



## Desizing of textiles





## SIZING

**Slashing** is the process where **Size** is applied to warp yarns for weaving. The purpose of size is to protect the yarn from the abrasive action of the loom. The process is carried out on a **Slasher** and the application procedure is called **Sizing** or **Slashing**.

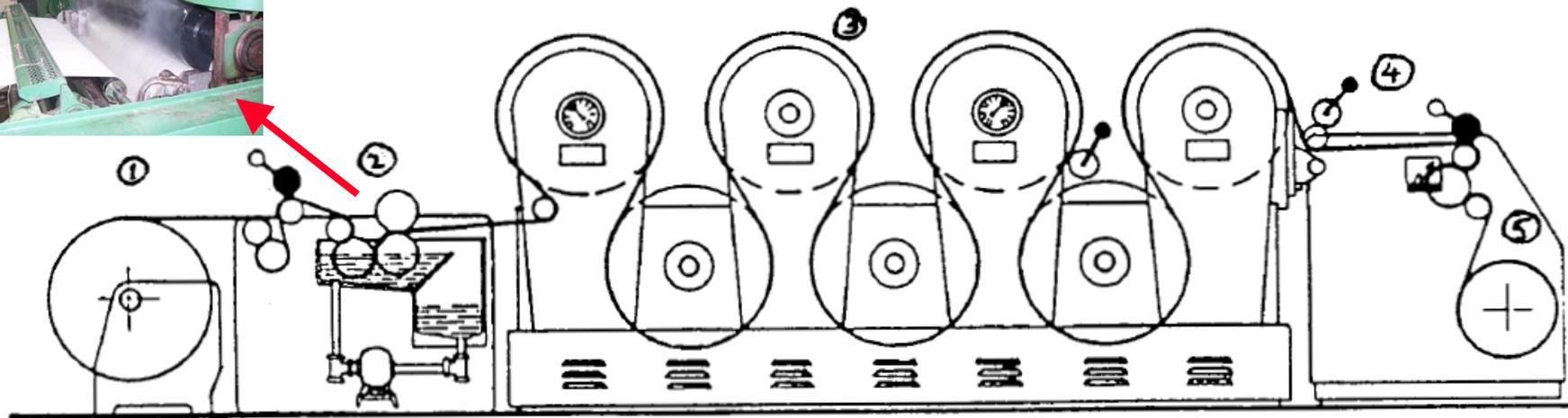
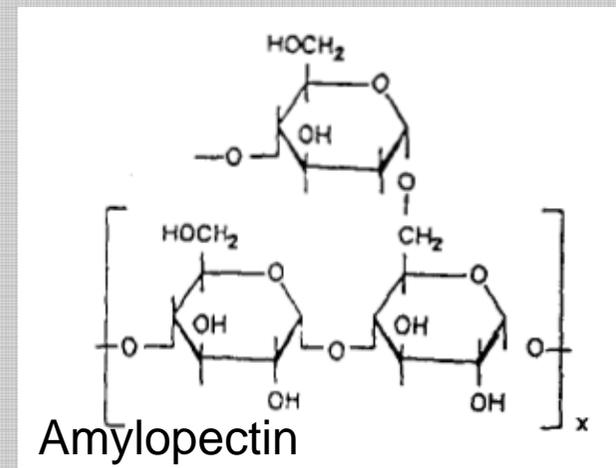
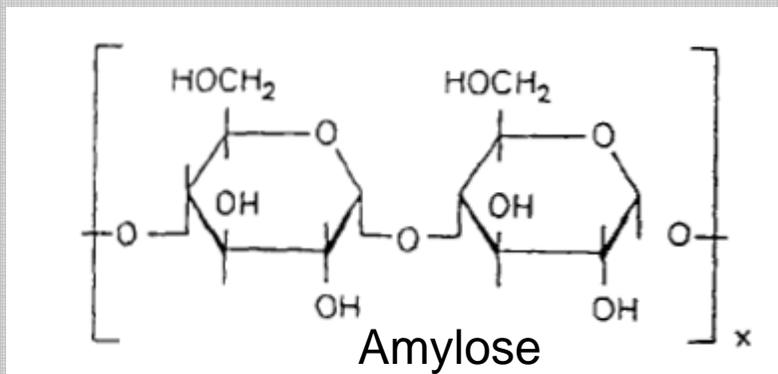


Figure shows a schematic diagram of a **SLASHER**. In slashing, section beams are combined to create a loom beam and at the same time apply the appropriate size to the warp yarns. The section marked (1) is the let-off station where one or more section beams are combined and fed through the rest of the range. The warp yarns are let-off as a flat sheet and then pass through a size applicator (2) consisting of a trough containing the size formulation and squeeze rolls. The yarns pass over heated cans (3) to dry. Located at the exit end of the slasher is an arrangement of bust bars which separate each warp end from its neighbor.



