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Sustainable Development in Textile and Clothing Industry

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Abstract

The public awareness about the environment has forced the textile industry to produce environmentally friendly products. Nowadays many companies and organizations focus on the environmentally friendly way of production. In order to create a sustainable textile, the main change factors have been linked to eco-materials so less and harmless waste, reusing/recycling, lesser usage of energy, water and chemicals and ethical issues in production processes. This article emphasizes the environmental effects of textiles in detail and contributes to cleaner production and sustainability in the textile industry by initiating a discussion on the opportunities for change in textile processes in accordance with the laws.

Introduction

According to Collins dictionary, the word 'Sustainability' is defined as 'Avoidance of the depletion of natural resources in order to maintain an ecological balance'. It means not using anything in excess that the planet cannot naturally reabsorb. Clothing being one of the three basic necessities of human race, it holds immense potential to adversely affect the planet, if the production and consumption practices are done with least care for the environment.Sustainable fashion refers to the clothing that is mindful of the many environmental issues that the fashion and clothing industry touches upon.

Objectives

1. To study how textile and clothing industry is adversely affecting the environment.
2. To study why sustainable practices are necessary in the textile and clothing industry.
3. To study the measures that must be taken in order to maintain an ecological balance in the environment.

As the technological developments took place in recent years, textile sector started developing rapidly which led to an increase of environmental problems. . The main environmental impact in the textile industry is manifested by the discharge of high amounts of chemical loads into the receiving environment. Other important elements are high chemical and water use, energy consumption, air pollution, solid waste and odor formation.

Environmental problems began with local movements in the early 1960s. Industrialists were forced to think about the environment by using minimum raw materials, reducing the use of energy, using non-harmful packaging materials and destroying them easily. Therefore, cleaner production and sustainability have been offered since a long time. In the past 10 years, this concept of cleaner production has evolved into sustainable production.

The first approach, which is used extensively to protect environmental values, is to eliminate pollution after it has been formed. "Pollution control", also referred to as the "end of pipe" approach focuses on the ways in which production and design phases are invariably adopted, and that pollution is the inevitable consequence of this, and therefore the better definition and elimination of pollution. This brings significant additional investment costs to the organization and high investment requirements are met with frustration by individuals or institutions in some areas and countries.

Cleaner Production Applications

Cleaner production applications can be classified into three main categories:

a. Reduction of waste and reduction of resource consumption,
b. Reuse and/or recycling,
c. Product modifications.

a. ***Practices for waste reduction at source:*** Some ways to reduce he waste at source are administrative preventions, better process control, material substitution, equipment modification, and new process technology
b. ***Reuse/Recycling*:** Reusing rinse water from one process to another cleaning process is an example of on-site recycling or reuse. It involves collecting waste and reusing it in the same or different parts of the production. Non-preventable wastes can be recycled or vend as an offshoot. This includes the creation of by-products, the sale of waste to consumers or other firms after collection of waste. For example; waste yeast, which is released in the brewery, can be reused as animal feed, fish production and food additive substance.
c. ***Product modification*:** One of the basic headings of cleaner production to reduce the pollution caused by products is to change product characteristics. Changing the product requires that the product and its requirements be reviewed again. Reducing the weight and the thickness of the products, designing that allows the product to be more easily recycled, changing the packaging are examples of this approach. The main point of view in the change of packaging is that the protection of the product is guaranteed by the minimum amount of packaging material.[8]

Tools and Methods for Cleaner Production

The choice of which tools are used to determine the use of cleaner production opportunities according to their application areas depends on the problem in operation and the work to be done. Single or multiple tools can be used based on nature of the problem.[11]

Environmental impact assessment (EIA): This is a procedure, which provides that environmental effects are taken into account before making decisions.

Environmental management system (EMS): It aims at the management of activities that are linked to each other, have an environmental impact or have potency.

Life cycle assessment (LCA): It also named "life cycle analysis", "life cycle approach", "cradle to grave analysis" or "eco balance", includes an assessment of aspects of a product system that are generally relevant to the environment at entire phases of its life cycle.

Environmental technology evaluation: Environmental impact assessments of various plants and projects involve the discharge of the use of various technologies and the determination of the risks of these technologies on human health and environmental values

Chemical evaluation: In this context, the toxic effects and quantities of the chemical substances used in the production phase are analyzed to evaluate jeopardy on the health of human and the environment. It also includes methodologies for hazard and exposure assessment.[15]

Waste inspection: Input/output inventories of processes, source, quality and quantity of wastes generated, efficiency and weak points of the current process, waste minimization targets for cleaner production are determined with waste control.

