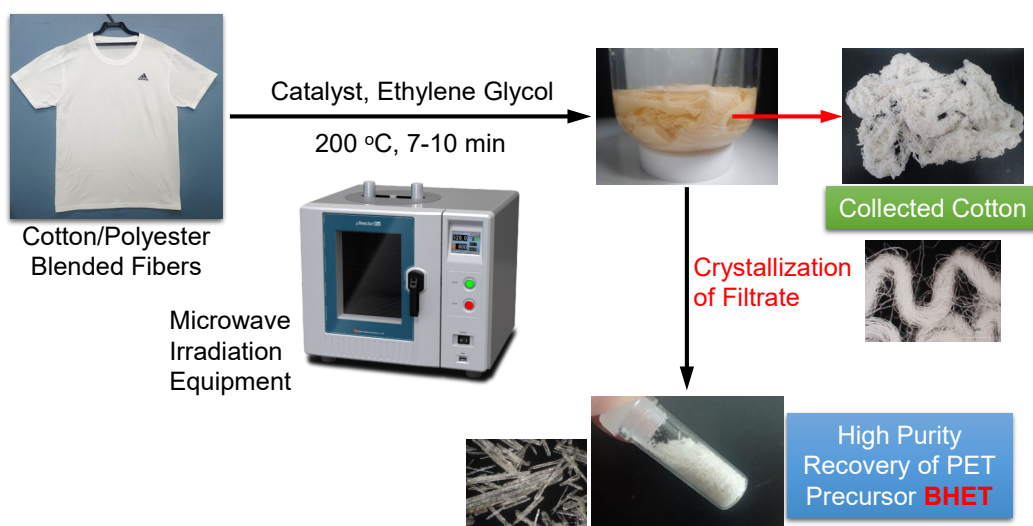
e-mail: uyama@chem.eng.osaka-u.ac.jp

Graduate School of Engineering, The University of Osaka, Suita 565-0871, Japan

Abstract (Times New Roman, 12 pt, justify, not exceed 250 words, justify, graphical abstract can be included but overall abstract pages should not be more than 2 pages)

In the transition toward a decarbonized society, reducing CO₂ emissions and plastic waste is a critical challenge. Plastics and synthetic textiles, especially cotton/polyester blends, are difficult to recycle because of their heterogeneous composition. While mechanical recycling is widely used, chemical recycling offers a promising route for recovering high-purity monomers from complex materials. We have developed a selective chemical recycling process for cotton/polyester blended fibers using microwave irradiation in the presence of a specific catalyst and ethylene glycol (Scheme 1). Within a few minutes, the polyester component is efficiently depolymerized into bis(hydroxyethyl) terephthalate (BHET), while the cotton fibers remain mechanically intact. Ethylene glycol serves as both solvent and reactant, and the selective catalyst enables polyester depolymerization under mild conditions without damaging cellulose. The recovered BHET is purified by simple crystallization with yields of approximately 70%, and cotton fibers are obtained almost quantitatively. This approach is expected to provide a practical pathway for recycling blended textiles and could be extended to other polymer blends, contributing to a circular economy for plastics and fibers. The recovered monomer can be directly reused for polyester resynthesis, enabling closed-loop material circulation. The concept also offers insights into material design for recyclability at the molecular level.

Scheme I



Biography (For Plenary, Keynote, and Invited Speakers)

Name: Hiroshi Uyama

Title: Professor

Affiliation: The University of Osaka

Country: Japan

Phone: +81-668797364

E-mail: uyama@chem.eng.osaka-u.ac.jp



Personal History:

Hiroshi Uyama obtained his Doctor Degree in Engineering from Tohoku University in 1991. In 1988 he joined as an Assistant Professor at Tohoku University and moved to Kyoto University in 1997. He was appointed as a Professor of Osaka University in 2004 and is presently the Professor of Department of Applied Chemistry, Osaka University. He is the recipient of several awards and recognitions, including the Young Scientist Award (Chemical Society of Japan), the Highest Award of Japan Biotechnology Business Competition, and the Mitsubishi Chemical Award (Society of Polymer Science, Japan). He has more than 700 papers and reviews (scopus) and his h-index is 75.

Research Keyword (3-5 keywords use commas to separate each word):

Biomass plastics, Biodegradable plastics, Bio-based polymers and hydrogels, Porous materials