

# Chemical Reuse, Recovery and Recycling in Textile Factories

Promotion of Sustainability in the Textile and Garment Industry in Asia-FABRIC

# 7. Group Exercise for making Techno-Economic Assessment for Chemical Reuse, Recycling and Recovery

**11.15– 12:00**

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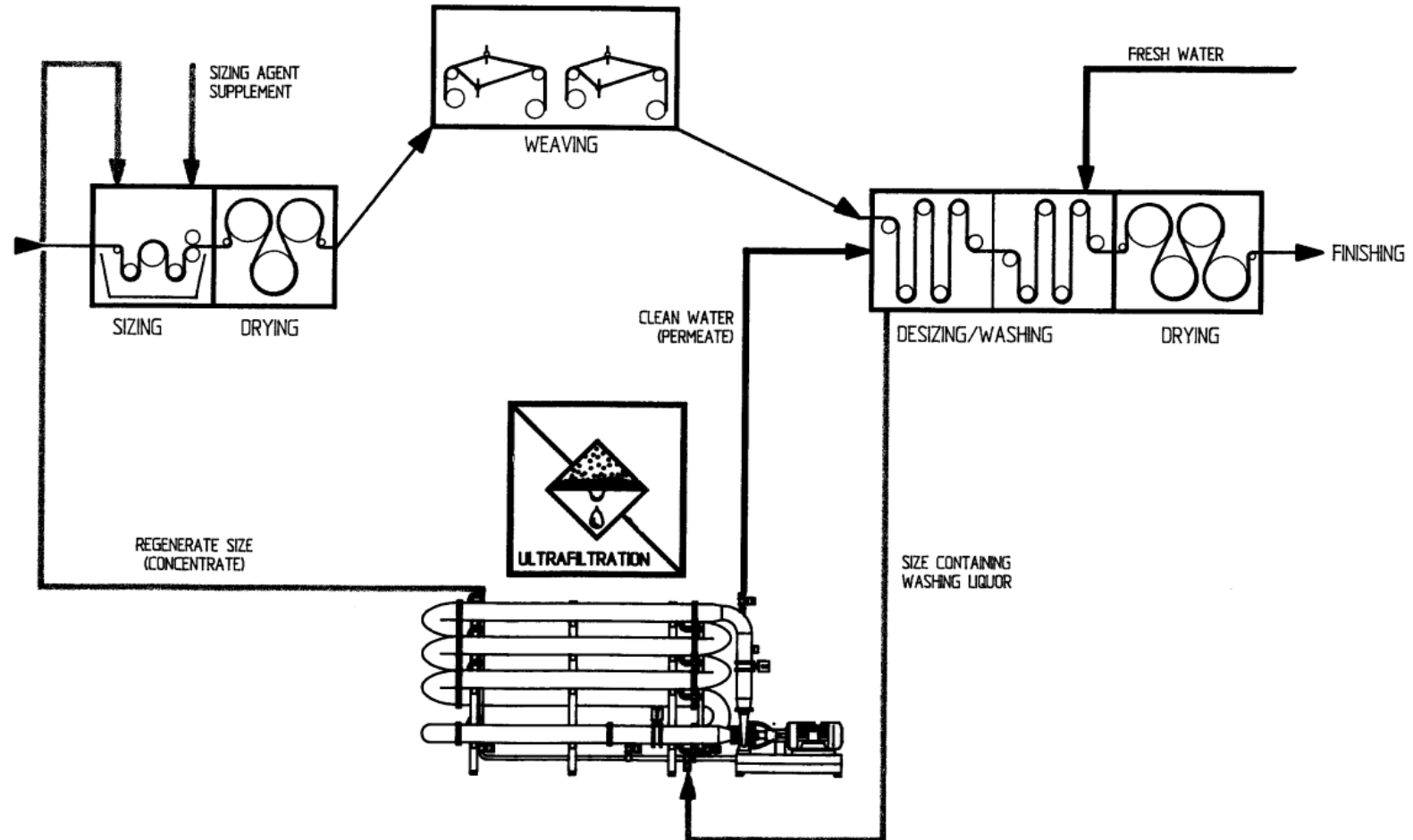
**on behalf of GIZ FABRICS and Espire Consult**

## **Presentation of the recovery process and the case study**

### **Group Exercise**

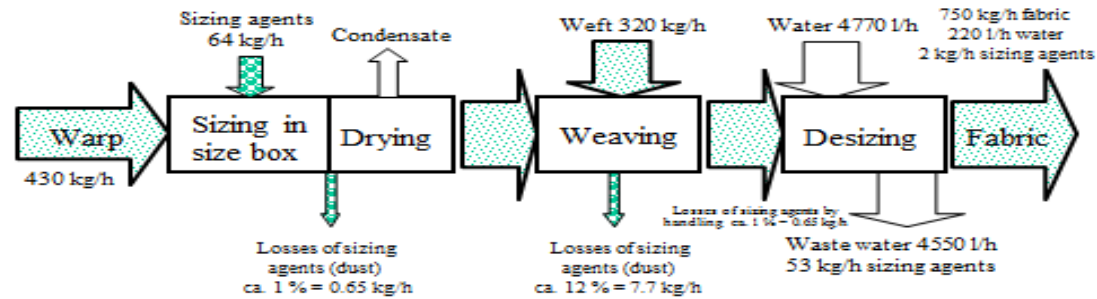
The principle of recovery by ultrafiltration is shown in the next slide. After sizing and weaving, sizing agents are removed during textile pretreatment by hot washing with water in a continuous washing machine (in order to minimise water consumption, the washing process may need to be optimised). The sizing agents concentration in the washing liquor is about 20-30 g/l. In the ultrafiltration plant, they are concentrated to 150-350 g/l. The concentrate is recovered and can be reused for sizing, whereas the permeate can be recycled as water in the washing machine. Note that the concentrate is kept at a high temperature (80-85 °C) and does not need to be reheated, which results in less energy consumption.

