



## Safety issues related to textile recycling

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### Several harmful chemicals are used in textile manufacturing

In 2014 about 2400 chemicals were identified to be used in textile manufacturing, some 10% of them were considered to be a risk for human health, and round 5% of them for environment. They include carcinogenic, toxic for reproduction and sensitizing (allergenic) substances. Such substances must be avoided in articles intended to direct and long skin contact. Substances hazardous for environment are often persistent and/or bioaccumulating.

In Finland, in routine spot checks performed by Customs, restricted and forbidden chemical substances are detected regularly in textile products. These include e.g. formaldehyde, prohibited aromatic amines and chromium VI compounds. However, during last years only roughly 2 - 5% of items tested have been illegal. Therefore, most of the post-consumer waste textiles are also safe, but the unknown history of waste textile may weaken the safety.

### Textile waste collected from consumers

Textile waste collected from consumers is quite heterogeneous. Typically it contains different kinds of clothes, underwear and outerwear, and home textiles like curtains, bedspread, towels. In principle, all the textiles collected from consumers can be considered as safe and suitable for their intended use unless contaminated with harmful substances during or after their primary usage.

### Textiles collected from companies

Textile batches collected from companies is more coherent in composition than those origin from consumers. In addition, the history of the waste textile is potentially known. However, some issues may restrict the further utilization the textile waste. Textiles intended to public facilities, for example, are typically treated with flame retardant. In addition, working clothes are often flame-proofed. The fire retardant treatment can be persistent or may disappear during wear and tear or during washing cycles. If persistent treatment is applied, and textile product's lifetime is long, it may contain also substances forbidden or restricted nowadays.

### Purity demands of waste textile from product safety point of view

Probability of textile containing certain harmful chemicals vary based on product types, but there is a lot of variation. During sorting visibly dirty textiles can be sorted out, but if contamination invisible or odorless, it is impossible to detect using senses only.

Different kinds of textile products are subject to different kinds of requirements, which may restrict new uses of recycled materials (especially via mechanical recycling) e.g. for children's and/or skin contact products. In direct skin contact, some chemical substances are forbidden (e.g. lead chromate containing dyes), and several are restricted (e.g. formaldehyde, certain azo dyes, Cr (VI) compounds, perfluoro octanic acid (PFOA)). This may restrict the further use of waste textile, especially when mechanical recycling is applied.

One possibility to ensure the quality and purity of waste textile is to use different kinds of analytical techniques. The suitability and efficiency of some on-line techniques is under discovering.

### Textile dust formation during processing may cause occupational health risk

For textile and other organic dusts, an occupational hygiene limit is given for 15 min and 8 h exposures. Most potential process steps in which lot of dust formation may occur within mechanical recycling process, are shown in Figure 1. In these steps the exposure of workers to harmful chemicals, and microbes, e.g. molds and spores, existing in the dust, is also possible.

### Global, EU and national rules exists

Restrictions for chemicals, also those of textile products, are defined in various global, EU or national regulations. All these aim to eliminate or restrict the production and use of harmful compounds. Persistent organic pollutants (POP) are globally regulated by Stockholm Convention. In EU, the use of chemicals are controlled by REACH Regulation (include listings of substances that need authorization, and restricted substances). National regulations may also exist, like in Finland, a restriction for formaldehyde amounts in textile products is in force.

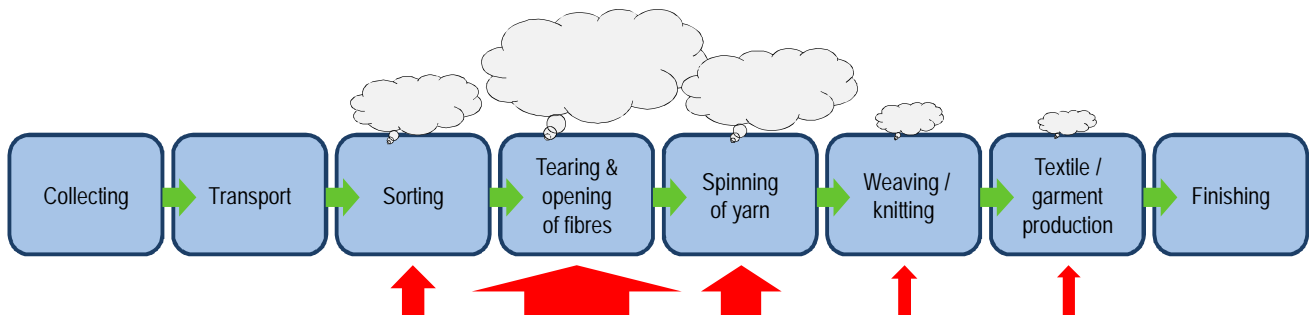


Figure 1. Mechanical textile recycling process from discarded textiles into new textile products.

The process steps in which dust formation may most probably need additional risk management measures are marked with red arrows.

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