Environmental inspection: It is the most commonly used and most important application tool of cleaner production.

Eco-label/environmental labeling: An eco-label indicates that a product or service is sensitive to the environment in a particular category. Ecolabelling is implemented worldwide and is a voluntary method for certificating environmental performance.[16]

Water footprint: For a single process or product, it measures the volume of clean water consumed and/or contaminated by humanity. It may also indicate how much water is consumed from a particular river basin or aquifer from globally/country.[19]

Risk assessment: The risks to be caused by a specific event on sanitary of human and the surrounding and the precautions to be taken about these risks are determined by this method.[10]

Sustainability

Sustainability was described as "meeting the needs of today's needs without compromising the

ability of future generations to meet their own needs". In the economy of sustainable development; consumption of resources, the non-renewable energy sources or the destruction of valuable natural capital is not permitted. In this regard, sustainable development can be identified as a balance between man and environment, programming the life and development of today's and future generations in such a way as to enable them to meet and develop the needs of future generations

Textile sector and its environmental impacts

The textile and apparel sectors play a significant act a part in the economy of developing countries. This sector is the first sector of the industrialization process and it is one of the leading sectors of global economies.

The acceleration of industrialization, the ever-increasing population of the world and the parallel reduction of clean water resources, the rapid increase in energy costs and environmental problems, the enormous sanctions of the laws related to the environment made it necessary to develop and use for environmental processes and chemicals, as it is in other sectors in the textile industry, which is at the forefront of the sectors that generate a great deal of clean water, energy consumption, and wastewater (Table 1).

Type of Finished Textile Product	Dyes, g/kg Textile Product	Auxiliaries, g/kg Textile Product	Basic Chemical Compounds, g/kg Textile Product
Polyester fibers	18	129	126
Fabrics from synthetic fibers	52	113	280
Fabrics from cotton	18	100	570
Dyed fabrics from cellulose fibers	11	183	200
Printed fabrics from cellulose fibers	88	180	807

Table 1 Basic contaminants of textile wastewater

In summary, the following areas may adversely affect the sustainability of the textile industry:

i. Use of toxic chemicals
ii. Water consumption
iii. Energy consumption
iv. Waste production
v. Air emissions
vi. Transportation
vii. Packaging materials.

Chemical usage

Since the textile industry uses high amounts of chemicals and water to form waste after processing, this sector has been convicted of pollution as one of the world's biggest criminals. In the textile industry, about 2000 varied chemicals are used, including dye, transfer agents etc. In the textile industry, about 25% of the sum chemical substances manufactured in the world are used.

According to the World Bank estimates, dyeing and finishing operations account for 17-20% of industrial water pollution. Despite this, only 72 of the toxic chemical substances in the wastewater of these operations could be detected and 30 of them could not be cleaned.

The chemicals that cause concern when left in the environment can show subsequent characteristics: durability (not easily degraded), bio-accumulation (collect in living organisms) and poisonousness. The chemicals in this property can also be called PBTs and/ or POP's.

Water consumption

Fresh water is a resource that is getting limited every day. Currently, approximately five hundred millions people maintain their lives in areas incline to lack of water and it is anticipated that by 2025 this figure will be five times that between 50-75% of the world's population in Figure 3.

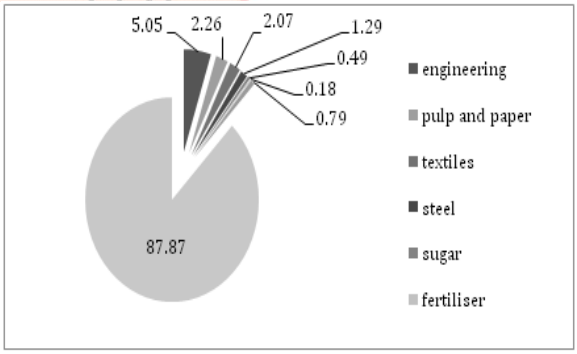

Figure 3. Water consumption by various sectors.

In the textile industry, used water is in each stage of the wet finishings to transport chemicals to textiles and to be washed the material before moving to the next step. Apart from these processes in

textiles, there is also water consumption during cooling water, boiler, steam drying and cleaning. Average water spending of a medium sized textile factory producing around 8,000 kg fabric/day is 1,6 million liters, approximately. Of these, 16% are spent in dyeing and half of it is consumed in printing.