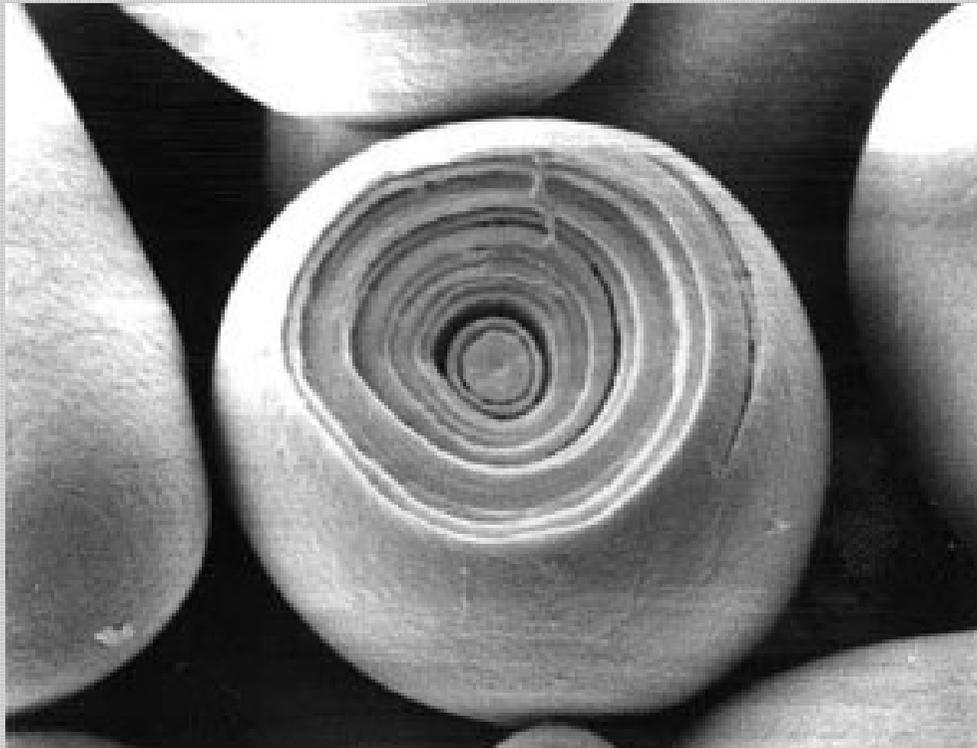
## NATURAL SIZING AGENTS I

- Natural sizing agents are based on natural substances and their derivatives:
- Starch and starch derivatives; native starch, degradation starch and chemical modified starch products
- Cellulosic derivatives; carboxymethylcellulose (CMC), methylcellulose and oxyethylcellulose
- Protein-based starches; glue, gelatin, albumen

