GREENBLUE®

FEATURE: LOOP INDUSTRIES

Chemical Recycling
Making Fiber-to-Fiber Recycling
a Reality for Polyester Textiles

Loop Industries: Recycling PET Waste into High-Quality Resin

Loop Industries has developed a chemical recycling process based on hydrolysis which, according to its patent filing, is an exothermic reaction that requires very little added energy for heat and operates at ambient pressure. Loop's technology was developed to process primarily PET bottles, containers, thermoforms and "fines" (small, contaminated particles of PET) from materials recovery facilities (MRFs) and PET recyclers.

Loop's process has a competitive advantage because it can extract more value from a mixed or contaminated bale of PET than is commonly possible with mechanical recycling. For example, PVC is a well-known contaminant in PET recycling streams, and less than 1% can foul a batch of melted polymer. Shrink sleeves on bottles and adhesives from paper labels are other common contaminants for mechanical recyclers.

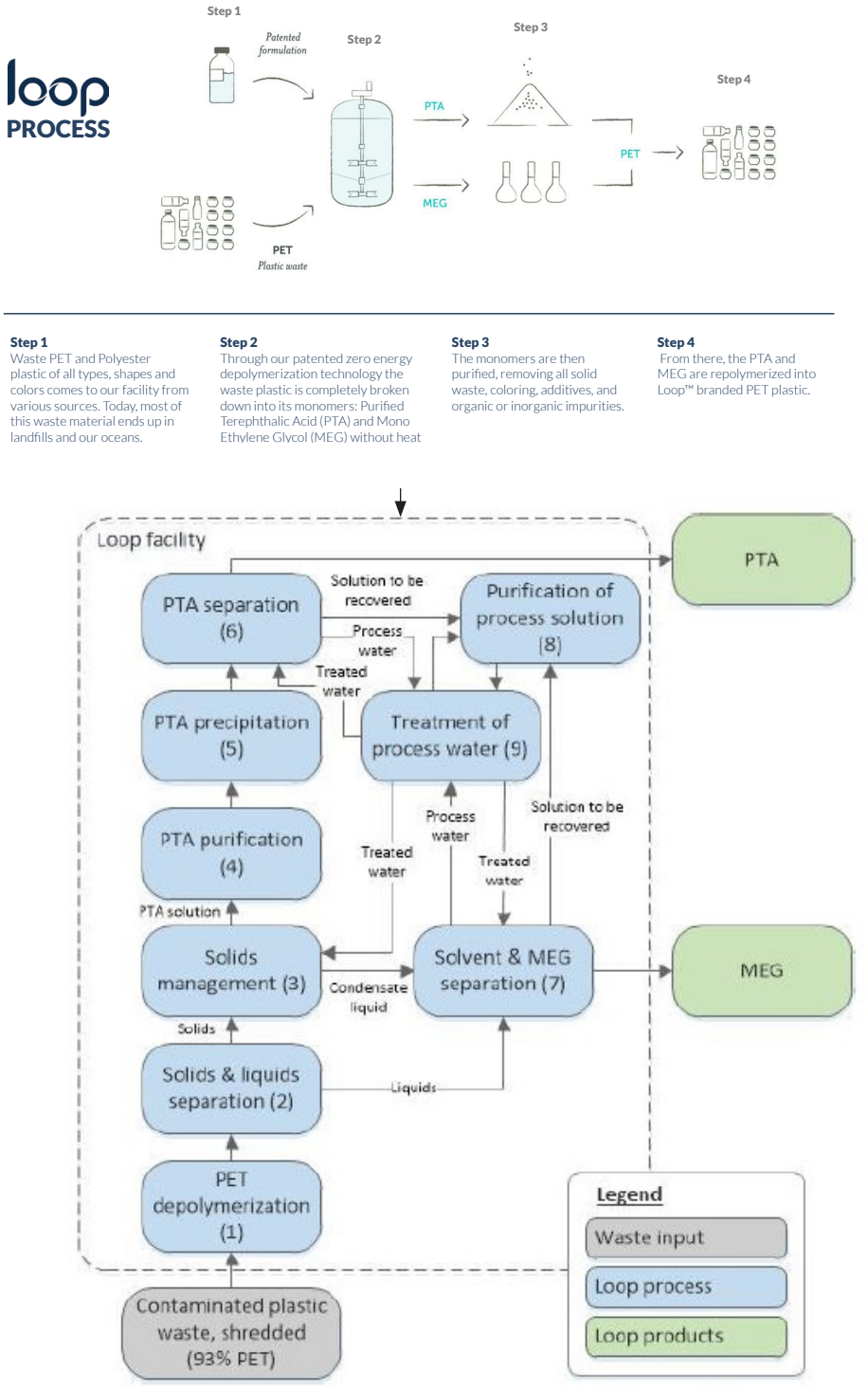
According to data from the most recent NAPCOR/APR report[1], as much as a 30% of collected PET is lost as un-recycled waste due to contamination. Loop's process uses various solvents to selectively dissolve PET fractions into solution, leaving all other plastics intact. The PET solution is pulled out and further purified into terephthalic acid (TPA) and ethylene glycol (EG). Unreacted materials such as other plastics typically used in packaging are float-sink separated to harvest additional value if viable end markets exist, which is the case for polypropylene (PP), high-density polyethylene (HDPE), polyethylene (PE), polystyrene (PS) and polyvinyl chloride (PVC). The process also is capable of recycling packaging that is technically challenging for mechanical recyclers, such as thermoforms, highly crystallized PET (e.g., black, microwavable food trays) and recycling fines.

