Advancing Chemical Recycling through Chemical Thinking and Chemolysis

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Collection logistics and practical challenges related to sorting and conditioning of end-of-live plastics figure centrally among the many challenges in chemical recycling. But it is axiomatic that at their root, all chemical recycling issues are driven by chemical considerations. Arguably, most daunting of them all is the diversity of both the polymers and the non-polymer contaminants in end-of-life plastic streams. Yet incongruously, the considerable art applied by polymer scientists and chemical engineers to assemble diverse polymers generally is not matched with commensurate finesse in their chemical deconstruction into lower-molecular-weight compounds. One thrust of this presentation is to briefly examine the palette of common methods for chemical recycling and then consider an established petrochemical analog for processing complex feedstocks. But its main purpose is to consider how the vision of chemical recycling may be expanded and realized more fully by application of newer chemolytic technology. Through reaction mechanisms corresponding better to the disciplined chemistry used to produce polymers, HydrochemolyticTM technology deconstructs addition polymers like polyethylene, polypropylene, and polystyrene through chemistry more controlled and selective than is possible with thermolytic techniques, thereby obtaining hydrocarbon products of higher function-group purity in higher net yields. Beyond examining the core chemolytic chemistry, results will be presented for continuous-flow, pre-pilot scaleup from rigorous studies in small-scale batch reactors with emphasis on a reaction model that relates feedstock composition and process variables to product quality and yield.