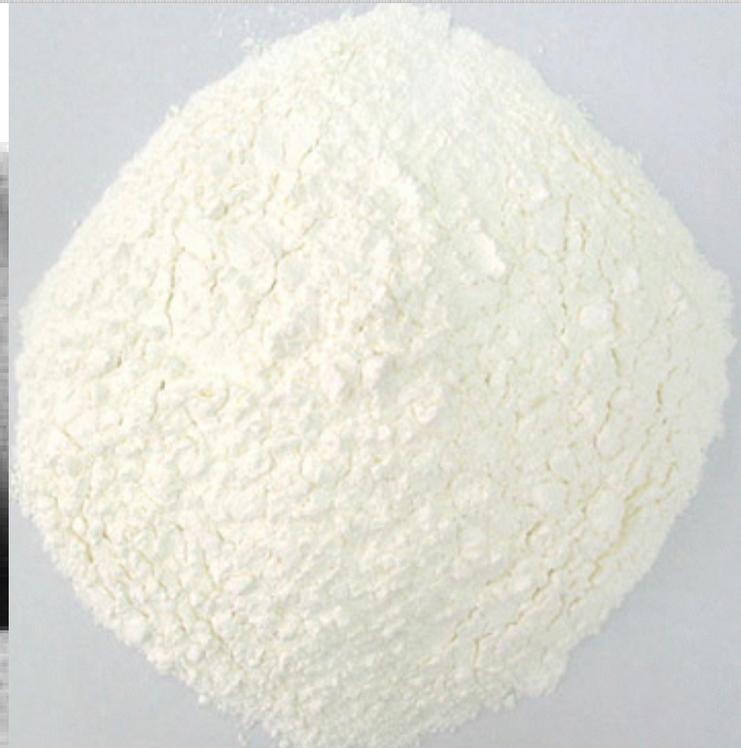




## NATURAL SIZING AGENTS II



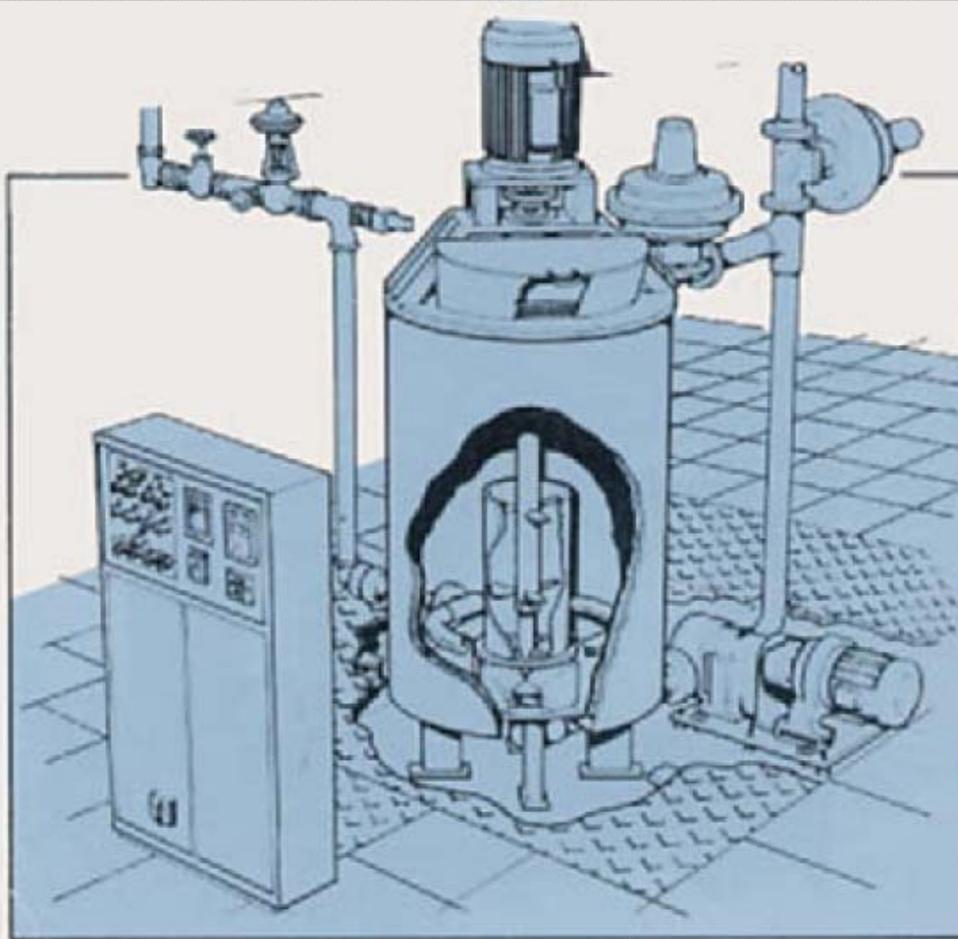
crosssection of a starch  
kernel under an electron  
microscope



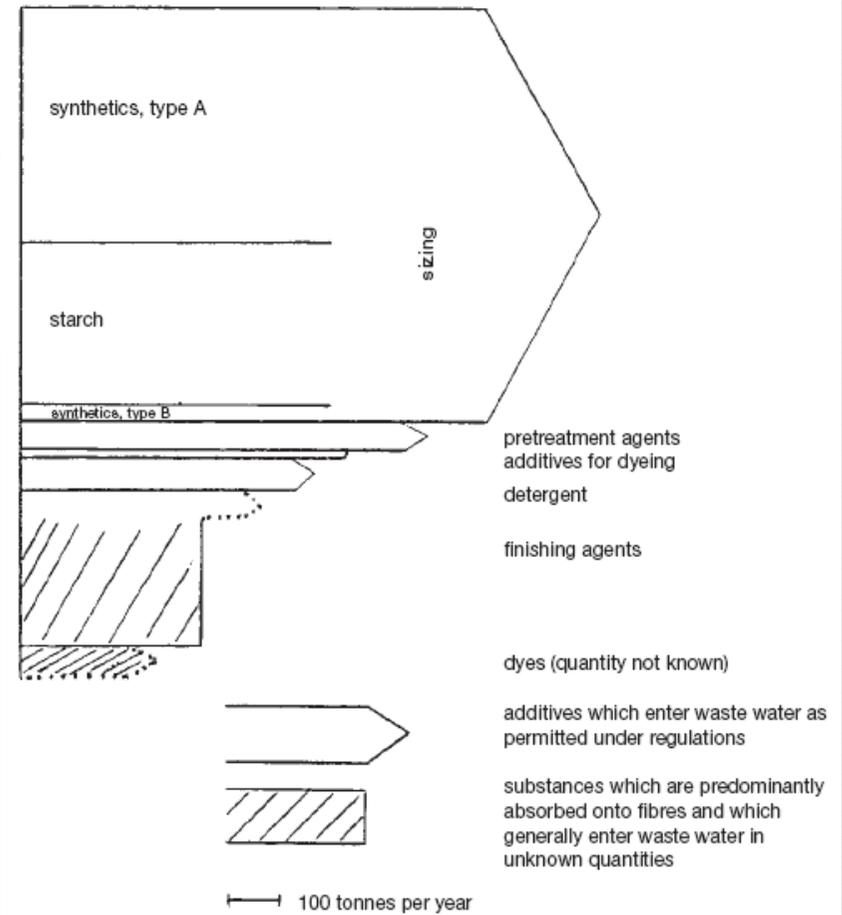
starch powder



## NATURAL SIZING AGENTS III



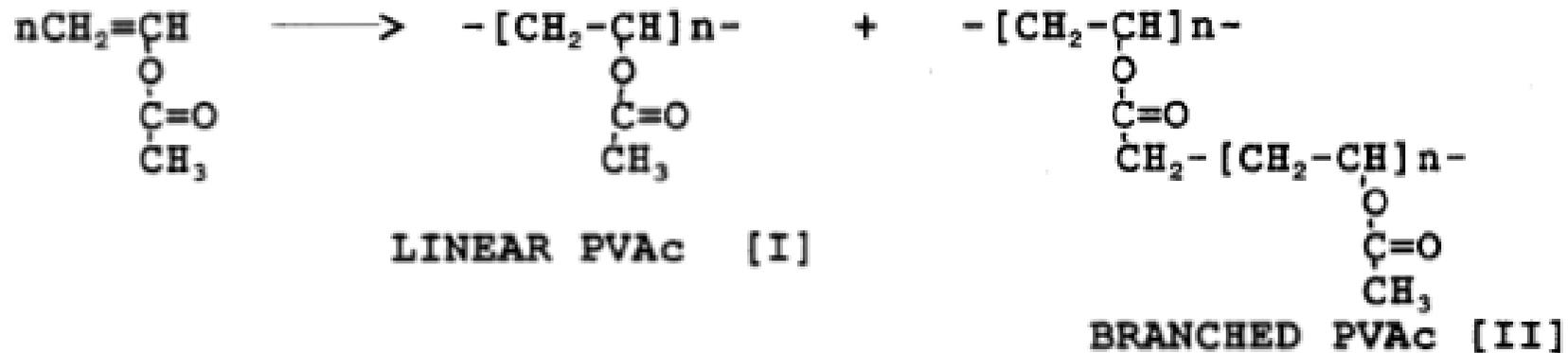
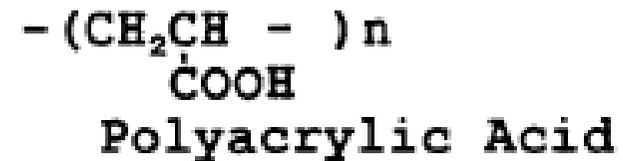
*Size boiler*





