

# Safety issues related to recycling waste textiles

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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 (allergens) 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, such as formaldehyde, prohibited aromatic amines and chromium VI compounds. During last years roughly 2 - 5% of items tested have been illegal.

## Textile waste collected from consumers

Textile waste collected from consumers seems to be 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. Except those textiles, potentially contaminated with harmful substances after their primary usage. Typically the history of the waste textiles collected from consumers is unknown.

However, it must be noticed, that different kinds of textile products are subject to different kinds of requirements. This may restrict the further use of waste textile, especially when mechanical recycling is applied. For example textile products planned for children or in direct skin contact typically have additional purity demands. In direct skin contact, some chemical substances are totally forbidden, e.g. lead chromate containing dyes, and several are restricted, e.g. formaldehyde, certain azo dyes, Cr (VI) compounds, perfluorooctanoic acid (PFOA), etc.

## Textiles collected from companies

Textile batches collected from companies may be bigger and more coherent in composition than those origin from consumers. In addition, the composition and history of the waste textile is potentially known.

However, some issues may restrict the further utilization of the textile waste, for example, flame retardant or moisture resistant treatments. The textiles intended for public facilities are subject to detailed instructions for their fire resistance and thus normally treated with flame retardant. In addition, working clothes are often flame-protected. 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 in product safety point of view

The fraction of waste textile collected from consumers is heterogeneous, but in principle it can be considered as safe for consumer products. Amount of illegal textile products is known to be quite low, only 2-5% of tested. The unknown history of waste textile may weaken the safety. By sorting the waste textiles in separate fractions based on textile product groups, such as jeans, will decrease the composition's variety in waste textile fraction. However, also in this case there might be a lot of variation in textile chemicals applied during manufacturing of the textile product, like in the use of dyes. During sorting of visibly dirty textiles, contaminated e.g. by motor oil, can be sorted out, but if contamination is invisible or odorless, it is impossible to detect only using senses. 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 discovery.

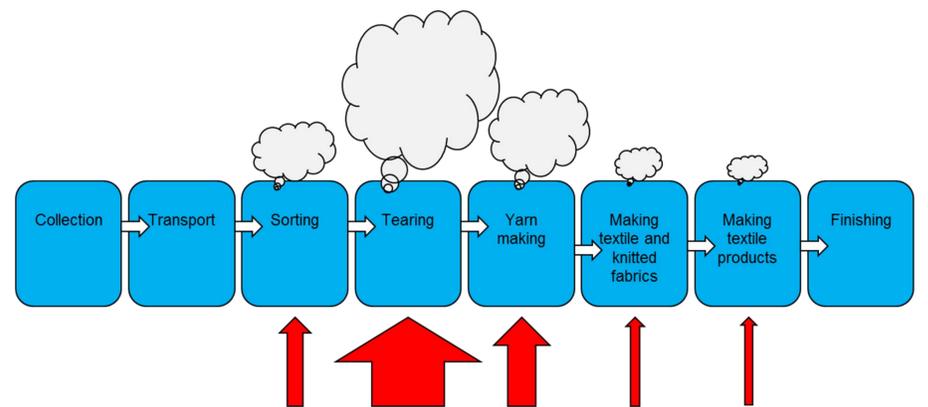


Figure 1. Mechanical textile recycling process. The process steps in which dust formation may most probably need additional risk management measures are marked with red arrows.

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

For textile dust which is organic dust an occupational hygiene limit is given for 15 min and 8 h exposure. Most potential process steps in which dust formation may occur is in Fig. 1. During process steps in which a lot of dust is formed the exposure of harmful chemicals, and microbes, e.g. molds and spores, existing in the dust, is also possible.

## Global, EU and national rules exist

Restrictions for chemicals, also those used in textile products, are defined in various global, EU or national regulations. All these aims 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. In Annex XIV the substances that need authorization are defined, and in Annex XVII restricted substances are listed. National regulations may also exist, like in Finland, a restriction for formaldehyde amounts in textile products is in force.

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