GreenBlue conducted depolymerization trials with Loop to explore the value of its process for fiber-to-fiber recycling of PET textiles. Trials included post-industrial materials from the contract textile and carpet sectors and post-consumer materials from the apparel sector. Loop considered the results to be promising and is interested in understanding the opportunities and constraints of using PET textile waste as a feedstock for its business.

Chemically recycling PET textiles is harder than recycling PET packaging. The complexity is due to the diversity of materials used to manufacture fibers, yarns, fabrics and finished products, which will present numerous by-products an order of magnitude greater in volume than the by-products associated with processing PET packaging materials. Typical by-products generated by processing textiles will include non-PET fibers from blended fabrics, backing materials, surface coatings such as durable water repellents or soil and stain resistant finishes, dyes, pigments, catalysts, and a host of other process chemistries that remain with the textile as it went to market. Solid and semi-solid fractions of this waste stream may go to a waste-to-energy (WTE) facility if the BTU value is high enough, or to an incinerator or landfill. The liquid fraction is pretreated onsite and released to a local wastewater treatment facility (WWTF). Ninety-five percent of the solvents used are recycled back into the recycling process, with the remaining five percent becoming part of the liquid waste stream.

Loop's primary end product for sale is not monomers, but rather Loop-branded PET resin made from a sustainable source that offers the same quality and material properties as PET made with

[1] NAPCOR and The Association of Plastic Recyclers. Report on Postconsumer PET Container Recycling Activity in 2015. October 13, 2016. https://napcor.com/wp-content/uploads/2017/02/NAPCOR_2015RateReportFINAL.pdf.



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virgin feedstocks. Its process is FDA-approved for food contact applications. Loop has created partnerships with some of the largest global PET bottle and fiber resin manufacturers who will use Loop's recycled monomers to create a brand of recycled resins marketed under the Loop Industries label. Selected resin manufacturers who have evaluated Loop's monomers have noted an absence of certain contaminants such as 4-carboxybenzaldehyde, P-tovic acid, and benzoic acid that are typically contained in virgin-derived p-xylene, the precursor to TPA. These contaminants are filtered out by Loop's patented purification process.

Initially, Loop will offer packaging resins as a blend of 50% recycled monomers and 50% virgin. However, the company can supply customers with 100% recycled content resin under a separate agreement. The technology has already caught the attention of large consumer product companies. In February 2017, Loop signed an agreement with Pepsi to process materials in support of their mail-in recycling program to support their newly launched Drinkfinity™ product line. Consumers receive a pre-paid envelope to mail spent drink pods directly to Loop to be depolymerized and turned into new bottle resin. Consumer product companies working with Loop find it advantageous to have greater latitude to use materials in their packaging designs that are typically considered to be contaminants for mechanical recycling.

Of all the PET chemical recycling technologies GreenBlue investigated, Loop Industries is the only one that will be operating at commercial scale within the next two years. Loop is in the process of expanding its pilot plant in Montreal, Canada to process 45-60 million pounds of PET feedstocks per year. In 2019, the company will open two full-scale plants with the capacity to process 135 million pounds of PET per year at each facility. One plant will be located in the southeastern U.S. and one in Europe. In 2021, Loop plans to add two additional facilities in the U.S. and Europe. The company also has plans to expand operations to Mexico and Asia by 2022.