## SYNTHETIC SIZING AGENTS

- Polyacrylates
- Modified polyesters
- Polyvinyl alcohols(PVA)
- Styrol/maleic acid copolymers





## SIZING AGENTS RELATED TO THEIR SUBSTRATES

size substrate	natural				synthetic				
	starch	CMC	galac- toman- nane	glue	poly- acrylic acid B	poly- acrylic ester B	PVA	PES	vinyl copoly- mer
<b>yarn</b>									
cellulose	+	+	+		+	+	+		
cellulose/PES	○	○	○		+	+	+		+
cellulose/PA	○	○	○		+	+	+		
wool	○	○		+		+	+		+
wool/PES	○	○				+	+		+
PES, PA	○	○				+	+		+
<b>flament</b>									
viscose rayon		+		+	+	+	+		+
acetate						+			+
triacetate						+			+
polyamide					●	●	●		
polyester						+	+	+	+

+ alone or in combination    ● alone    ○ only in combination with synthetic sizing agent



## DESIZING I

- Desizing is the process of removing the size material from the warp yarns in woven fabrics.
- Sizing agents are selected on the basis of type of fabric, environmental friendliness, ease of removal, cost considerations, effluent treatment, etc.





## DESIZING II

Desizing, irrespective of what the desizing agent is, involves impregnation of the fabric with the desizing agent, allowing the desizing agent to degrade or solubilise the size material, and finally to wash out the degradation products.

***The major desizing processes are:***

- Enzymatic desizing of starches on cotton fabrics
- Oxidative desizing
- Acid desizing
- Removal of water soluble sizes





## ENZYME DESIZING I

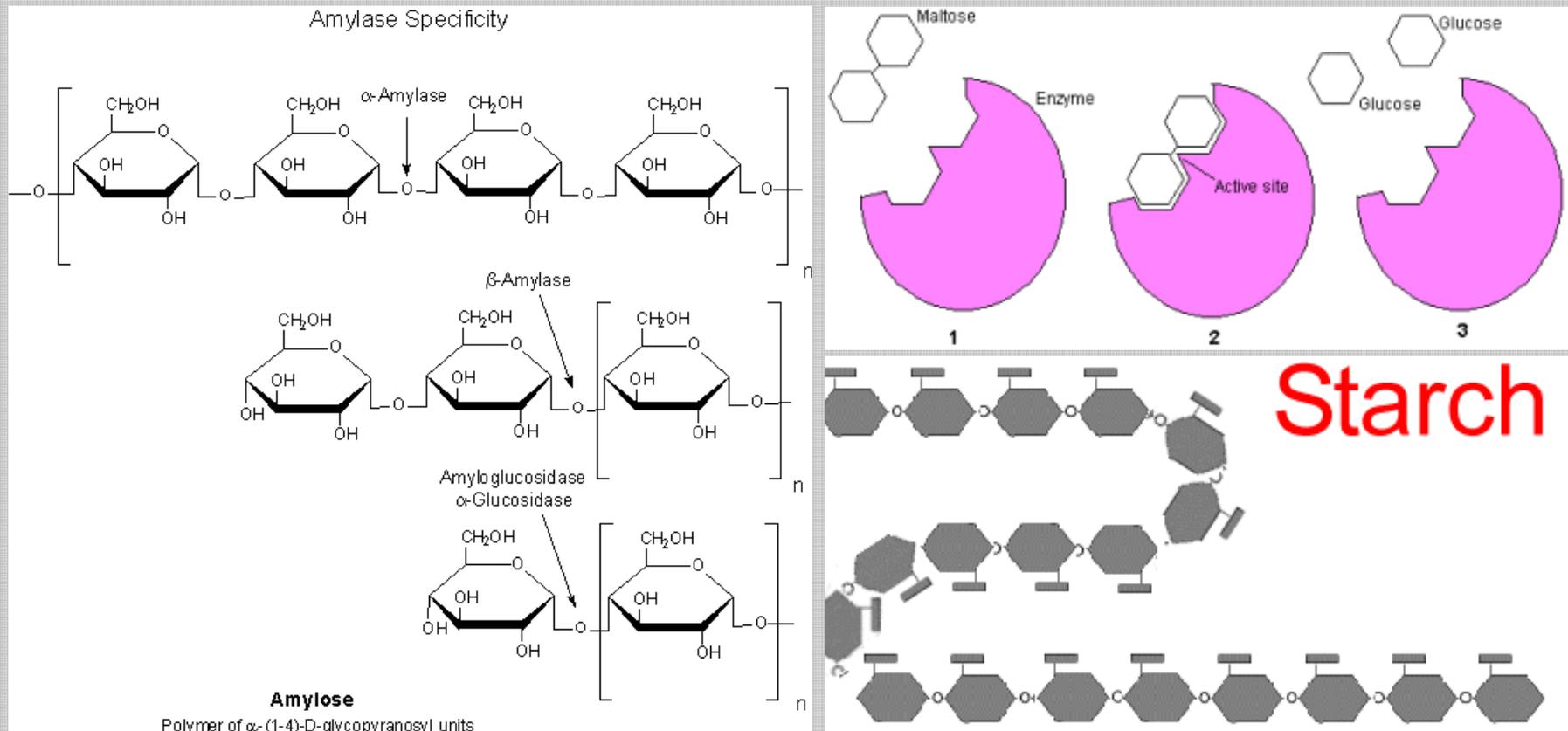
- Enzyme desizing is the most widely practiced method of desizing starch.
- Enzymes are high molecular weight protein biocatalyst that are very specific in their action.
- Enzymes are named after the compound they break down, for example:
- ***Amylase*** breaks down amylose and amylopectin,
- ***Maltase*** breaks down maltose and
- ***Cellulase*** breaks down cellulose.