# Recovery of sizing agents by ultrafiltration

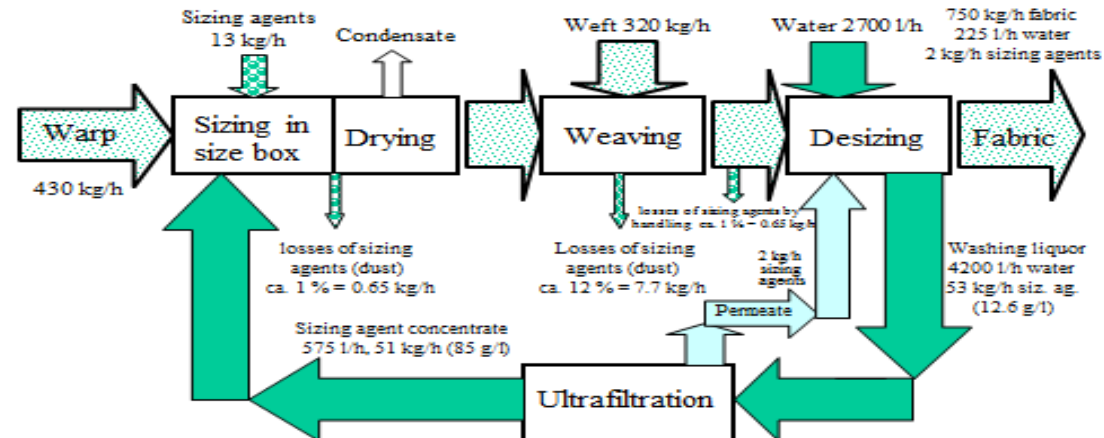


# Recovery of sizing agents by ultrafiltration

Material balance for sizing agents without recovery



Material balance for sizing agents with recovery



# Recovery of sizing agents by ultrafiltration

## Environmental performance and operational data

Next slide shows the mass balance of sizing agents and water for the process with and without recovery in a representative case study. It can be noticed that, even with recovery, some losses of sizing agent still occur at various steps stages of the process, especially during weaving. Furthermore, a certain amount of sizing agent still remains on the desized fabric and a fraction ends up in the permeate. In conclusion, the percentage of sizing agents which can be recovered is 80-85 %.

## Achieved environmental benefits

- Resource efficiency as sizing agents are recovered
- Reduction of the pollutant loads in the waste water.
- Reduction of energy consumption.
- Sizing agents in wastewater do not need to be treated.

# Recovery of sizing agents by ultrafiltration

Rapid and complete removal of the size may be achieved by using new washing systems with, for example, a steamer or vacuum suction. The steamer facilitates the delamination of the size, improving the removal before the fabric runs in to the washing process. This results in an increase in washing efficiency, water and energy savings of the following washing process. This process is particularly gentle to fabrics and therefore suited for fine fabrics. [ÖKOPOL 2011 ]

## **Operational data**

In order to minimise scaling and fouling, fibres have to be removed before ultrafiltration. The same applies to fine particles, such as singeing dust. A pre-filtration step is carried out for this purpose.

When desizing coloured woven fabric (dyed warp yarn), the desizing liquor becomes slightly coloured. Dyestuff particles are more difficult to remove and the liquor needs to be submitted to microfiltration (which is more complex, but still feasible) [UBA, 2001].



# Recovery of sizing agents by ultrafiltration

Ultrafiltration is very efficient in reducing the high organic load from textile mills. The COD load of wastewater is reduced by 40-70% due to size recovery.

Ultrafiltration needs energy, but the amount consumed is much less than the energy required to produce new sizing agents and to treat them in a waste water treatment plant.

Reuse in the weaving plant is not always without problems. The recovered size needs to be kept under sterile conditions when stored and mixed with virgin fresh size, to avoid bacterial growth (biological degradation of concentrates and contamination of the ultrafiltration equipment).

Recovered sizing agents are kept at temperatures above 75 °C, under these conditions there are no problems of microbial attack and therefore no addition of biocides is needed to maintain sterile conditions.

# Technical considerations

The recovery of sizing agents by ultrafiltration is suitable for water-soluble synthetic sizing agents such as PVA, polyacrylates and carboxymethyl cellulose. Recently, it has been confirmed that as well as some kind of modified starches such as carboxymethyl starch can also be recycled.

Limitations in the applicability of this technique may arise from cases where the auxiliaries applied to the yarn are not only sizing agents, but also waxes, antistatic agents, etc. These compounds remain in the concentrate after UF. The concentrate can be reused for sizing, but limitations can be found when reusing the same concentrate for different kinds of yarns (with different applications and end uses) which may need specific additives.

To date, the weavers' acceptance of recovered size is still limited. Weavers are concerned about the quality of the recovered size. Furthermore, certain effects such as minting can only be carried out with non-desized fabric. For these reasons, reuse of the concentrate is typically applied in integrated companies with a uniform production, recovery and reuse of sizing are only technically and economically feasible for integrated finishers with weaving and finishing processes nearby. Furthermore, the sizing recipe must remain unchanged.

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