

## Techno-economic and Life Cycle Assessment of Plastic Waste Recycling for Monomer Production

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Polystyrene waste has become a significant environmental issue as a result of high production volume and its non-biodegradable property. Recycling polystyrene waste provides compelling economic and environmental benefits. In this study, a new approach to recycling is used to depolymerize polystyrene into its starting materials, which are styrene monomers. Process simulations, economic evaluation, and life cycle assessments are part of the study. Data from experiments is used to validate the simulation models. Aspen Plus software is used to simulate the process. The depolymerization of polystyrene waste to styrene monomer is achieved using  $K_2CO_3$  catalyst at  $350^\circ C$  and under 1 atm pressure. Then the monomer is purified via distillation columns to achieve more than 99% purity. An initial economic analysis indicates that the minimum selling price of this process is comparable to the price of the current market for styrene monomer. By comparing the life cycle emissions of this process to the production of styrene monomer from fossil fuels, this process results in fewer greenhouse gas emissions.