Impact of Impurities in the Mechanical Recycling of Mixed Fiber Textiles

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Globally, the share of post-consumer textile waste that is subjected to recycling amounts to only 0.5%, while most textile waste ends up in landfills or incineration [1]. Direct mechanical recycling of mixed textile waste, e.g. cotton and polyester fibers, is hampered because of fundamental differences in the structure and chemical constitution of the constituents, which require completely different approaches for their reprocessing. To separate different fiber types, chemical recycling, biotechnological approaches, or mechanical separation processes can be utilized, all of which are connected to their very own drawbacks [2]. The approach of mechanically separating fibers yields reasonably pure material streams of the main fibrous ingredients, however, impurities and contaminants as well as residues from the other fiber type(s), have to be accepted. In particular, minor elements of textiles, e.g. rubber bands or labels, are frequently not completely rejected because of chemical similarities between the main textile fibers and those elements. This would require manual sorting processes, which are economically not feasible. Thus, in a compounding process of recovered polymers, those elements are inevitably present and are hypothesized to play a major role in the mechanical properties of recovered polymers. The aim of this study is to identify potential impurities present in mixed fiber textile apparel and to evaluate their impact onto the mechanical performance of recovered polymers from mechanical recycling. Upon identification and characterization of disruptive elements, model formulations of polyester with known contents of the impurity were processed on a conical, co-rotating twin screw extruder and evaluated for their mechanical performance.

Keywords: polyester fiber, cotton, mixed fiber textil, textile recycling

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References

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