# Issues in the textile industry

The Textile Industry

1. An overview of the textile industry

The textile industry is regarded a major and largest industry around the world in terms of its output, production and employment. It brings a large contribution to various national economies including both global small and large-scale operations (Parvathi, et al., 2009). The textile manufacturing is based on the conversion of three types of fibre, the most one being yarn then fabric and finally textile. The fibres are then manufactured into clothes and others.

However, the textile manufacturing originated from hand craft practices by spinners, weavers and some skilled craftsmen. The first textile companies surfaced in the United Kingdom and the Western European countries. This came with the new technological developments that were being introduced (Warshaw & Leon, 2011).

According to Warshaw and Leon (2011), the term textile industry was initially concerned only with the weaving of fibres, but today it involves a variety of processes. Therefore, as illustrated by Greenberg (2003), the production of textiles involve processes like; spinning, weaving, knitting, dyeing and finishing of different natural and synthetic fibres. Today, wet processing is used in the finishing treatment of textiles. It is further categorised into 3 more processes, which is the; preparation process, coloration process and finishing process.

2. Hazards present in the textile industry

There are various hazards to which the textile workers are exposed. These hazards are categorised as; (i) exposure to chemical substances, (ii) exposure to physical agents, (iii) exposure to biological agents, (iv) exposure to dusts and fibres, and also (v) psychosocial hazards (European Agency for Safety and Health at work, 2008).

1. Exposure to chemicals

The spinning, weaving and knitting process do not involve high use of chemicals. The most substantial chemicals used in these operations are sizing agents like starch and other polymers such as lubricants to prevent yarns from being entangled. There is a wide variety of chemical substances used processes such as dyeing, printing, finishing, bleaching, washing, dry cleaning, sizing and spinning. The most commonly found chemicals are dyes, solvents, optical brighteners, crease resistance agents, flame retardants, heavy metals and anti-microbic agents. Textile fibres, reactive dyes, synthetic fibres and formaldehyde are the respiratory and skin sensitisers that can be identified in textile industries (European Agency for Safety and Health at work, 2008). The dyes that are used for cotton are usually classified into three groups; firstly is the water soluble dyes, secondly are dyes soluble by alkaline reduction and lastly are the dyes formed on fibre. In addition, workers may be also exposed to aliphatic hydrocarbons, such as mineral spirits and kerosene, which are used for cleaning of equipments and parts of the plants (Greenberg, 2003)

2. Exposure to physical agents

From the European Agency for Safety and Health at work (2008), it has been concluded that textile workers are exposed to various physical agents such

as noise and vibrations during the weaving, spinning, sewing, twisting and cutting process. As such, being exposed to very high noise level can result in permanent hearing damage while exposure to vibration along with other risk factors for Musculoskeletal Diseases can cause long term harm. It has been noticed that workers are also exposed to electromagnetic fields.

3. Exposure to biological agents

Biological agents are also present in the textile industry, in processes like carding and willowing. The workers are exposed to anthrax, clostridium tetani and coxiella burnetti. These can cause allergies and respiratory disorders. Normally, work areas having air conditioning systems and high humidity, the workers tend to have allergies and respiratory problems caused by moulds or yeasts.

4. Exposure to dusts and fibres

People working in the textile industry are usually exposed to airborne particles formed from both the natural and synthetic fibres in their work environment (Oldenburg et al., 2007). Studies have shown that workers in the textile industry are more prone to respiratory symptoms caused by cotton dust (Wang et al., 2003). In UK, the Workplace Exposure Limit (WEL) for inhalable cotton dust has been fixed at 2. 5 mg/m $^3$ for an 8 hour time weighted average (HSE, 2005).

5. Psychosocial hazards in the textile industry

Employees experience work-related stress when they are unable to cope with the work demands. The WHO (2003) define work-related stress as “ the response people may have when presented with work demands and

pressures that are not matched to their knowledge and abilities and which challenge their ability to cope". As such, psychosocial risks have been considered as being an integral factor of the process of stress. On the one hand, these can be in relation to the job content, the organisation and management of work, environmental and planning conditions while on the other hand it can be in terms of the competence and needs of employees. The interaction between all these factors can be dangerous to the health of employees through their perceptions and experience (Cox et al., 2002). According to the WHO (2010), psychosocial risks and work-related stress are closely associated. However, textile workers are faced to psychosocial risks since they have to perform repetitive and fast paced tasks and they cannot take any decision by themselves.

3. The textile industry and green technology

The textile industry has experienced a lot of changes and there has been the introduction of many new technologies. Today, it has been seen that there is a shift to more eco-friendly processes and chemicals used in the textile industry. These include the use of novel biopolymers along with some enzymes. The use of greener dyes forms part of the essential constituents of green technology. The other constituents of green technology in the textile industry encompass systems which include waste water reduction by recycling, automatic process control and other filtration techniques (Sekar, 1999). In the dyeing process, the usage of water accounts to approximately 30-60 litres of water for 1 kilogram of cloth, thus new technologies to minimise the use of water is being adopted (Deo & Wassif , 1999). The new

technologies that have been introduced in the textile dyeing and finishing process are as follows:

- Plasma Treatment Technology

Plasma is the state of a gas when its kinetic energy increases to such an extent that the energy is equal to the ionisation energy of the gas. At this stage, the rapid cascading of ionisation caused by the collisions of the gas particles result in plasma. Plasma is the 4 $^{th}$ state of matter.

In addition, the plasma technology is applicable to the textile industries. It alters the chemical structure and surface properties of fabrics, chemical matters are deposited for better functionality and substances are removed from the fabrics to improve the applicability. The plasma technology is used mainly in the processes like pre-treatment, dyeing and finishing (Shah & Shah, 2013). It is a green and simple process.

