

## CHAPTER 5

# CONCLUSIONS

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The idea of "Eco-designing" items from beginning to end has emerged. From the fibre through the finished product, including its fabrication, but also its packaging and labelling, right through to the product's recycling at the end of its useful life, it requires taking the ecological aspect of the entire production process into consideration. These developments in textile chemical processing will open up new opportunities.

Upholding high standards; being cost-effective; having improved functionality; producing less waste; requiring little or no water and chemical use; and generally being environmentally friendly

The textile wet processing sector, which is typically viewed as a traditional sector, currently faces greater competition from the worldwide market. There is a widespread understanding that old processing methods might not be enough to maintain a profitable business and that the textile industries must shift towards more cutting-edge and high-quality products. High-tech textiles, which are characterized by previously unheard-of functions and effects, are developed in response to new materials and technology.

The first stage of Textile wet processing is the pretreatment and cleaning of textiles. Start wet processing by desizing process with an enzyme which is a more eco-friendly process. In the present investigation the same concept was adopted for the formulation of a desizing agent with different auxiliaries for making one shot product. This one-shot EDA is prepared, tested, and standardized by Zydex lab and industrial trial which shows product attributes as follows:

- The addition of only EDA in a single bath process is enough for total pretreatment of viscose which **reduces the consumption of water and energy.**
- **No soda is required for the pretreatment of viscose**
- **Faster grey wetting** property which penetrates enzymes easily in the core of the fabric and hence reduces the processing time.
- **Very low foaming** and hence suitable for long liquor exhaust process in high shear machines.
- **Very high detergency and emulsifying action**, which removes & suspends oily and greasy impurities as well as size and soil particles.
- **APEO free eco-friendly product**

- **Feel after pre-treatment is excellent**
- **Fabric cleanliness** is good compared to other emulsifiers.

Reducing the pollution load and saving the utility cost like water, steam, chemicals/ auxiliaries are also important in the second stage of wet processing called scouring and bleaching. A one-shot product called a polymeric-based wetting agent was prepared. The experimental data confirm that the developed product reduces the concentration/ dosage of NaOH/ Soda ash in scouring. When sodium hydroxide is released into the effluent and reacts with other chemicals, it quickly breaks down. When sodium hydroxide dissolves in water, it separates into sodium cations (positively charged sodium atoms) and hydroxide anions (negatively charged oxygen and hydrogen atoms), reducing the water's acidity in the process. The following list of PWA product properties is provided:

- Outstanding performance by **micro cleaning** of wax on cotton and oils & greasy material for polyesters.
- It **does not provide temporary wetting** like low mol. weight scouring agent
- It is important to distinguish the scouring effect of this product by observing **the solidity of dyeing** rather than the absorbency of scour fabric.
- Artificial wetting after scouring will go away after 2-3 times washing but PWA shows **good wettability throughout washing**.
- **Eliminate total soda concentration** in the scouring bath by adding PWA.
- Fabric **cleanliness in terms of kitties, dirt, and dust is good** compared to other scouring formulations.
- **Very low foaming** and hence suitable for high shear machines.
- **Very high detergency** and emulsifying action which **removes & suspends oils, grease, and natural wax impurities as well as size material and soil particles**.

Both the products were tested and passed in the lab in terms of Stability, Viscosity, Solid content, Dispersibility, particle size distribution, Zeta potential, etc., and started bulk production on a large scale in the industry.

Several laboratory tests on various cotton and viscose rayon fabrics include set the optimum pH, temperature, time, dosages of auxiliaries, etc on each fabric were carried out in the Zydex lab. For desizing of cotton and viscose woven fabric in Recipe 1 & 3 respectively, final set the optimum 0.5% EDA dosages, 5.5 pH, 75°C temperature, 45

minutes time and for scouring & bleaching of cotton woven and knitted fabric in Recipe 2 & 4 respectively, set the optimum 0.5% PWA, 0.8% NaOH, 3% H<sub>2</sub>O<sub>2</sub> dosage; 90°C temperature, 45 minutes time

The bulk trials for the same were performed in wet processing industries against the current process adopted by the respective industry. In contrast to the current pretreatment procedure, the bulk trial findings of the new modified method were promising.

Current and modified processed all fabrics were taken from the industry and evaluated in the lab showing that most of the properties like weight loss (3-3.5% on Cotton woven; 5.25% in current process and 3.5% in modified process), Tegawa rating (6-7 rating on cotton woven and 8-9 rating on Viscose woven), Absorbency (Avg 1-3 seconds on all fabric), Sinking time (Avg 2-3 seconds on all fabric), Whiteness and Yellowness index (Avg WI of fabrics are  $60 \pm 2$ ) and Yellowness index (Avg YI of fabrics are  $10 \pm 2$ ), core pH of fabric (viscose is near to neutral whereas 0.4 pH higher seen in current pretreatment of cotton woven and knitted fabric compared to modified), colour strength of the pretreated fabric, Tensile and Tear strength of fabric were almost same or negligible difference but feel of the fabric was improved in the modified process due to good cleaning, lesser caustic used and polymer deposition on fabric.

The effluent generated in the modified process of Cotton woven, Cotton knitted, and viscose rayon fabric by 20 -40% lower compared to the current process. Also TDS, COD, and pH were showing lower values in the modified process of Cotton woven and knitted fabric but slightly increase all values in the viscose woven modified process.

Reduced processing time, temperature, and water and steam usage are all signs of the modified process. So, from per economy point of view, 550 - 580 Rs/ 200-250 kg batch save which converts to large savings on monthly and yearly bases in water, Steam, and auxiliaries using all types of fabrics. Also, the time of processing per batch was reduced which increases production by 25% in cotton knitted, 40% in cotton woven and 60% in viscose woven fabric.

The production of both the products in financial year 2021-22 was **40 tonnes** which increased to **70 tonnes** in the financial year 2022-23. The targeted production for the financial year 2023-24 is **100 tonnes**.

Since the textile wet processing sector is the main source of pollution, it is important to examine it closely from an ecological standpoint. Eco-alternatives to these chemicals will benefit society as a whole because it is directly impacted by them as well as the customer. Since they are the first to be impacted by any immediate exposure, a detailed look at worker safety is also necessary. Some alternatives are even more effective and cost-effective than their predecessors. Therefore, using such things shouldn't be postponed. The employment of enzymes also acts as a replacement from an ecological and environmental standpoint, particularly for the preliminary phase. Therefore, "Substitution is better than cure" should be the motto of the textile industry.

Because of cotton's comfort qualities, affordability, and environmental friendliness, its consumption will rise globally. Effluent and waste disposal are issues that the textile sector has to deal with. Additionally, the forbidden colours and red-listed compounds are extremely hazardous or carcinogenic. The quantity of pollutants in the finished product is what has a negative impact on people's health. On the other hand, environmental restrictions are tightening up over the world every day as people's awareness of the quality of the environment grows.

In the last 150 years, rapid industrialization has damaged the environment. Otherwise, as J. Krishnamurthy famously put it, "Our present is because of what we were in the past and our future is what we are in the present." It is time to take action to conserve our planet Earth and to create regulations and legislation to firmly enforce the same. If you don't change right away, humanity will not be rescued. We are destined to perish.