Journal of Science and Technology
ISSN: 2456-5660 Volume 06,Special Issue 01, August 2021,

www.jst.org.in *DOI: https://doi.org/10.46243/jst.2021.v6.i04.pp332-339*

Case Study on Cotton Textile Waste Management

Kaushiki Kulkarni[1], Anand Ayyanagoudar[2], Maithili Karande[3], Mrunmai Ranade[4]
[1](Student, Department of Computer Engineering, Vishwakarma University, India)
[2](Student, Department of Computer Engineering, Vishwakarma University, India)
[3](Student, Department of Computer Engineering, Vishwakarma University, India)
[4](Faculty, Department of Engineering Science, Vishwakarma University, India)
(kaushikikulkarni2108@gmail.com)[1]
(202001254@vupune.ac.in)[2]
(maithili7411@gmail.com)[3]
(mrunmai.ranade@vupune.ac.in)[4]

To Cite this Article

Kaushiki Kulkarni[1], Anand Ayyanagoudar[2], Maithili Karande[3], Mrunmai Ranade, *"*Case Study on Cotton Textile Waste Management*", Journal of Science and Technology, Vol. 06, Special Issue 01, August 2021, pp332-339: .*

Article Info
Received: 15.07.2021 *Revised: 24.07.2021* *Accepted:10.08.2021* *Published: 16.08.2021*

Abstract: - *Our paper is trying to focus on Cotton textile industry and its sustainability. The Objectives of our study are: (i) Gather information about waste management during the production of cotton. (ii) Spread the awareness of adverse effect of cotton wastage and fashion on environment. (iii) Study the composition and management of cotton that is used in abundance in daily fashion. (iv) Focus on some measures to reduce the waste and recycle it. Some of our observations during this study are (i) Cloths we use daily, contribute roughly 1/5th of water pollution and even adverse the condition of air and landfill pollution. [5] (ii) Among the total usage of all kind's fabrics like rayon, polyester, nylon etc. Cotton contributes 65% of this usage. (iii) Very less attention is paid to the most significant waste, "Textile/Cotton Waste". We studied varies steps to achieve goal of reducing this cotton waste like, (i) to find out the composition of waste produced. (ii) Different ways to dispose the waste produced in cotton industry. (iii) Recycle the fabric as far as possible.*

Keywords: *Waste management, Textile, Cotton.*

(I) Introduction

Some studies have shown us that India is 2nd largest cotton producer and the largest cotton consumer. It contributes 23% of world cotton production, which is 3 million tons of cotton every year. Light rainfall, high temperature, sandy loam and silt loam soil facilitates high yield of cotton. Asian countries including China, India, Pakistan, and Bangladesh are successful in cultivating high potential cotton crops. Highest production in the world accounts the highest consumption of cotton worldwide. [4] With time, the atmospheric and environmental condition of earth is declining rapidly, so we have to take some measures to prevent this crisis. Efficient way to conserve our environment is either to produce less waste as possible or to properly manage the waste produced. This awareness of saving our mother earth led us to this topic of managing cotton wastage which contributes significantly in total waste produced.

(I.1) Environmental Impact

It's important to study and discuss the destructive effects of cotton and textile waste. External components like residential area, water resources, plants and animals are wildly affected by textile industries. For an instance waste water expelled from textile industries is highly toxic and contain harmful elements like lead, fluorine, formaldehyde etc. [2] These elements disturb the aquatic ecosystem and affect the lives of fishes, phytoplankton etc. The contributionof textile industries can cause allergies like asthma and other air-borne diseases. High decibel sound waves during industrial process, can also have great impact on human health causing tachycardia, irritability and even psychotic effects.