For desizing starch, amylase and maltase are used.



# AMYLASE



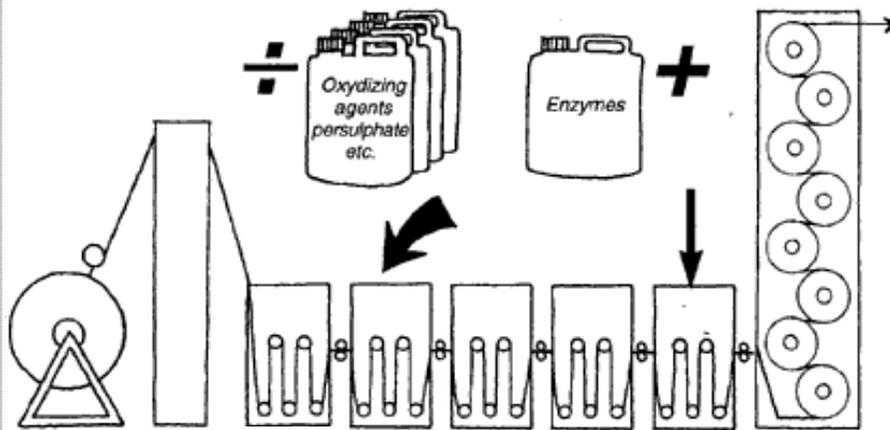
**First of all it should be noted that enzymes are proteins and that they are substrate specific.**

This means that a given enzyme only will work on a certain substrate and only do a very particular job. Secondly it should be remembered that, although they take part in a chemical (enzymatic) reaction, they do not change during that reaction. They are what we call biological catalysts that accelerate or facilitate chemical reactions.