The Textile Industry is forced to think about water saving because of many reasons, mentioned above. Because of industrial and residential expansion, reduction of water tables and sources of clean water, rivalry for clean water rises. Generally, costs of water and waste can constitute 5% of manufacture costs.

The initial results of water and wastewater problems have begun to be felt in textile treatments. In China and India, for example, new companies do not receive grant support unless they offer a case that convinces them that they will help solve water consumption and wastewater problems. Nowadays, in the textile, protection and reuse of water is getting essential rapidly and they can have huge advantages through reduced charge of purchased water, by this way decreasing in production costs, decreases the price for wastewater treating, and avoiding from discharging infringement. Water conservation measures lead to reduction in thermal and electrical energy consumption.

According to, water conservation methods for textile mills are; use of automatic shut-off valves, flow control valves, low material to liquor ratio systems, flocculation of clean water of pigment printing, use single stage of processing, water conservation measures in dyeing equipment and good housekeeping.

Reuse of wastewater can provide significant savings, such as reducing water, energy and chemical consumption. Condensed steam and cooling water which are clean can be easily recovered and their thermal power recovery improves return on investment.

Energy consumption

In addition to a huge amount of water and chemical consumption, textile treatments consume a great deal of energy to heat, dry and operate the machines which cause with going up the greenhouse gasses emission and the carbon footprints. These cases are due to the long and complex structure of the textile. It is estimated that the annual textile production in 2008 is 60 billion kilograms of fabric, and 1.074 billion kWh of electricity and 6-9 trillion liters of water are necessary to produce it. It has been reported that for manufacturing and consumer use, the total thermal and electric energy necessities are 18.8-23 MJ and 0.45-0.55 kWh per meter of fabric, respectively.

Textile is one of the sectors that produce greenhouse gasses in maximum amounts. Indirect carbon footprints of textiles, 'embedded energy' inside the goods, which is totally used energy in the manufacturing process, is important to define the carbon footprint of any goods. The carbon footprint of a textile commodity depends on raw material type and its processing. When the contributions of the cotton textiles treated in the continuous system to the process-based emission are examined about half of the total emission comes from drying, 40% and 10% come from washing, steaming and chemical usage, respectively. For knitwear finishing process emission caused from heating the water in exhaust process.

Protection of the energy is an inevitable stage to tackle the problems of the global environmental deterioration and emergency of energy. The energy can be conserved via modifying of processes, machinery, and chemical prescriptions and using of recent technologies. Dissipation of heat through machinery which running at high temperatures and poorly maintained steam pipes lead to energy loss. Convenient isolation ensures reluctance to convectional heat transfer from machines and pipes to ambient air via lesser spending of vapor and fuel. Moreover, insulation lessens the risk of burns by decreasing the outer surface temperatures and make more comfortable the working environment.

Air emissions

Air and water pollutants affect the world with varied weather events and spending amount of soiled nutrition goods. Pollution of air is the chemical substances, particles or biological materials that induce damage or disturbance to human beings or the other creature penetration into the atmosphere.

It is known that data about emissions of air belong to textile processes are not easily accessible, but many processes in textile cause air emissions.

The secondary important pollutant in the textile after waste disposal is the emission of gas. Air emissions include dust and lint, oil fumes, acid vapor, solvent mists, odor and boiler exhausts. If textile materials contain oil, plasticizers and other materials, they degrade when exposed to high temperatures, and forms fog. At the forefront of environmental problems are greenhouse gas emissions that pose a threat to all living things due to the effect on climate. Burning fossil fuels significantly increases the amount of carbon dioxide emissions, which is the primary source of the greenhouse effect.

Transportation

Textile and ready-to-wear sector consist of a long and complex manufacturing stages such as manufacturing source, fiber production, coloring and finishing treatments, mounting of apparel, packaging, carrying, recycling and/or final eradication.

Life-Cycle Inventory (LCI) is an essential ingredient of LCA. Data of emissions, materials, and energy inputs connected with all manufacturing and usage stages of goods are defined numerically in this way. The LCI include data about the carriage, readymade, and disposal, also. Carriage of an intermediate product such as raw cotton transportation to the spinning mill, treated fabric from finishing mill to cut-and-sew and after to customer take part in transportation. The transportation increases the total amount of consumed non-renewable fuel. Namely, this means that it contributes to global warming by CO_2 emission.