This case study will be useful for understanding the importance of attention required by fashion or textile waste management. It provides the ideas for recycling cotton waste and ways to dispose this waste. RCRA (Resource Conservation and Recovery Act) defines that any waste, including solid, semi-solid, liquid or even gaseous waste from industrial activities comes under the category of solid waste. [3]

According to the statistical analysis of central pollution control board, waste generation in all over India is approximately 6.23 million tons. Studies have shown us that "Gujarat" is the largest generator of textile waste, accounting about 28% of gross generation of Industrial waste in India.
The objective policy of Gujarat is to have an integrated approach to promote 5F's, which is a value chain- "Farm toFiber to Fabric to Fashion to Foreign". This policy enhances sustainable growth of farmers and industries. [5]

"Navi Gujarat Vastraniti" targets to attract Rs. 20, 000 crore along with creating new employment opportunities for over 2.5 million people, 50 percent of which are expected to be rural women. [5]

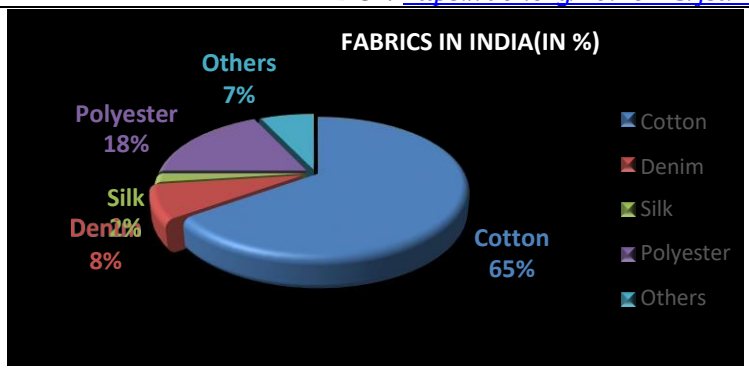

Fig. 1 *Proportion of fabrics used in India*

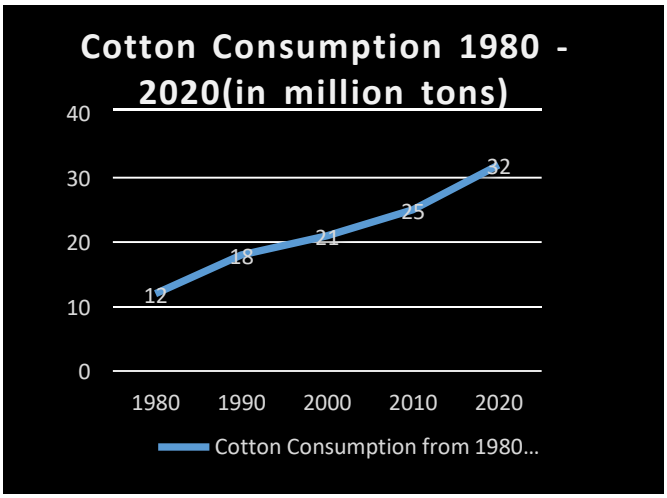

Fig. 2: *Cotton Consumption 1980 – 2020*

(II) Composition

All kinds of waste including textile waste can be classified mainly into hazardous and non-hazardous on the basis of amount of substantial threat it can cause to public health and environment. Characteristics of hazardous wastes are flammability, toxicity and even high reactivity while characteristics of non-hazardous are exact opposite. [3]

Textile Industries produces waste in all states including solid, liquid and gas. This waste consists of many components like, cellulose, non-cellulose, metals, ash residue, ether extractive and even moisture. [6] Analytical representation is as follows:

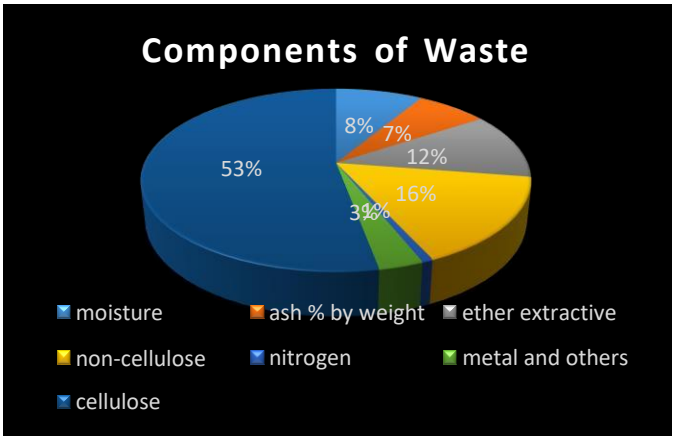

Fig. 3: *Components of cotton Waste*

(II.1) Solid Waste

Textile waste is produced by many processes including spinning, weaving, knitting, dyeing, de-sizing, mercerizing and consumer waste. [1] Most of the waste produced during this process are soft fiber wastes, yarns, beaming wastes, off-cuts, spoons and cereals etc., comes in category of solid wastes. [4] Our case study will focus on most contributing solid wastes (as shown in graph above). Cellulose can be referred as long straight polymer chain of glucose, which forms natural fiber like cotton. [4] Waste cellulose is hard to be operated on because of its tight bonding and crystallinity inhibiting the access of enzyme and therefore it's difficult to degrade.

