Solvent-Based Recycling of Waste Plastics

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Abstract

Plastics provide many benefits to society. However, with plastic consumption comes plastic waste. Improper plastic waste management is a growing problem. Solvent-based purification (SBP) of waste plastics is one way to address this problem. This type of recycling method uses a selective solvent dissolution process to remove impurities from postindustrial and postconsumer plastic, thereby recovering plastics of suitable quality for reuse. The clean polymer can be recovered from the solution by precipitation. Plastics recycling via SBP is considered a physical recycling process rather than a chemical recycling process. There are several processes that have been developed based on solvent-based recycling of plastic waste. Proctor & Gamble’s PureCycle™ Process uses a solvent dissolution process to recover virgin-like recycled polypropylene (PP). APK AG’s Newcycling® Process recycles multilayer plastics to yield polymers with properties close to virgin materials. Fraunhofer’s CreaSolv® Process selectively dissolves targeted polymer from plastic waste, removing contaminants, and precipitating the resulting polymer fraction. Polystyvert uses a solvent to dissolve waste polystyrene (PS), filtering out contaminants from the PS solution and then recrystallizing the polymer.

In this report, IHS Markit presents the industrial status and a technology review of solvent-based recycling of waste plastics. We present the process economics for

- The PureCycle™ Process for postconsumer PP waste
- A selective solvent dissolution-precipitation process for postconsumer PS foam demolition waste
- A selective solvent dissolution-precipitation process for postindustrial polyethylene/polyamide-6 (PE/PA-6) film waste
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Process description

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Section 200—Polymer purification section
Section 300—Product finishing section
Section 400—Solvent recovery and purification section

Process discussion

Plant design capacity
Feedstock
Solvent and antisolvent
Polymer dissolution and precipitation
Flame retardant separation
Solvent recovery
Material of construction
Environmental

Cost estimate

Capital costs
Production costs
Sensitivity analysis

7 Recycling of multilayer film waste by a selective solvent dissolution-precipitation process

Section 100—Raw material preprocessing section
Section 200—Polymer purification section
Section 300—Product finishing section
Section 400—Solvent recovery and purification section

Process discussion

Plant design capacity
Feedstock
Solvent
Solid-liquid separation
Solvent recovery
Yield
Product
Material of construction
Environmental

Cost estimate

Capital costs
Production costs
Sensitivity analysis

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