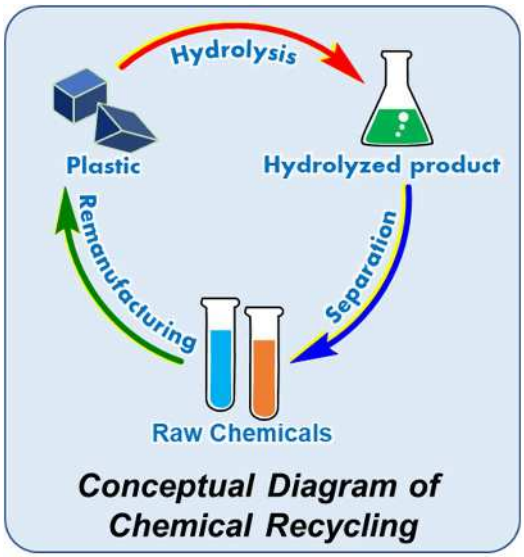
Name	Job Title	Area of Expertise
MOTOKUCHO Suguru	Assistant Professor	Polymer Chemistry, Environmental Materials Science

1. Main Research Topics

Chemical Recycling of Polyurethane

Currently, chemical recycling of polyurethane (PU) products remains a major challenge. Conventional degradation methods often suffer from uncontrollable side reactions, making it difficult to recover the original raw materials in high yield. As a result, practical implementation of closed-loop or horizontal recycling—where recycled materials are used to produce products of the same quality—has not yet been realized.



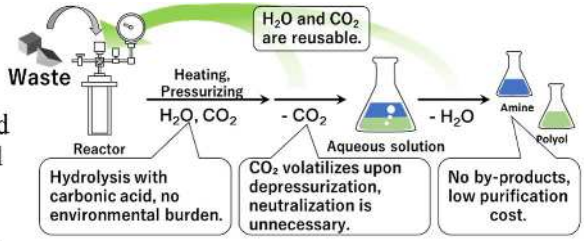
Conceptual Diagram of Chemical Recycling

In this study, we have developed a novel depolymerization process that uses carbonic acid, generated from water and carbon dioxide, as a catalyst. This method enables the quantitative recovery of reusable amines and polyols from model polyurethane without forming any unwanted byproducts.

Key features of our process include:

- Use of carbonated water as the catalyst—extremely low environmental impact
- Carbon dioxide naturally evaporates after the reaction, eliminating the need for a neutralization step
- The reaction proceeds under mild conditions, close to room temperature and atmospheric pressure

We have further applied this technique to commercial polyurethane foam (PUF) products with practical formulations. Using the recovered amines and polyols, we successfully regenerated PUF, thereby achieving complete horizontal recycling of polyurethane materials.



This research not only contributes to sustainable materials circulation, but also provides a highly practical technological platform for companies aiming to develop environmentally friendly products and reduce production costs.

2. Keywords

Chemical Recycling, Polyurethane, Carbon Dioxide, Building a Sustainable Society

3. Remarks and Websites

Patents

WO2025017988A1 Method for polyurethane foam

Topic

https://www.pu-forum.com/en/lecturers/#session2

researchmap : https://researchmap.jp/motokucho
Laboratory : https://www.cms.nagasaki-u.ac.jp/intro/organization.htm