

### **BACKGROUND AND EXPLANATION**

The main environmental concern in the textile industry is about the amount of water discharged and the chemical load it carries. Over the last years, there has been a growing trend on the part of the authorities to impose strict rules on effluent discharge and to impose significant charges for water consumption. There is also a growing awareness that the energy consumption, associated with heating water to carry out dyeing processes, contributes to the emission of greenhouse gases.

Therefore, there has been a drive to develop processes that use less water, energy and chemicals.

### **CONVENTIONAL DYEING PROCESS**

Dyeing is a method for colouring a textile material in which a dye is applied to the substrate in a uniform manner to obtain an even shade with a performance and fastness appropriate to its final use.

Dyeing can be carried out in batch or in continuous/semi-continuous mode. In conventional dyeing, a certain amount of textile material is loaded into a dyeing machine and brought to equilibrium with a solution containing the dye and the auxiliaries over a period of minutes to hours. Pre-treatments, dyeing and washing operations are often carried out in the same type of equipment.

Pre-treatment processes are necessary to ensure the removal of foreign materials from the fibres in order to improve their uniformity, the affinity for dyestuffs and finishing treatments, the improvement of the ability to absorb dyes uniformly and the relaxation of tensions in synthetic fibres. Washing process is carried out to remove unfixed dyes and chemicals.

In addition to water and energy consumption of pre-treatments, dyeing and washing processes, the conventional dyeing process generates wastewater. The pollutant load of the wastewater is due to the presence of remains of dyes, detergents and residue additives used. Consumption and emission levels are strongly related to the type of fibre, the dyeing technique and the machinery employed.

### **SPUN DYEING vs CONVENTIONAL DYEING**

Spun dyeing is a dyeing method in which pigment colour is added to the spinning mass solution and the entire body of the fibre is coloured instead of only the surface, as in conventional dyeing.

If we compare conventional dyeing system and spun dyeing system, the fundamental differences, which determines the improvement of the technology used, are the following:

- In spun dyeing system the fibre is dyed before yarn spinning and knitting by dyeing of spinning solution, while in conventional dyeing the fabric or garments are dyed.
- In spun dyeing system, conventional dyeing fabric process and washing-off process are avoided.

The following flowcharts (Fig. 1) show both manufacturing processes.