Table no 1: *Process and their Composition and their Pollutant Nature*

Sizing	Desizing	Bleaching
Starch, waxes, Carboxymethyl Cellulose(CMC), Polyvinyl Alcohol (PVA), wetting agents	Starch, waxes, CMC, PVA, fats, pectin	Starch, waxes, Carboxymethyl Cellulose, Polyvinyl Alcohol, wetting agents
High in BOD, COD	**High in BOD, COD, SS, dissolved solids (DS)**	**High alkalinity, high SS**

Mercerizing	Dyeing	Printing
Sodium Hydroxide, Cotton wax	Dyestuff, urea, reducing agents, oxidizing agents, acetic acid, detergents, wetting agents	Reducing agents, alkali, oils, cross-linkers, pastes, urea, gums, acid, starches, binders
High pH, low BOD, high dissolved solids (DS)	**Strongly colored, high BOD, DS, low SS**	**Highly colored, high BOD oily, SS, slightly alkaline**

(II.2) Chemical Waste

Textile Industry expel large amount waste water after production of fabric. The waste water produced comes through many chemical processes primary of which is dying. Dye consists of many lethal metals like lead, fluorine etc. which contributes in increasing the water pollution. Organic, inorganic and chemical pollutants present in waste water fluctuates parameters like BOD (Biological Oxygen demand), COD (Chemical Oxygen demand), pH, Color, Salinity extremely. [8] Composition of pollutants during different process of textile industries are tabulated: Textile Waste Effluents contributes significantly in air pollution. It constitutes of heavy metal fumes, ash residue, and moisture. Color pigment of textile dyes consists of heavy metals like, chromium, lead, cadmium, copper, nickel etc.

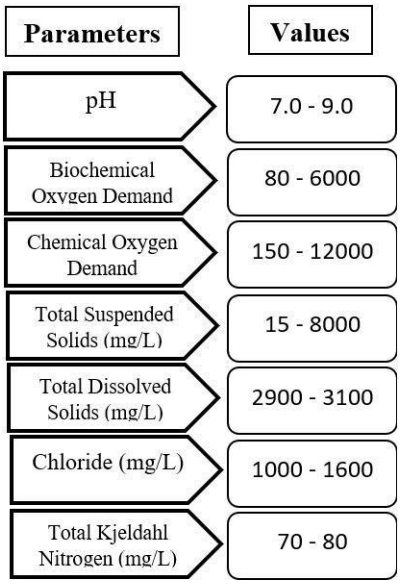

Fig. 4 *Parameters of Textile waste water*

(III) Process

The overall process of Textile waste management including manufacturing, usage and discarding these textile products. After discarding this textile waste, it has to be collected efficiently.

(III.1) Collection

When consumers are done with their garment usage, they are discarded. These fabrics are either donated to charity organizations, municipalities or is sold to retail collectors or professional collectors. [2] Most of them are sorted depending on their quality and are reused or recycled accordingly. Other collected textile waste is either landfilled or incinerated. Many professional and retailer collectors are present whose job is to collect this textile waste from factories which produce made with irregular shape size amount and even different fabrics.

(III.2) Cotton Recycling

Urge to attain sustainability have led human race to manage all types of wastes. In case of textile industry, ourstudy mainly focuses on cotton recycling. This process starts with experimenting the industrial leftover, sorting it out on the basis of quality, color and types. Stripping machine is used to strip and shred which breaks the fabric into yarns and fibers. This mixture is further carded and 8% of water at 4 Kg/min. This material is compressed into sheets.

