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ASPECTS ON THE WASTE MANAGEMENT OF TEXTILE MATERIALS

Ph.D.Eng.Lecturer Anca SERBAN
Ing. Valentina BOUNEGRU
"Dunarea de Jos" University of Galati

ABSTRACT

In the category of waste, an important place belongs to textile and leather waste. Textile wastes come from textile packaging, yarns, fabrics, knitwear, nonwovens, from which new raw materials are used to produce thick wool or cotton yarn, also for packaging, technical products, blankets, carpets. The textile industry affects the environment through high water consumption, energy, and chemicals, as well as a large amount of waste that it generates as a result of the use of an impressive number of chemicals and technological processes, which requires a permanent activity of waste reducing and capitalizing.

KEYWORDS: textile waste, chemicals, recycle, reuse

1. THE ENVIRONMENTAL PRESSURES

The textile industry affects the environment by the high consumption of water, energy, and chemicals, as well as by a large amount of waste that it generates as a result of using an impressive number of chemicals and technological processes which leads to a constant activity of waste recycling and capitalization.

The textile materials as raw material are very high resource-consuming during the production process because they go through many processes until the final form, specific to each type of material, such as: solvent washing, dyeing, printing, drying and fixing, finishing, applying films and rolling.

All these processes involve significant emissions to air and water, which involves the implementation of some preventing methods and reducing them, such as physic, chemical, and biological treatment plants for wastewater and installations for reducing suspensions, greenhouse gases, and volatile organic compounds.

2. THE ACTIVITIES IN THE TEXTILE INDUSTRY

The activities of the textile industry are distributed all over Europe but are particularly concentrated in a few European Union countries. Thus, Italy is the main European producer way ahead of Germany, England, France and Spain. These five countries all together are liable for over 80% of the textile and clothing industry of the European Community.

The old system of nomenclature (NACE 1995) classifies the activities of the textile industry as follows [1]:

- artificial fibre industry
- wool
- cotton
- silk
- flax / jute
- knitting
- finishing
- carpets
- other textiles
- canvas for household

Instead, the new system of nomenclature (NACE 1997) identified the following categories [1]:

- Textile yarn
- Fabric
- Finishing textile

- Domestic textile
- Industrial textile
- Fabric and knitted articles

The textile industry covers a wide variety of products such as hi-tech synthetic yarns, wool, bedlinen, industrial filters, geo-textiles, clothing. The clothing and textile industry had a contribution of 5 to 10% of global environmental impact throughout the EU [2].

3. THE TEXTILE WASTE CLASSIFICATION

The classification of textile waste according to certain criteria [3]:

-by the fibre's nature: natural and synthetic

-by the provenance place: pre-consumption (industrial) and post-consumption (domestic)

-by the colour: unicolour, multicolour

-by the electrostatic charge: with and without electrostatic charge

-by the degree of soiling: clean and dirty

-by the ecological impact: very pollutant, pollutant, non-polluting

-by their type: fibres, yarns, filaments, fabrics (patches, strips), knits (patches, strips), non-woven fabrics (from tailoring, tailoring, manufacturing).

The main lots of waste are [3]:

-The wastes of group A are natural and chemical fibres upon first use, but also natural fibres by processing (scoured, sorting, cleaning, melting) of which 40% are lost.

-the wastes of group B are technological wastes in the yarn ends form, semi-products from the spinning mill that resulted from the first stage of fibres and yarn processing.

-the wastes of group C are technological wastes resulted from weaving mills, knitting, clothing, non-woven textiles.

-the wastes of group D are collected or post-consumption wastes in the form of clothing, products to be cleaned and processed by cutting, opening-blending, defibring which are high energy consumers.

4. THE WASTE ROUTE IN A GARMENT FACTORY

The sources and the lifecycle of the waste were followed within a shirt factory in order to show the efficient use of materials but also the management of all types of waste. The study aimed to characterize the waste management system in the garment factory during a year.

In the April-May period (fig.1) the resulting quantities of textile waste are higher due to the thick fabrics used in long-sleeved products.