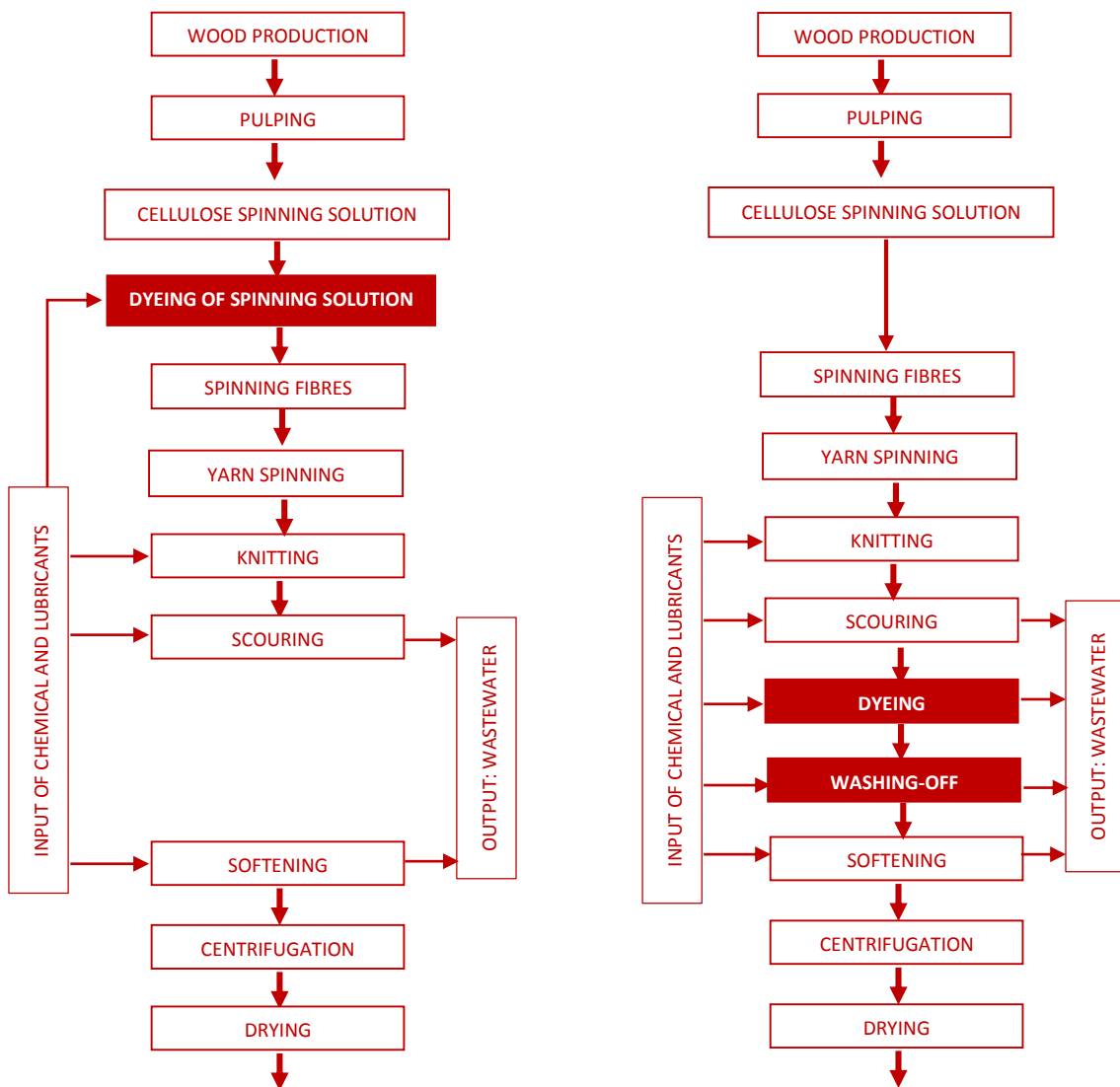


Figure 1 Flowchart of conventional dyeing process and Spun dyeing process

## **ENVIRONMENTAL ADVANTAGES OF SPUN DYEING.**

ENERGY USE: Spun-dyed fabric needs about 50 % lower energy compared to conventionally dyed fabric. This difference mainly comes from conventional dyeing and washing-off processes. Sources of energy consumption in conventional dyeing processes are: electricity, steam and energy required for producing dyes and chemicals used. In spun-dyeing, energy and steam consumption of conventional dyeing steps (dyeing and washing-off) can be avoided and can be translated into energy cost savings.

WATER USE AND WASTEWATER: Water consumption of 1 kg fabric produced by spun-dyeing is about 50% lower than by conventional dyeing. Spun dyeing avoids the consumption of water associated with the conventional dyeing process (pre-treatments, dyeing and washing). In addition, spun dyeing avoids wastewater effluents of conventional dyeing and washing processes. This reduction of wastewater can be translated into cost reduction of process water and treatment of effluents.

CHEMICALS USE: Spun-dyeing needs very little quantity of dye as opposed to high quantity of dye required in conventional dyeing due to poor fixation. The total pigment requirements of spun-dyeing are only about 20% of the dye required for conventional dyeing.

Besides, conventional dyeing and washing-off processes use chemical substances as reactive dye, caustic soda, soda ash, sodium sulphate, soaps and acetic acid. Spun dyeing system saves consumption and cost of these chemical products.

## **ADVANTAGES OF SPUN DYEING vs. CONVENTIONAL DYEING**

- Reduced energy and water-consumption: Eliminates conventional fabric dyeing and washing-off steps, saving water and energy.
- Lower wastewater effluents: The volume of wastewater needing treatment prior to discharge into the environment is reduced.
- Lower use of pigments and chemicals products.
- Fibres are dyed successfully with excellent fastness properties and uniform in colour. Therefore, garments do not lose the colour during washes.

## **LIMITATIONS AND FURTHER RESEARCH OF SPUN DYEING.**

- Available in limited colours. Spun dyeing is only suitable for large lot sizes, for this reason, usually few colours are available.
- The equipment has to be cleaned thoroughly for a new colour production.
- When the spun dyeing yarn is partially overdyeing in the final finishing process of the fabric/garment, more research is needed to quantify the environmental advantages.

## **WHY SHOULD SPUN DYEING BE PROMOTED?**

The environmental improvement of textile processes beyond regulation is necessary to achieve a more sustainable and responsible textile industry. The spun dyeing technology reduces water, energy and chemicals products.

Using spun-dyed fibres for making garments ensures substantial reduction of the environmental footprint of final products. This offers the opportunity to reduce the overall footprint of product.