FAQs: Why Smaller is Better in Polymer Recycling

Global demand for plastics continues to rise, and current recycling rates are relatively low. In fact, most of the global plastics waste goes into incineration (25%) and landfills (40%), meaning these materials are lost forever as a resource despite the potential for reuse and recycling.[1] In the last few years, however, there has been a societal shift toward sustainability in plastics and packaging. For example, Europe announced a target of 55% for the recycling of plastic packaging by 2030. That's a very large gap to fill over current estimates, but moving toward a circular economy is a step in the right direction. To realize this vision of a circular economy, high-quality polymer recycling is necessary as scientific innovations continue to move us closer to a green future.

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Q: What impact has polymer recycling had on polymer quality?

A: The DIN SPEC 91446 standard for simple classification and comparability of recycled plastics has finally provided answers to quality questions in the polymer industry. The standard divides and classifies recycled polymers into quality levels dependent on available data, such as chain length, purity/impurity, degeneration, sorting quality and other characteristic values. Naturally, if polymers are high-quality and well-defined, they receive a better class. Therefore, high-grade polymers benefit from **well-documented material identification** and thorough **inspection of potential impurities.**

Q: What are a few challenges in polymer recycling and how can they be solved?

A: One of the most common challenges in polymer recycling research is the limited amount of material available for testing. This holds true for pre-sorted plastic waste of a given polymer as well as additives. If material is at a minimum, a large-scale extruder is not able to run. Thus, it is handy to have a smaller system available that can stimulate the same conditions as its larger counterpart. Additionally, a high number of screening tests are required to **select the right additives** and find the **best compound formulation.** While these tests can be performed on a large-scale extruder with sufficient materials, it is much **faster and more convenient** to conduct screening tests on small-scale equipment.

Q: What are the benefits of small-scale extrusion?

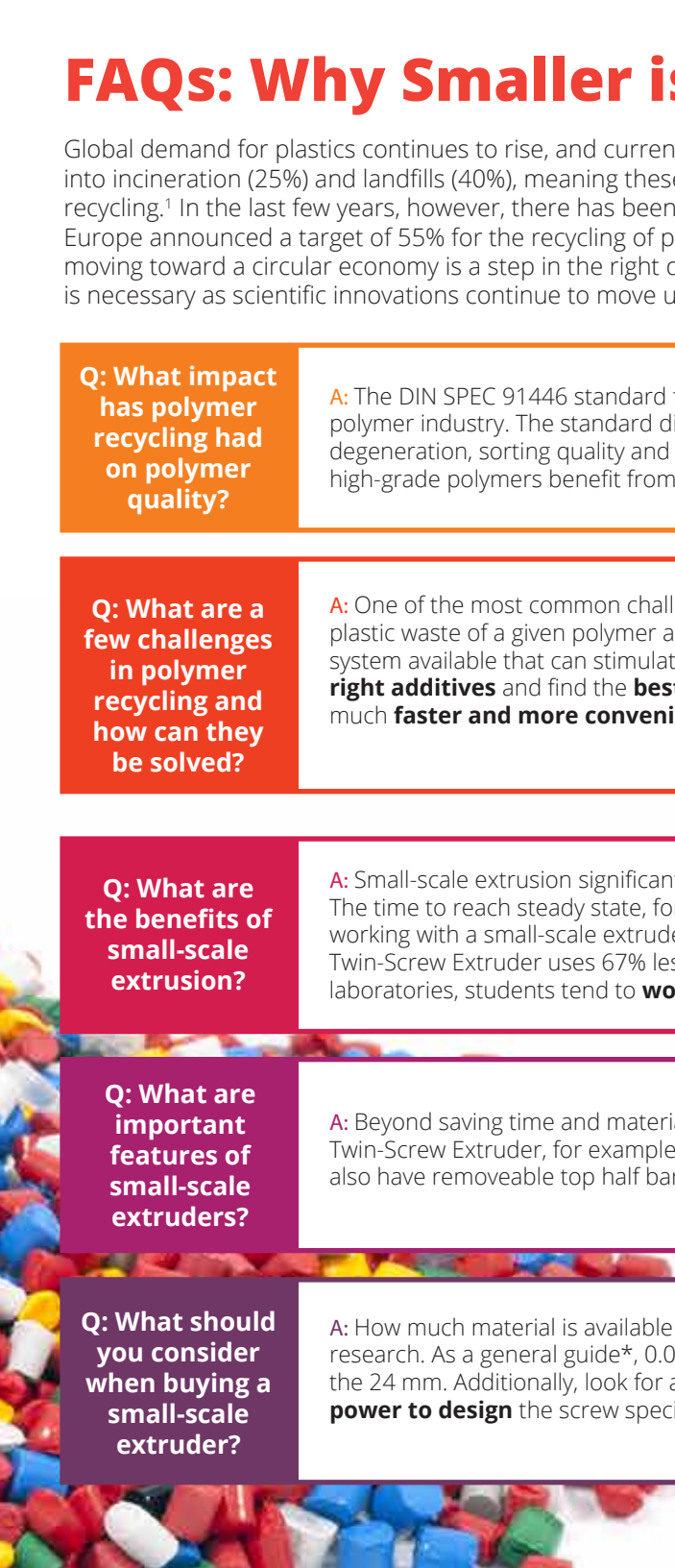
A: Small-scale extrusion significantly lowers experimental time and personnel requirements in the laboratory when compared with larger-scale extruders. The time to reach steady state, for example, is much faster, cleaning requires less time, and less personnel are needed to run a test properly. Additionally, working with a small-scale extruder allows you to **use less material** and **produce less waste.** For example, the Thermo Scientific Process 11 Parallel Twin-Screw Extruder uses 67% less material than a comparable 16 mm extruder and 90% less than a 24 mm extruder. Lastly, for university or college laboratories, students tend to **work better and more confidently** with small-scale extruders at the benchtop.

Q: What are important features of small-scale extruders?

A: Beyond saving time and material, you can also **save lab space**—which is a precious commodity—with small-scale extruders. The Process 11 Parallel Twin-Screw Extruder, for example, has a footprint of approx. 4.8 ft2 . Its 24 mm pilot-scale sibling requires more than 3 times as much. Some small extruders also have removeable top half barrels, which allow **easy cleaning** and a quick way to peer inside the instrument if needed.

Q: What should you consider when buying a small-scale extruder?

A: How much material is available for testing or if a process development is considered will determine the most suited extruder size for you and your research. As a general guide*, 0.02 to 2 kg/h is right for process development with the 11 mm extruder; 0.2 to 20 kg/h for the 16 mm; and 1 to 50 kg/h for the 24 mm. Additionally, look for a **segmented screw design** that allows flexibility in choosing conveying elements and mixing elements. This gives you the **power to design** the screw specifically to your research application.



To learn more about Thermo Fisher Scientific's lab-scale extruder solutions, please visit **thermofisher.com/tse**

[1] https://www.mckinsey.com/industries/paper-forest-prosducts-and-packaging/our-insights/the-drive-toward-sustainability-in-packaging-beyond-the-quick-wins

*depending on material