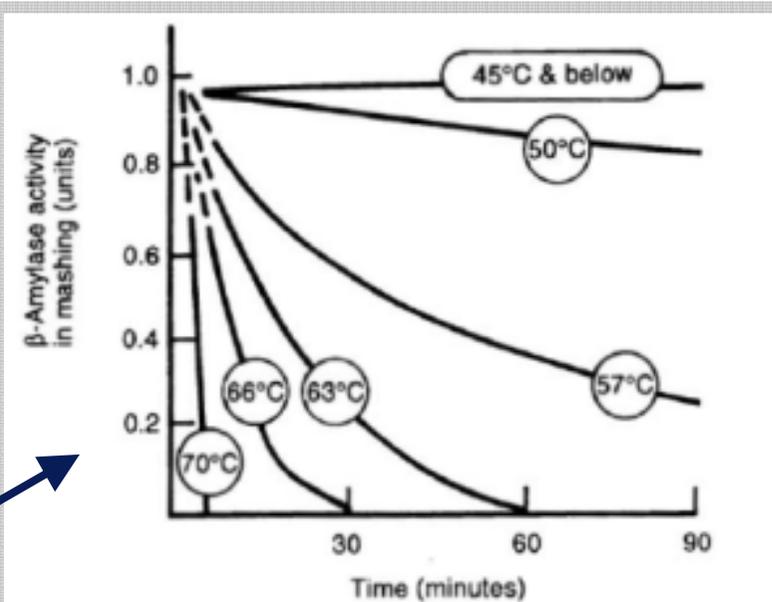
## ENZYME DESIZING II

*Desizing with enzymes on continuous line*



Summary of Optimum Operational Conditions for Amylases

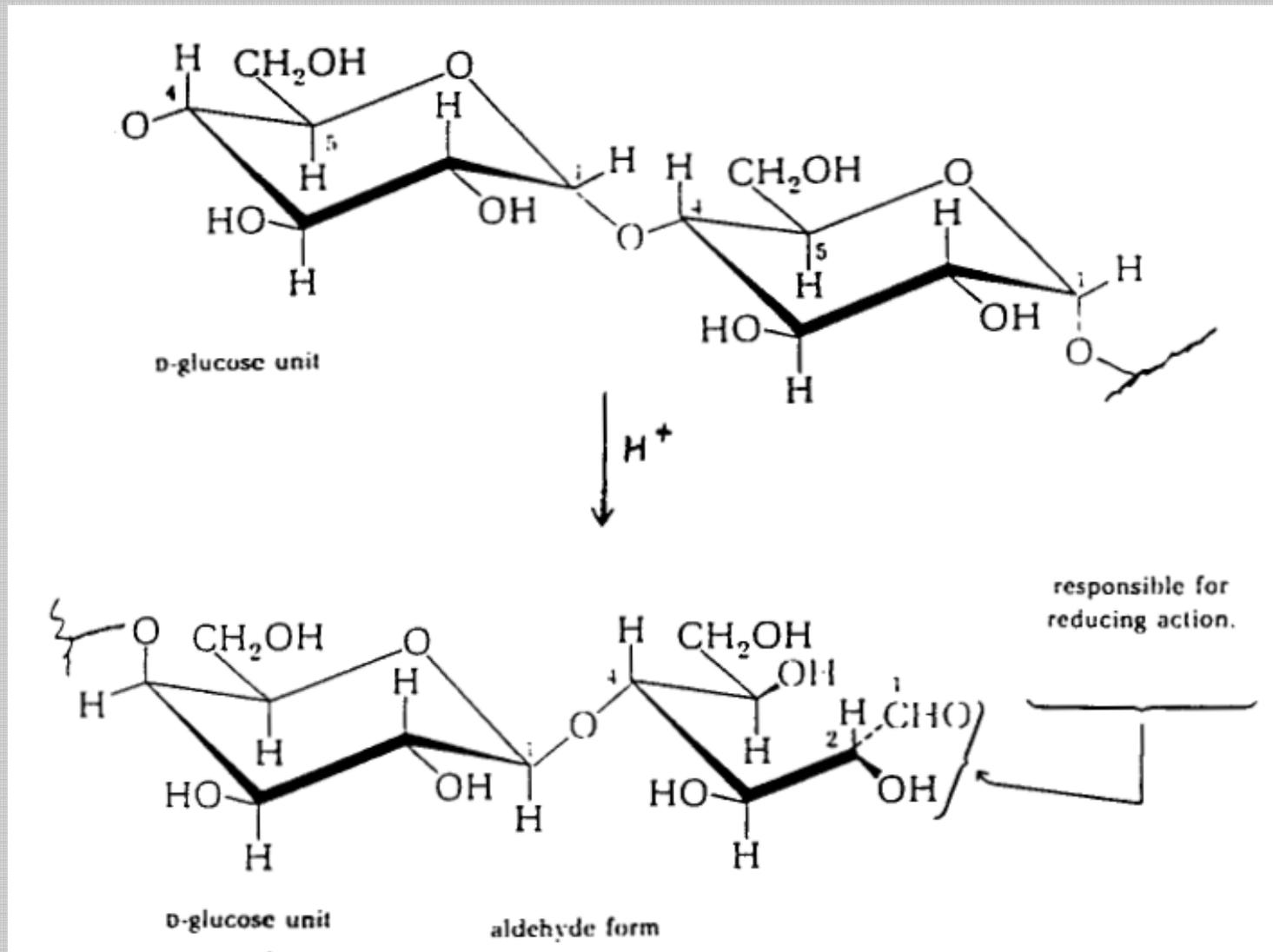
Alpha Amylase	Optimum pH	Effect of Temp. °C	Effect of NaCl	Effect of CaCl <sub>2</sub>
Pancreas	6.8-7.0	40 - 55	+	+
Malt	4.6-5.2	55 - 65	-	+
Bacteria	5.0-7.0	60 - 70	0	+



