

Multi-University Center on Chemical Upcycling of Waste Plastics (CUWP)

Project Director: Prof George W Huber

Project Objectives: The objective of the Center on Chemical Upcycling of Waste Plastics (CUWP) is to develop the scientific and engineering principles that will enable the circular upcycling of plastic wastes into virgin plastic resins using chemical technology. The center will analyze the supply-chain, infrastructure, capital costs, total economic costs, and environmental impacts of different chemical recycling technology options.

Project Goals: The expected outcomes from this work are:

1. Detailed process models for chemical upcycling of waste plastics.
2. Collection and sorting technology and practice that improve the volume, composition, and quality of bailed plastics from material recovery facilities (MRFs).
3. Production of plastic-derived oils from thermal depolymerization of mixed plastic waste streams in laboratory and pilot plant scale.
4. Catalytic upgrading of plastics-derived oils into aromatics and olefins (plastic monomers) in a continuous flow reactor.
5. Use of solvent-based recycling strategies for converting multi-layer films into pure resins.
6. Development of undergraduate and graduate curriculum material for plastic recycling.

Description of Project: CUWP will focus on two primary plastic waste streams: 1) post-consumer waste (PCW) streams; and 2) post-industrial waste (PIW) streams. CUWP will focus on two main approaches to chemically recycle waste plastics: 1) thermal depolymerization of mixed plastic wastes followed by either catalytic upgrading or steam cracking; and 2) solvent-targeted recovery and precipitation (STRAP) processing of waste plastic films. Three approaches to thermal depolymerization will be explored: thermal pyrolysis, oxo-degradation, and liquid-phase depolymerization. We will also develop catalytic approaches to convert the plastic-derived oils and waxes produced by thermal depolymerization into aromatics and olefins.

Potential Impact of Project: The simplicity and robustness of CUWP's approaches for plastic upcycling have the potential to dramatically increase recycling of plastics, reduce plastic disposal in landfills and reduce uncontrolled release of plastic into the environment. The proposed consortium will improve the selectivity of desired products and the economic attractiveness of plastics upcycling.

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