In Gujarat, Saurashtra, Ketan Patel from "Kotton Exim Inc." have successfully implemented cotton recycling plant. [9]

(III.3) Different method in waste management

To process or recycle cotton fabric it is necessary for us to decolorize its dyes and remove mineral salts, oxidize ions and other chemical auxiliaries. Some methods and its significance are discussed here. **Biodegradation [1],** is the method which can be used to eliminate the oxidizable substances about 90% but dyes are not that highly biodegradable therefore cannot be used so efficiently. Another treatment that can be used is **Ozone Treatment [1]** which helps in de-colorization. **Nano Filtration** technique can also be used for separating organic compounds of lower molecular weight and divalent ions from monovalent salt. [1] It is affordable for us to use electrocoagulation for de-colorization.

There procedure explained above is summarized in following chart:

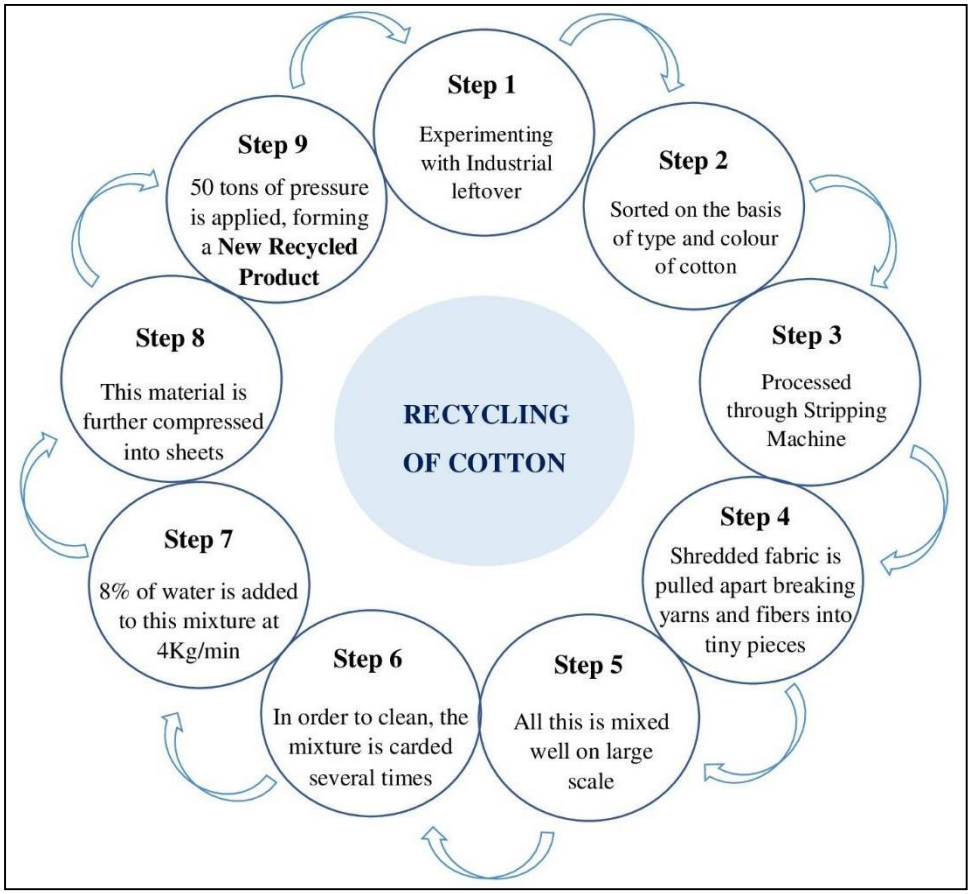

Fig. 5 *Flowchart showing the Recycling of Cotton*

Electrocoagulation

Electro coagulation is a technique used for distillation of waste water in textile industry. In this process, electricity coagulates impurities separate from desired filtered water. [7] These impurities include refractory organics, emulsified oils, suspended solids and even heavy metals. Salient Features of Electrocoagulation are as follows:

1. The inexpensive abrasive material cathode reactor effectively removed dyes.
2. The Fe3+ was predominant within the resolution of the abrasive material cathode reactor.
3. Its voltage and energy consumption are low.
4. The toxicity of decolorized solutions is low.
5. Its efficiencies failed to clearly decrease throughout the seven cycles of utilize.

