



Foil shred recycling using Thermo Scientific twin-screw extruders

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Plastics are easy to shape, do not corrode and decompose slowly. These properties are advantageous for a wide range of applications, but the extensive use and durability of plastics contribute to significant waste management problems. 260 Mt of plastics are produced annually¹ and the majority, i.e. 38%, is used for packaging². After it has fulfilled its function, it most often reaches its final destination in the waste. Plastic packaging accounts for 76% of the disposed plastic in the EU². Furthermore, plastics are fabricated from petrochemicals and to reduce the reliance on fossil fuels as well as plastic waste one of the key strategies is recycling.

Plastic recycling with twin-screw extruders

Melting and re-extrusion is a traditional recycling approach for plastics. Commonly, single-screw extruders are used in the first recycling stage to reshape shredded plastic waste and co-rotating twin-screw extruders are applied in the second stage to mix fillers, colorants and other additives into the melt. Novel twin-screw extruder solutions combining two twin screw-extruders for improved degassing and odor removal are commercially available with throughputs up to several tons per hour³. However, to investigate recycling solutions and to develop additives etc. down-scaled extruders (saving material and time) are valuable. Thermo Fisher Scientific provides twin-screw extruders in lab and pilot scale with throughputs ranging from 200 g/h to 30 kg/h.



Figure 1: Thermo Scientific Process 16 twin-screw compounder and twin-screw feeder for foil shred recycling.

For plastic recycling applications, co-rotating twin screw extruders provide:

- Excellent dispersive and distributive mixing to balance out fluctuations of input material properties
- Efficient degassing due to constant surface renewal of the melt and hence large degassing surface to remove odour and volatile contaminants
- Optional stripping the melt with water, nitrogen or carbon dioxide for degassing enhancement

Thermo Scientific Process 16 – The pilot extruder for foil shred recycling

While regrind material with high density can easily be fed into the extruder, fluffy foil shred and fibers with low bulk density represent a challenge. Shredding to further reduce the size and compaction is generally expedient. The Thermo Scientific™ Process 16 Twin-Screw Extruder eases feeding of larger foil shreds with a particularly wide feed throat. Blockage is prevented and additional stuffer feeders are available. Special wide throat screw elements in the feed section improve fast conveying of the shreds into the extruder barrel.



Figure 2: Large primary feed port of Thermo Scientific Process 16 twin-screw extruder with wide throat feed screw elements ensures uptake of larger foil shreds.

The dosage of foil shreds into the extruder is realized with an agitated twin-screw feeder equipped with spiral screws and adjustable screw speed. It feeds foil shreds with a broad size distribution (see Figure 3) continuously into the extruder.

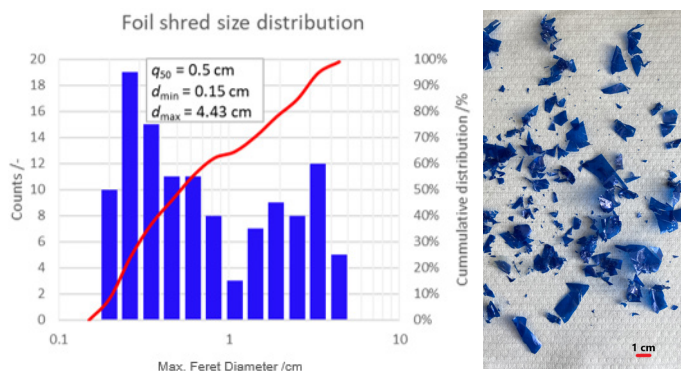


Figure 3: Maximum Feret length distribution (left) of foil shreds obtained by analysis of the displayed image (right).

Another challenge that comes with handling plastic foil shreds is their stickiness caused by electrostatic charge. Some foil shreds tend to attach to surfaces like the feeder outlet and the feed funnel where a larger amount can pile up and cause blockage. An Ionisator placed at the feeder outlet, as displayed in Figure 4, discharges the shreds and allows maximization of the feeder output.

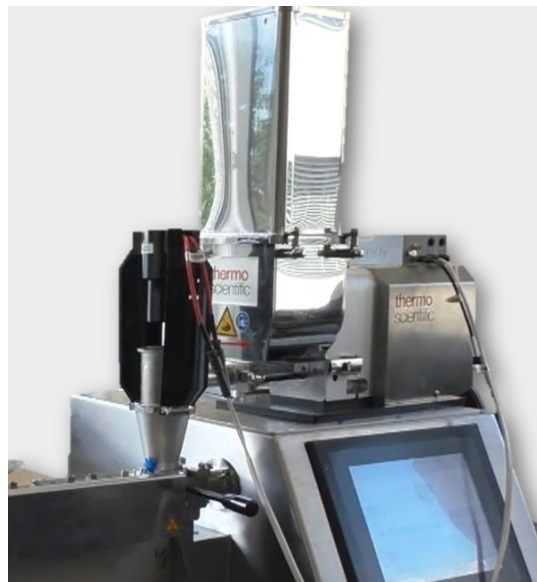


Figure 4: Twin-screw feeder with Ionisator at the outlet tube prevents feed funnel blockage by electrostatically charged foil shreds.

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