Considering that in January, February, March they used light and thin materials, for the spring-summer collection, while in April-June they worked for the winter collection of the following year, a conclusion can be drawn regarding the efficiency of using the materials.

The best ratio of pieces/waste quantity based on the number of pieces of shirts tailored it was obtained in November, namely 10 g of waste/shirt. This is explained by the fact that in September-December they are working with thinner materials for the spring period (fig.2).

Higher values of the amount of textile waste in other months, such as May of 25.4 g / shirt denote not necessarily a lower efficiency in the use of the material, but the amount of waste must be reported to the material thickness because in the spring months they work shirts for the next winter (fig.3).

Other wastes generated within the textile factory during a year are:

- cardboard: 2.000 kg/ month (cardboard rolls, bales, boxes, patterns),
- foil: 500 kg/month (vacuum foil, fabric bales foil, packing bags),
- paper: 300 kg/month (sketches, thumbnails, various packages from the auxiliaries, descriptions, the paper under the sponges),
- plate sheet: 100 kg/month (patterns, cloth, packaging, cleaning solutions for shirts, defective parts),
- plastic: pipes, bales, bottles, hoses, defenders, crates, baskets, thread,
- wood: pallets, countertops from sewing machines,
- lighting tubes.

The company that deals with the collection of all fractions of waste within the factory is a society with a wide spectrum of waste collection and capitalization.

In a garment factory, the production of shirts is influenced by the fashion trends of the season as well as by the forecasts for the next season, such as colour, fabric, and pattern.

The season starts in March. The garments are made in the summer for the winter period (long sleeve, thick fabric) and in winter for the summer period (silk, short sleeve).

In a textile factory of shirts, we investigated the waste flow from the manufacturing process as well as the quantities resulting from a year's production.

5. CONCLUSIONS

The main environmental problems resulting from the activities in the textile industry mainly relate to the pollutant emissions in air and water and to energy consumption. And of these, water consumption and pollution have the highest weight. The textile industry uses water for removing the impurities, dyeing, finishing