Qualitative beta amylase activity for different mash temperatures

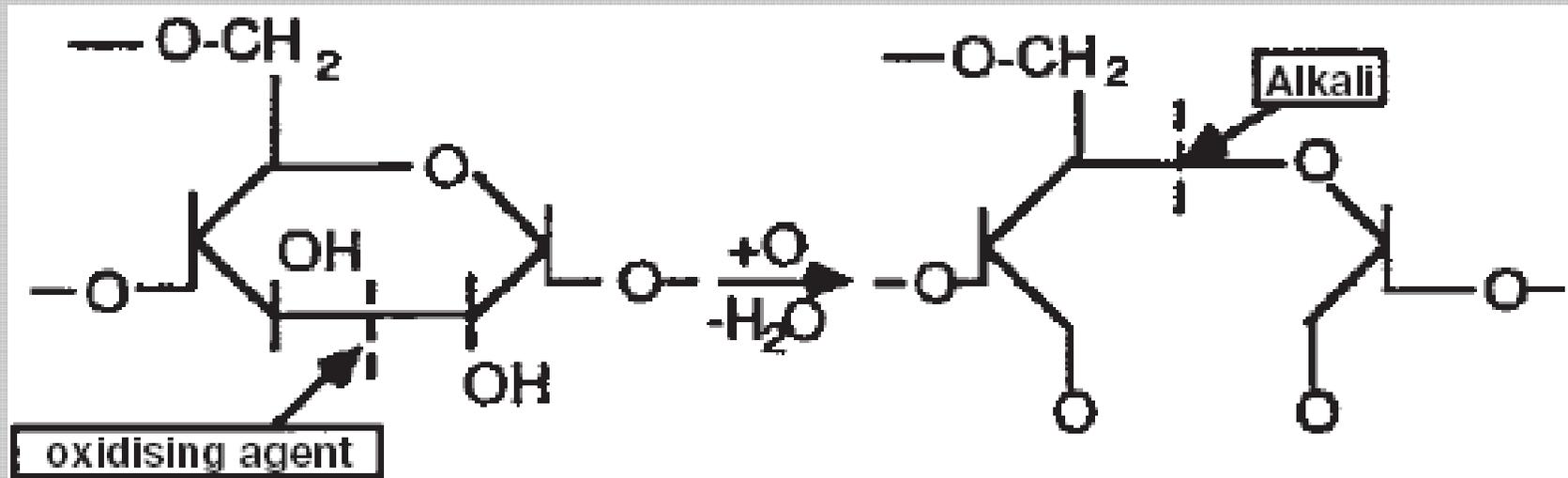


## HYDROLYSIS OF STARCH





## OXIDATIVE DESIZING OF STARCH



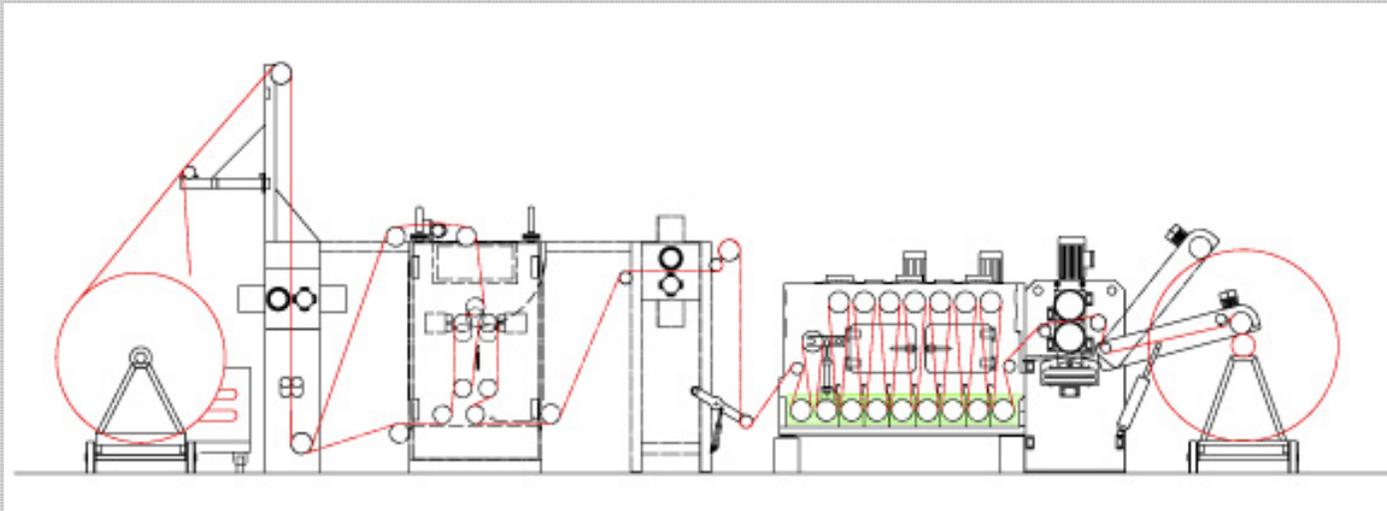
- The oxidative desizing methods are relatively unimportant and when using them, damage to fiber can never be completely avoided.
- The power of oxidizing agents to break down starch has always given occasion to use this method for desizing.



## SYNTHETIC SIZING AGENTS DESIZING

One of the advantages of PVA is that a dried film will redissolve in water without having to degrade it first.

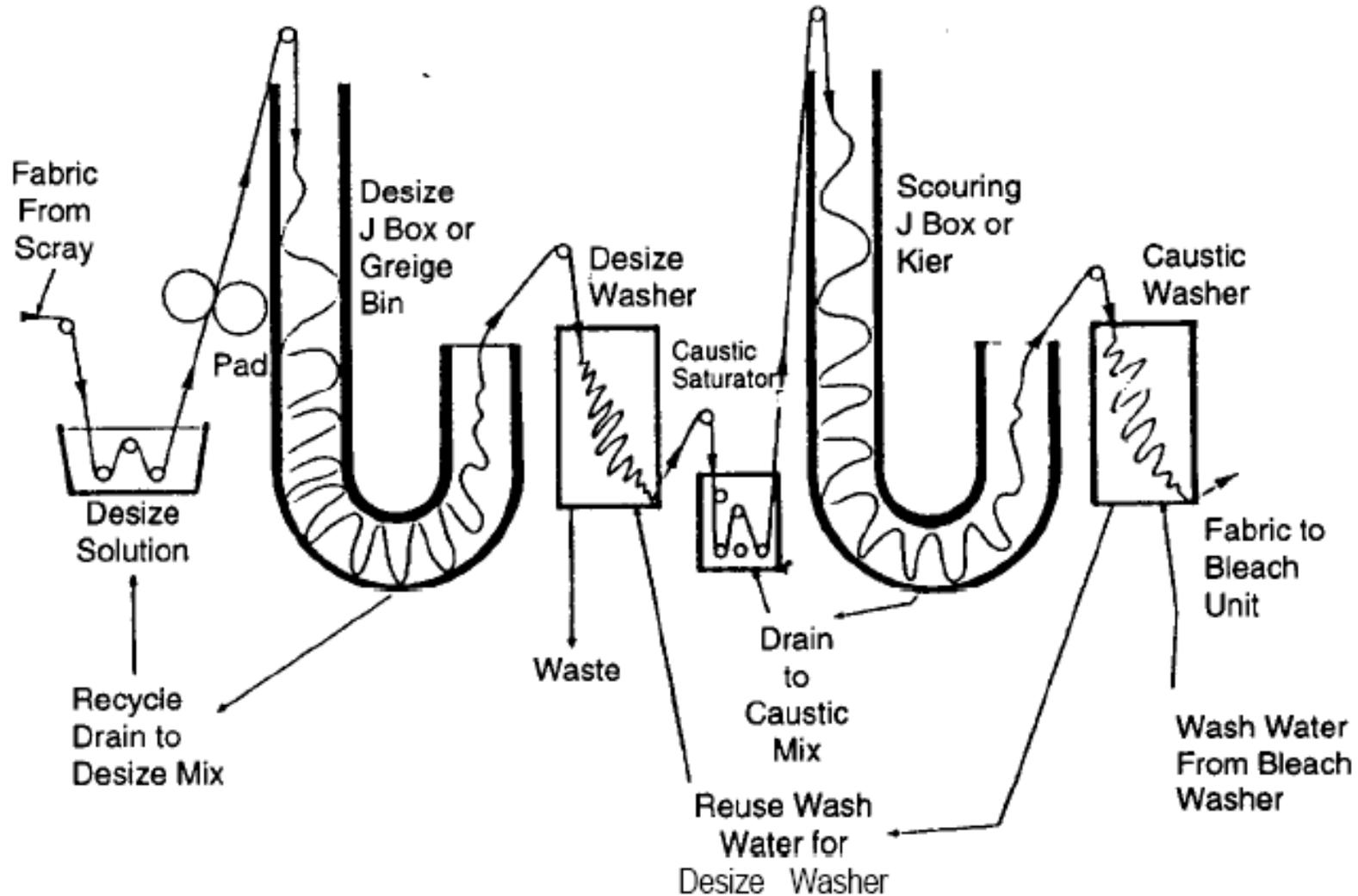
*For example fabrics sized with PVA are desized by first saturating with water containing a wetting agent (for rapid penetration) and then by heating in a steamer or J-box (to hydrate the film).*