The Higg Index, the core of the Sustainable Clothing Coalition, allows trademarks, retail dealers and mills to evaluate their ecological and communal and labor effects and to specify fields that need recuperation. This index also covers the whole life span of goods, containing from raw materials to bundling, carriage, user utilization and end-of-life.

Packaging materials

The packaging process has five main purposes. The first aim is to protect the product against any damage that may occur during transportation and storage. The second aim is to assemble the products. The third one is to transfer the information which is about to usage, disposing and transporting of the product. Marketing and preventing the theft of products are the fourth and fifth one, respectively.

During other textile processes like spinning, fabric manufacturing, dyeing etc., in packaging various sources like energy and chemicals are used. Today's packaging substances are usually produced from petroleum-based materials. Recently, the packaging area has faced strict rules on the reuse and recycling. The Directive 94/62/EC on "Packing and Packaging Waste", which is being implemented in the EU, has forced many package types to be observed. This directive remarks a series of necessaries for packaging and it's trashes. At the same time, it sets maximum levels for recycling targets and heavy metals. Companies carrying out environmentally friendly actions are seeking to reduce their carbon footprint by using packaging material which obtained from recycled and compostable stuff, natural goods are produced without any chemicals like pesticides. In clothing process 2.472MJ energy is consumed; 49.8 % used in sewing, 29.6% in cutting, and 20.6% in packaging.

Conclusion

Sustainability is much more than a trending word at a certain time. The three key elements of sustainability are; economic and social development, environmental protection, and each one each one should be considered in relation to the others. Sustainability is very crucial because it maintains people quality of life with protecting diversity and ecosystems in the world with various ways; protecting natural resources, providing energy savings, decreasing waste quantity, investment in the future and economy with recycling/reusing. Namely, it ensures the existence of species. A contemporary and secure business environment is created by respecting human rights, securing the social justice and protecting the working rights within the scope of sustainability.

References

1. United States Environmental Protection Agency (US EPA). *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*. US EPA; 2010. p. 13.
2. Environmental Hazards of the Textile Industry. *Textile Industry Poses Environmental*

Hazards. Hazardous Substance Research Center, Ecotextiles, 2005. p. 4.
3. Reddy BS, Ray BK. Understanding Industrial Energy Use: Physical Energy Intensity Changes in Indian Manufacturing Sector. *Energy Policy*. 2011;39:7234–7243.
4. Arputharaj A, Raja ASM, Saxena S. *Developments in sustainable chemical processing of textiles*. Green Fashion, 2015. p. 217–252.
5. Global Ecolabelling Network. Introduction to Ecolabelling. 2004. p. 1–17.
6. Sustainable Apparel Coalition.
7. Environmental Guidelines for Textiles Industry. p. 1-6.
8. United Nations Industrial Development Organization (UNIDO).
9. Katharine Earley. *Industrial symbiosis: Collaborating to harness waste energy and materials for mutual benefit*. 2015.
10. Gardner G, Assadourian E, Sarin R. *The state of consumption today*. The World watch Institute. 2004.
11. Ströhle J, Benninger AG, Böttger D. Water and energy-saving solutions. *Dyeing Printing & Finishing, Textile World*. 2008.
12. Hoekstra AY, Chapagain AK, Aldaya MM, et al. *The water footprint assessment manual: Setting the global standard*. London: Eartscan; 2011. p. 228.
13. Wiedmann T, Minx J. A definition of 'carbon footprint'. *Ecological economics research trends*. 2008;1:1–11.
14. Darnerud PO, Eriksen GS, Johannesson T, et al. Polybrominated diphenyl ethers: occurrence, dietary exposure, and toxicology. *Environ Health Perspect*. 2001;109(1):49–68.
15. Greenhouse Gas Emissions. Understanding Global Warming Potentials.
16. World Business Council for Sustainable Development.
17. Jürgen Ströhle, Gerhard Schramek, Benninger AG. Textiles achieve ecological footprint: New opportunities for china. p. 1-7
18. Review of the Environmental Impact Assessment (EIA) Directive.
19. Laxman MS. Pollution and its control in textile industry. *Dyes and Chemicals*. 2009.
20. Khandare RV, Govindwar SP. *Microbial Degradation Mechanism of Textile Dye and Its Metabolic Pathway for Environmental Safety*. 2015. p. 399–439.