

ABSTRACT – Product parameters with special consideration of fabric blends which are decisive for the eco-design of apparel in order to design a recyclable product

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Abstract: This article deals with the product parameters that are crucial for the eco-design of textile products in order to promote an environmentally friendly and, in particular, recyclable product design in terms of use and recycling. In this context, it was investigated how the consideration of blended fibers from post-consumer end-of-life textiles can support fiber-specific recycling processes to promote a closed textile loop and how parameters for the requirements for the eco-design of apparel textiles can be derived from this.

Keywords: *Eco-design, post-consumer textiles, fabric blends, recyclability, closed-loop*

Introduction: With each circulation of recycling, it must generally be assumed that the properties of the materials deteriorate and therefore have a limited range of applications. It can be deduced from this that the complex composition of textile products should inevitably be included in the discussion of the textile circular economy, for example with regard to the (mandatory) use of recyclates, and should be increasingly addressed when discussing the ecodesign of textiles [1]. This goes hand in hand with the European Ecodesign Regulation published by the European Commission as part of the EU Textile Strategy 2022. In this context, both recyclability and the use of recycled materials are listed for elaboration in Article 5 of the Ecodesign Regulation. These product aspects are to be developed in the coming years and, in addition to other product aspects, are to regulate the sustainable product design of textiles in the long term.

Methods: The separation and determination of individual material fractions are generally assessed as important aspects for sorting and processing to ensure their use as secondary raw materials. In this context, it was investigated how the consideration of mixed fibers from post-consumer end-of-life textiles can support fiber-specific recycling processes in order to promote a closed textile loop [2]. The basis for the considerations of this investigation was the insufficient data situation of this material flow and the required adaptation to current fiber-to-fiber textile recycling processes and those under research. In the course of a data analysis of material flows of post-consumer used textiles, potential recycling routes were addressed and illuminated in this analysis. A sorting analysis of collected used textiles carried out by the Center Textile Logistics has created the basis for collecting well-founded data on the nature of post-consumer used textiles.

Results: The main aspects that emerged from the evaluation carried out are therefore, on the one hand, the number of different material layers within a product. On the other hand, the number of differently identified material types and their distribution within the assigned groupings of reuse or further use and recycling were evaluated. The ten most frequently frequented material blends were evaluated and four specific types of fiber blends were concluded from them, which can be attributed to the majority of the approximately 900 apparel products examined. The specific results of this analysis were used in a further step to derive sustainability-oriented and recycling-based product parameters with regard to the eco-design of clothing.

Conclusions: By considering material flows, of used textiles, the development of potential recycling processes can be supported in their development. Especially when it comes to the economic aspects of such a technological implementation in practice, it is necessary to estimate the feasible amount of products or fabrics and fibers to be recycled [2]. In order to ensure the practice-oriented implementation, eco-design-specific parameters are required in a further step, which allow the products to be fed into material recycling and are of such a good quality that they can be used for re-spinning. Existing and novel recycling approaches do not represent an all-encompassing solution for a circular economy, but can be considered as part of a solution approach. The results and findings from this conducted analysis can and should be used for further surveys in this area and thus drive the research for a textile and apparel industry that is as circular as possible in the future. A first step in this direction is implemented by the obligation of separate collection from 2025 by EU Waste Framework Directive and the adopted Ecodesign Regulation.

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