RECYCLING & RECOVERY

ASSESSING THE FEASIBILITY OF RECYCLING FLEXIBLE PLASTIC PACKAGING

Testing and analysis show potential for single-stream recycling of films and multilayer packaging

Researchers from the American Chemistry Council (ACC), Resource Recycling Systems (RRS), and Idaho National Laboratory (INL) collaborated on an effort that confirmed the technical feasibility and economic and environmental benefits of recovering and recycling flexible plastic packaging (FPP) via single-stream residential curbside recycling.

Cling wrap, grocery sacks, snack pouches, and other types of FPP have long fallen outside municipal recycling streams due to limited end-use markets and lack of technology at materials recovery facilities (MRFs) to recover the FPP. U.S. Environmental Protection Agency has estimated that as of 2018, about 17 billion pounds of FPP waste are generated each year; about three times the amount of PET bottles and containers.[1]

The ACC, RRS and INL team evaluated the environmental, material, and economic impacts of collecting flexible plastics and transforming them into a new product called rFlex. The research dovetails with a multiyear pilot ACC program, Materials Recovery for the Future, that demonstrated the successful flow of flexible plastic packaging with fiber streams using optical sorting equipment and air flow placement.[2]

PROJECT DESCRIPTION

This two-year project established the first U.S. example of loose, cart-based curbside collection of film and flexible plastic packaging along with sortation by a single-stream MRF. The resulting bales of this mixed flexible plastic, known as rFlex, were evaluated for four potential secondary markets: wallboard, durable goods (e.g., manhole covers and fence posts), conversion to pellets, and conversion to film.

To determine the market potential of each pathway, the environmental impacts versus the economic value of each outlet were compared. Each of the pathways will have different quality requirements for the sorted rFlex material, and they will also require extra processing steps to achieve the required quality. All pathways will require shredding of the film. Some will require extra sorting, and some will require washing steps to remove dirt and other surface contaminants.

Optical sorters and ancillary equipment for recovering flexible plastic packaging was installed at a pilot facility, TotalRecycle in Birdsboro, Pennsylvania. Flexible plastic packaging was intentionally collected from over 60,000 residential customers. The research team gathered data on mass balances, utility use, and rFlex product quality. This data informed life cycle impacts in terms of energy use and greenhouse gas emissions for adding flexible plastic packaging sortation to a MRF.

The project team also collected data on the collection, transportation, washing, and reprocessing of the material for each end market pathway. The four product pathways were evaluated in comparison to emissions produced from the manufacture of virgin materials, and a techno-economic analysis model identified the cost to produce rFlex products versus competitive products in each pathway.

[1] Advancing Sustainable Materials Management: 2018 Tables and Figures (epa.gov)

[2] S. Graff, Materials Recovery for the Future Final Report, Feb. 2023

PROJECT NUMBER: 18-01-RR-17

PROJECT IMPACT

The research done under this project shows that recycling flexible plastic packaging leads to lower overall greenhouse gas emissions in each of the market pathways studied, compared to products they would displace. The analysis found that rFlex roof coverboard could achieve the largest emissions reduction of 40% compared to gypsum drywall. rFlex products were also found to be cheaper than their competitors, reducing costs anywhere from 4 to 65% depending on the category.

NEXT STEPS

Due to reduced staffing levels at the pilot MRF due to the pandemic, the achievable capture of flexible plastic found in inbound feedstock was about 75%—lower than the target of at least 90%. Options to increase recovery have been explored and are under consideration by the equipment vendor and MRF operator, including further testing and re-analysis of previous tests for troubleshooting purposes.

Future research in this area would include optimizing MRF separation of the material, incorporating technology to reduce the labor force required for effective sortation, and commercialization of wet and dry wash systems for further processing of the material.

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PUBLICATIONS

Coddington, B. Determining Material, Environmental and Economic Efficiency of Sorting and Recycling Mixed Flexible Packaging and Plastic Wrap: Final Report for REMADE Project 18-01-RR-17. November 2022.

Yingqian Lin, Michael H. Severson, Ruby T. Nguyen, Anne Johnson, Christopher King, Beth Coddington, Hongqiang Hu, Brennan Madden, "Economic and environmental feasibility of recycling flexible plastic packaging from single stream collection," Resources, Conservation and Recycling, Volume 192, 2023, 106908, http://dx.doi.org/10.2139/ssrn.4186807

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