

# Systems Engineering Tools for the Separation and Recycling of Multilayer Plastic Films

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Food packaging is a leading global source of plastic waste; this type of packaging often appears in the form of multilayer plastic films, which are composed of up to 17 layers of different polymers that serve key specific goals (e.g., oxygen/moisture barrier and refrigeration). Approximately 40% of all multilayer film production is discarded as post-industrial waste and is not recyclable via mechanical routes. In this talk, we discuss our work on using systems engineering tools for analyzing the economic viability and environmental impacts of solvent-based processes for the separation and recycling of multilayer films. We analyze the interplay between multilayer film design, process economics (associated with separation difficulty), and environmental impacts (e.g., energy use, solvent toxicity). Specifically, we discuss how systems tools serve as a backbone that enables the integration of experimental data, techno-economic analysis (TEA), life-cycle assessment (LCA), and molecular simulations to guide designs and identify new multilayer films and scalable separation processes. We show these capabilities via case studies that target multilayer films provided by industrial collaborators.