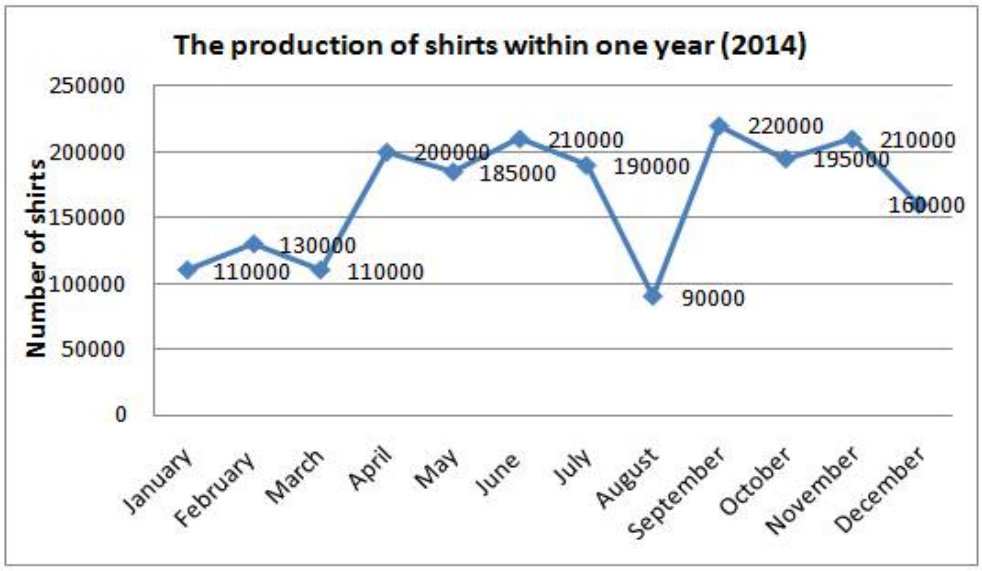

Fig. 1. The number of shirts in every month of the year

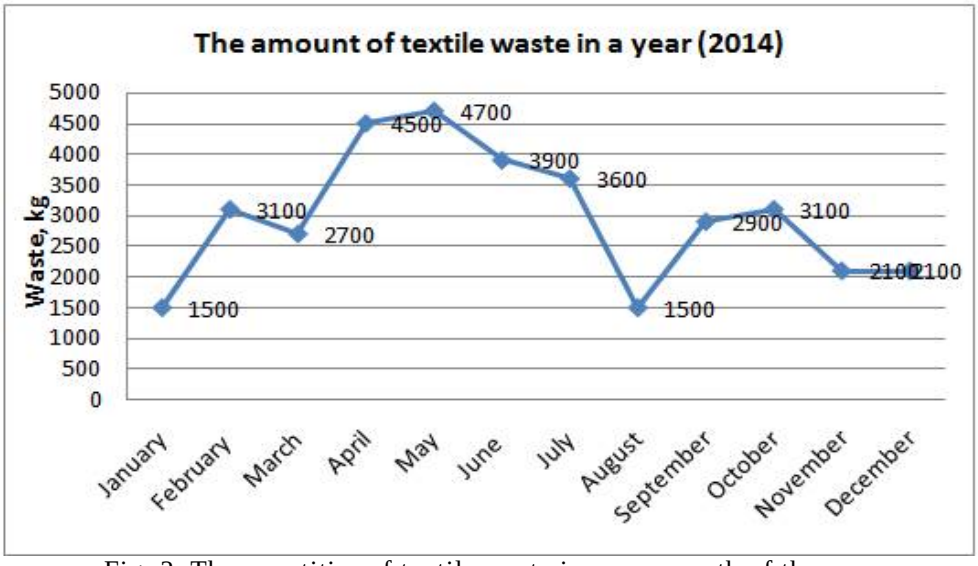

Fig. 2. The quantities of textile waste in every month of the year

Fig. 3. The quantity of textile waste for a shirt specific to each month of the year

agent application, and steam generation.

A large percentage of the total emission resulting from activities in the textile industry is attributable to substances that pre-exist in raw materials before they enter the chain of finishing processes. These are generally [1]:

- gluing agents;
- processing agents;
- impurities and associated materials from natural fibres.

Gluing agents are used to help the weaving process. They are then removed from the fabrics before the finishing processes, thus resulting in increased levels of organic load in the water.

The processing agents and spinning oils are used to treat the fibres at various stages of the process, from the production stage (in the case of synthetic fibres) to the production of spun yarn. These organic substances are then removed during the preparatory step carried out at the finishing plant either by a wet process (washing) or by dry processing (high temperature adjustment). In the first case, these organic substances contribute to the increase of the organic load in wastewater, and in the second case, they will be found in the air [1].

All types of natural fibres contain a certain percentage of impurities and associated materials. The associated substances are component parts of natural fibres (line fat, pectin, and hemicellulose in cotton wool, lignin for linen, and sericin for silk). Impurities are metals, minerals, and pesticides. All these substances must be removed from the fibres before they go through the finishing processes. Impurities and associated materials, therefore, have an increased potential for environmental impact. The amount of chemicals and additives added during finishing processes can reach up to 1kg per kg of processed textiles. The number of these substances is over 7000 additives. Other substances such as dyes are responsible for other environmental issues, namely decreasing the access of light through water to aquatic plants, decreasing the elimination of organic compounds or absorbable organically bound halogens (AOX) or metal, especially for certain types of dyes [1]. The greatest effect on the environment of the substances used during processing is salts, detergents, and organic acids.

In terms of air emissions, volatile organic compounds are released into the air as a result of specific technological processes such as [4]:

- Printing and cleaning processes, in cases of using organic solvents.
- Treatments at high temperatures when textiles contain substances that evaporate or thermally degrade (oils, finishing agents, plasticizers, etc.).

The emissions of CO_2, SO_X, NO_X, and particles associated with the process of burning fossil fuels in order to obtain thermal energy have also an important environmental impact [4].

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