- Super Critical Dyeing Fluid

A substance which is under a pressure above its critical temperature is known as a super critical fluid. There is no distinction between gases and liquids under these specific conditions and the substance is then characterised as a fluid. As such, super critical fluids possesses the same solvent power as light hydrocarbons used for most solutes.

Super critical fluids is advantageous to the textile processing because of their ability to combine the properties of gases and liquids. Also, their solvating power is equivalent to their density while when referring to their viscosity, the normal gas possesses a similar one. However, it is this particular combination which gives it such impressive penetration properties.

The dyeing process favour this increase in density along with the increased power of solvation because of the positive effect that it has on the dissolution of disperse dye in the super critical carbon dioxide medium (Kannan & Nithyanandan, n. d.).

- Ultrasound

The use of ultrasound in the textile industry started only after synthetic materials and their blends were introduced. It is applied mainly in mechanical processes (weaving, knitting and finishing) and wet processes (sizing, scouring, bleaching and dyeing). Ultrasound has a lot of benefits such as; the processing time and energy consumption is decreased, it enhances the quality of products and the use of auxiliary chemicals are reduced. For instance, using ultrasound in the dyeing process will replace expensive thermal energy and chemicals by electricity. Various experiments were carried out to show the effectiveness of ultrasound on textile and it has been shown that the adsorption power of disperse dyes on cellulose acetate is influenced greatly by ultrasound compared to the dyeing rate when using direct dyes ( (Prince, 2009).

- Electrochemical Process Technology

Traditionally, electrochemical techniques were used only for compounds synthesis and treatment for metal recovery but today its use has been expanded to the textile industry. In order to obtain functionalised fabrics, electrochemistry is applied for the production of smart textiles. However this technique is used mainly in the bleaching of cotton fibres and finished denim fabrics.

Electrochemical process is also applied in sulfur and vat dyeing processes to reduce the amount of dyes used making the process eco-friendly since it will not involve the addition of chemical reagents like sodium dithionite (Mireia & Carmen, 2012). Electrochemical dyeing process has advantages like; product saving, less chemicals used, incomparable environmental compatibility and better quicker properties is achieved. Good reproducibility also is set by using electrochemical dyeing. (Das, et al., 2012)

- Nanotechnology

Nanotechnology is concerned with materials which are 1 to 100 nm long. The use of nanotechnology in the textile industry increase the durability of fabrics. This is because nano-particles possesses large surface area-to-volume ratio and high surface energy which means that they have better affinity for fabrics, thus increasing the durability of the function. The sporting industry, skincare, space technology and clothing are some examples where the nanotech enhanced textiles are being applied. It ensures that the wearer is better protected when exposed to extreme environments. Therefore, to treat textiles with nanotechnology materials is a way to enhance the properties of the fabric by making it more durable and have nicer colours (Kiron, 2013).

4. Impacts of textile industry on environment

The textile industry is a diversified industry being from the raw materials used to the various techniques adopted. At each steps involved in manufacturing fabrics, there are a number of environmental impacts associated with them which are also varied. For instance, the spinning,

weaving and industrial manufacture of garments affects the air quality while the dyeing and printing processes use up large amount of water and chemicals. Also, there is the emission of several volatile agents into the atmosphere which have harmful effects on the human health (Challa, n. d.).

In addition, each stages of the textile processing generates innumerable wastes streams which are of liquid, gaseous, solid or hazardous nature. The type of textile processes, technologies used, chemicals used and types of fibres will determine the nature of wastes generated. However, the most prevailing environmental impact is the water body pollution which arises due to the disposal of untreated effluents. The second greatest environmental problems caused by the industry are air pollution caused by Volatile Organic compounds (VOC) and other air pollutants. The VOC does not only affects the environment but also the workers and public health. The noise level emitted by textile machineries can also harm the environment by disturbing the natural habitats of various species in the area (C Parvathi, T Maruthavanan, C Prakash, 2009).

5. The role of textile industry in the Mauritian economy

The textile industry was set up and appeared in the government agenda of Mauritius in the 1960s. The industry then experienced a drastic expansion during the year 1980 to 2000. Mauritius was faced with a series of positive conditions for the past 30 years. These conditions helped the country in achieving a solid textile industry along with foreign and local investment. The industry was regarded as the main employer of Mauritius and contributed to 12 % of the GDP.

However, the textile industry has not only brought a lot of improvements and developments to the economy of the country, but it can be said that its success also coincides with the social changes that came along. The first change is that it has encouraged the emancipation of women. Many women were employed when the textile industry developed. In fact the number of women being employed today also is increasing. The women, who were once viewed as housewives and who did not have the opportunity to study, were regarded as an important pool of labour. Working women started to bring income in the family and this eventually changed their role; they were no longer considered as docile housewife but an independent income earner. The second change is that the status of families has increased from the past years since a working woman helped in increasing the family income (Joomun, 2006).

Today, the textile industry of Mauritius has achieved a very high status among other countries and there is currently about 174 textile entreprises employing approximately 55000 people. The industry has invested continuously on innovation and greener production to satisfy the demand of the global market which is emphasising more on eco-friendly practices and products. [1] http://www. gov. mu/portal/sites/nsp/industry/greenertex. htmIn 2009, Mauritius was ranked as the second largest buyer of machineries, accounting to 2300 machines and 9 % of the global sales. Mauritian manufacturers have also invested in latest cleaner technologies and reorganised their activities so as to combat against the low-cost competition of Asian countries. As such the Mauritian and Indian Governments have collaborated together and signed a contract for the transfer of new

technologies along with deciding on ways of improving the performance of the textile sector in Mauritius [2] http://www. fibre2fashion. com/news/textile-news/mauritius/newsdetails. aspx? news_id= 119742