(IV) Discussion

The humongous amount of solid cotton waste and water waste is produced in cotton textile industry. It can be reduced with conscious effort towards sustainability. As shown in pyramid, our priorities while dealing with waste can be summarized as Prevention, Minimization, Reuse, Recycling, Recovery and Disposal. [3]

As a social impact, many companies and textile industries will have great profit after recycling the textile waste. For example, the exchange will reduce the extra spending of company and if the frequency of waste generation is high then it will be the part of extra investment. Along with this, large number of prospective purchasers will increase the financial value of this waste.

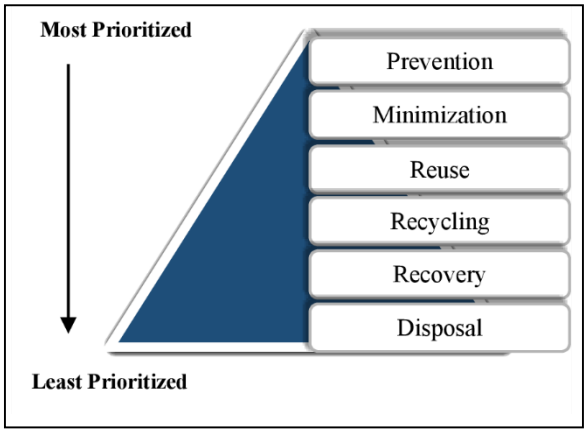

Fig.6 *Priorities dealing with textile waste*

(V) Conclusion

The 12th sustainable development goal (SDG) is responsible Consumption and Production. If the techniques discussed in this paper are applied to textile industries all over globe, then, it will surely contribute a step towards the achievement of 12th SDG.

References

[1] B. Ramesh Babu, A.K. Parande, S. Raghu, and T. Prem Kumar, An Overview of Wastes Produced During Cotton Textile Processing and Effluent Treatment Methods, Journal of Cotton Science, April 2007, 11(110):2007, https://www.researchgate.net/publication/230667514_An_Overview_of_Wastes_Produced_During_Cotton_Textile_Processingand_Effluent_Treatment_Methods

[2] Bahareh Zamani, Towards Understanding Sustainable Textile Waste Management: Environmental impacts and social indicators, 2014, https://publications.lib.chalmers.se/records/fulltext/204502/204502.pdf

[3] Rinku Agrawal, Madhu Sharan, Municipal Textile Waste and Its Management, Research Journal of Family, Community and Consumer Sciences, Vol. 3(1), 4-9, March (2015), http://www.isca.in/FAMILY_SCI/Archive/v3/i1/2.ISCA-RJFCCS-2015-006.pdf

[4] Alex Andrews George, Cotton Cultivation in India: Important Things You Should Know, November 2020, https://www.clearias.com/cotton-cultivation/

[5] Fibre2Fashion, Gujarat government extends textile policy by one year, Fashion Network, September 2017, https://in.fashionnetwork.com/news/Gujarat-government-extends-textile-policy-by-one-year,864029.html

[6] C. Sundar Raj, S. Arul, S. Sendilvelan, C.G. Saravanan, Textile Cotton Waste - An Alternate Fuel for Diesel Engines, The Open Waste Management Journal 2(1), July 2009, https://www.researchgate.net/publication/229008695_Bio_Gas_from_Textile_Cotton_Waste-An_Alternate_Fuel_for_Diesel_Engines

[7] V.Khandegar, Anil K.Saroh, Electrocoagulation for the treatment of textile industry effluent – A review, Journal of Environmental Management, Volume 128, Pages 949-963, 15 October 2013, https://doi.org/10.1016/j.jenvman.2013.06.043

[8] Farah Maria Drumond Chequer, Gisele Augusto Rodrigues de Oliveira, Elisa Raquel Anastácio Ferraz, Juliano Carvalho Cardoso, Maria Valnice Boldrin Zanoni and Danielle Palma de Oliveira, Textile Dyes: Dyeing Process and Environmental Impact, January 2013, DOI: 10.5772/53659, https://www.intechopen.com/books/eco-friendly-textile-dyeing-and-finishing/textile-dyes-dyeing-process-and-environmental-impact

[9] Koton Exim Inc, https://kotonexim..com