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A Review on "The Sustainable Scouring Processes of Organic Cotton Fabric"

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Abstract: The textile industry is focusing on consumerization in the name of adaptation of innovation and advanced technology. To meet the demand for sustainability, the incorporation of natural textiles is necessary, and the adoption of natural and less harmful processes for the finishing process of the textiles, such as scouring, bleaching, and other wet processing treatments, so that the minimum use of chemicals leads to less hazardous conditions for human beings and the environment. This study provides a broad, comprehensive overview of existing research on scouring methods for cotton fabric.

I. Introduction

Organic cotton fabric, or eco-friendly cotton fabric, is grown organically with the absence of any chemical agents at any stage of the plant or the fabric production stages. The use of organic cotton fabric is on the rise due to increasing awareness of the hazardous substances used in the manufacture of synthetic or regenerated natural textiles and their negative impact on the environment. [1] [2] [3].

The conventional/regular cotton fabric is green and environmentally friendly, with the demerit of being environmentally ill-disposed because of the use of pesticides during cultivation and chemicals from the fiber to the fabric stage; that is a negative impact for humans and nature. The most improved and ethical option for conventional cotton is organic cotton, as the organic cotton fabric is sustainable from its beginning stage to the finished outcome of the fabric. The Better Cotton Initiative (BCI) is working on the main aim to reduce the level of toxic chemical fertilizers used in traditional cotton harvesting by developing standards for the quality of soil, ecosystems, and conservation of water. [4] [5] [6]

Grey organic cotton fabric consists of cellulose encircled by hydrophobic layers of impurities such as hemicellulose, pectin, lignin, lipids, waxes, proteins, and mineral compounds. Scouring is the process of removing contaminants from the fabric. [7] .[8]

Chemical scouring of cotton fabric by using alkaline substances suffers from the negative effect that it is harmful to the fabric, humans, and nature. Because of reduced durability of the fabric due to reduced tensile strength, it may cause skin allergies, and toxic effluents cause imbalances in ecosystems and biodiversity. Bio-scouring, a method of featuring xylano-pectinolytic enzymes produced through a microbial isolate, is cost-effective; the outcome is more softness and stronger fabric. [9]

In a study comparing bio-scouring and conventional alkaline scouring on knitted cotton fabric strength and morphology, it was proven that bio-scouring is economical with no significant changes in fabric strength. bursting strength, when compared with conventional scouring. [10]

Researchers and technologists are implementing innovative technologies to mitigate environmental impacts in textile manufacturing.[11] Bio-based materials, such as bio-polishing, enzymatic desizing, and bio-scouring, are ecologically sound and commercially feasible dyeing operations that combine a small quantity of synthetic dyes as well as an elevated amount of natural dye. And advanced dyeing machinery and technologies, such as plasma technology, supercritical fluid technology, UV technology, and foam dyeing, are also being adopted to reduce effluent volume and energy usage. recycling process input and waste, such as alkali-containing mercerized liquor. Advanced effluent treatment plants have been established to convert wastewater into clean drinking water and are being explored to reduce manufacturing costs and environmental impacts. [12] Sustainability includes decreasing the use of inventory, reuse, and sustainability in the social and economic spheres. [13]

Due to the connection between the cotton fiber's primary cell wall and cuticle, enzymatic scouring, when compared to the established method to eliminate cotton fiber waxes, is inefficient in large-scale operations. Temperature is an important factor in the removal of wax, whereas pre-rinsing or extraction techniques may help reduce the volume of wax impurities. [14] [15] Kiered scouring method, a new, effective, and sustainable method, has exhibited results that are similar to those of traditional approaches.

The selection of the enzymes depends on the sort of contaminants encountered in cotton fibers and the way they interact with the substrate, including loss of weight as the evaluated factor, and have an impact on suitable pH and temperature, the required processing period of time, and end final product quality. [16].

Bio-scouring, despite its complexity, has a bright future in wet textile processing in the future. According to the study, the quality of the fabric can be improved by reusing alkali and hydrogen peroxide from scouring and bleaching operation water. Absorbency and whiteness index get boosted by removing impurities, and materials that underwent a 30:70 scouring-to-bleaching procedure

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displayed more vibrant colors than cloth that was ready to be dyed, and the K/S value and amount of dye used were proportional. The samples showed good fastness to washing, rubbing, and light. [17]

To reduce the toxicity, natural compounds are the best option because of their mode of action, chemistry, and pH measurement. [18] Natural compounds are biodegradable, have less toxicity, are cost-effective, and are eco-friendly, and they can be used as alternatives to chemicals. By switching to natural scouring agents, it is possible to avoid the demerits of chemical scouring. The reason is that the industry is creating the most toxicity on earth. Natural scouring agents include enzymes, plant extracts, etc. [19]

Scope of the Sustainable Scouring Processes:

Chemical scouring techniques suffer from drawbacks such as the discharge of pollutants that leads to waterborne diseases and water scarcity, especially in less developed countries like Bangladesh. So, the environmentally friendly bio-scouring that has fewer disadvantages than chemical scouring is preferable to follow in textile industries. [20]

The environmental issues of the textile industry are the product of the selection of chemicals used for finishing the textile fabrics. And bio-scouring is more appropriate for the depreciation of toxic chemicals. [21].[22]

In a study, the eco-friendly bio-scouring of cotton knit fabric with biosurfactant saponins from soapnut extract was evaluated. The weight loss, absorbency, and dyeability were lower. Though the process is economically and environmentally friendly, it lacks large-scale application. [23]

Xylanase and pectinase enzymes produced out of agricultural waste can be used as an eco-friendly scouring because the analyses of the results proved better results in removing natural impurities from the cotton fabric with increased whiteness, brightness, and tensile strength and decreased yellowness. [24]

Saponin and wild yam root powder exhibited superior results, such as weight loss and water absorption without fabric damage. Wild yam powder can be an option for the combination of scouring and bleaching cotton fabric, as the outcome of the results can be comparable with 30% caustic soda. [25]

II. Conclusion

It is sure that the textile industry will move towards sustainability and adopt the conventional or green or less harmful finishing process so that the effluents can be reduced and so produce less toxic waste for humans as well as nature. This review paper examined organic cotton and the nature-friendly scouring process of the same that will impact the industry in upcoming years. There is a critical comparison of studies on the scouring methods of cotton fabric in this study. The article can be used for future research on sustainable methods of scouring organic/conventional cotton fabric.

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