

## The Environmental Impacts of Textiles Reuse and Recycling: A Review on Life-Cycle-Assessment Publications

**Authors :** Samuele Abagnato, Lucia Rigamonti

**Abstract :** Life-Cycle-Assessment (LCA) is an effective tool to quantify the environmental impacts of reuse models and recycling technologies for textiles. In this work, publications in the last ten years about LCA on textile waste are classified according to location, goal and scope, functional unit, waste composition, impact assessment method, impact categories, and sensitivity analysis. Twenty papers have been selected: 50% are focused only on recycling, 30% only on reuse, the 15% on both, while only one paper considers only the final disposal of the waste. It is found that reuse is generally the best way to decrease the environmental impacts of textiles waste management because of the avoided impacts of manufacturing a new item. In the comparison between a product made with recycled yarns and a product from virgin materials, in general, the first option is less impact, especially for the categories of climate change, water depletion, and land occupation, while for other categories, such as eutrophication or ecotoxicity, under certain conditions the impacts of the recycled fibres can be higher. Cultivation seems to have quite high impacts when natural fibres are involved, especially in the land use and water depletion categories, while manufacturing requires a remarkable amount of electricity, with its associated impact on climate change. In the analysis of the reuse processes, relevant importance is covered by the laundry phase, with water consumption and impacts related to the use of detergents. About the sensitivity analysis, it can be stated that one of the main variables that influence the LCA results and that needs to be further investigated in the modeling of the LCA system about this topic is the substitution rate between recycled and virgin fibres, that is the amount of recycled material that can be used in place of virgin one. Related to this, also the yield of the recycling processes has a strong influence on the results of the impact. The substitution rate is also important in the modeling of the reuse processes because it represents the number of avoided new items bought in place of the reused ones. Another aspect that appears to have a large influence on the impacts is consumer behaviour during the use phase (for example, the number of uses between two laundry cycles). In conclusion, to have a deeper knowledge of the impacts of a life-cycle approach of textile waste, further data and research are needed in the modeling of the substitution rate and of the use phase habits of the consumers.

**Keywords :** environmental impacts, life-cycle-assessment, textiles recycling, textiles reuse, textiles waste management

**Conference Title :** ICTWR 2023 : International Conference on Textile Waste Recycling

**Conference Location :** Paris, France

**Conference Dates :** July 10-11, 2023