*The desizing step is completed by rinsing in hot water to complete the removal.*

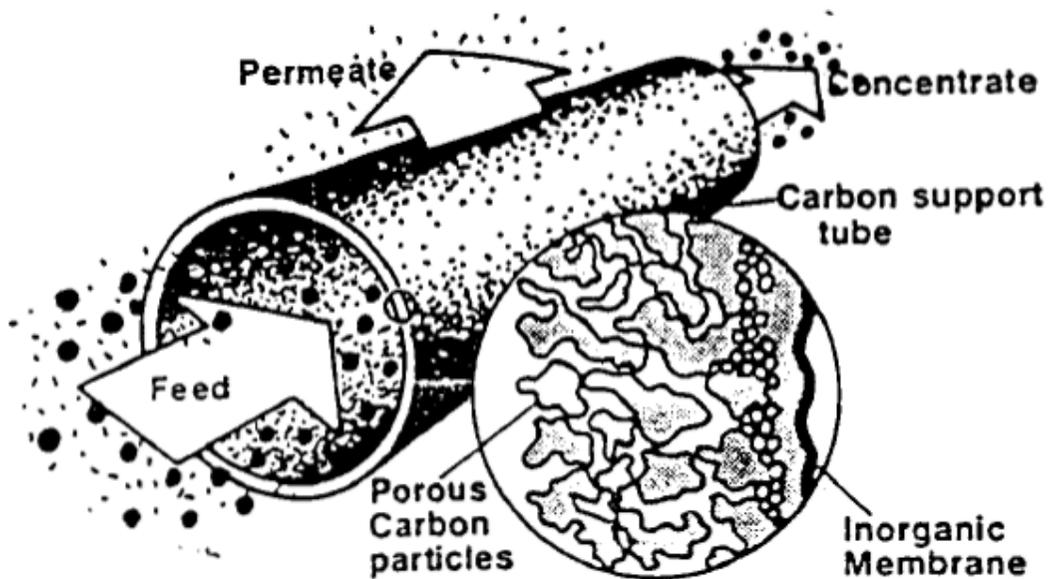


## REUSE OF ALKALINE WASTE STREAMS FROM DESIZING AND SCOURING OPERATIONS

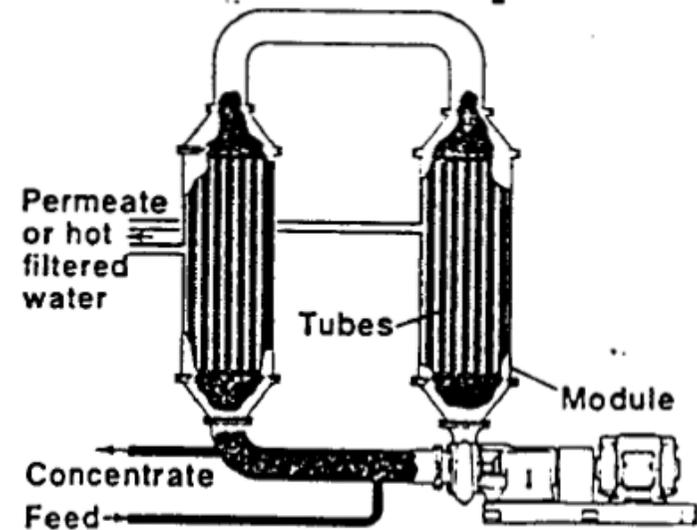




## SIZE RECOVERY



## Ultrafiltration Loop

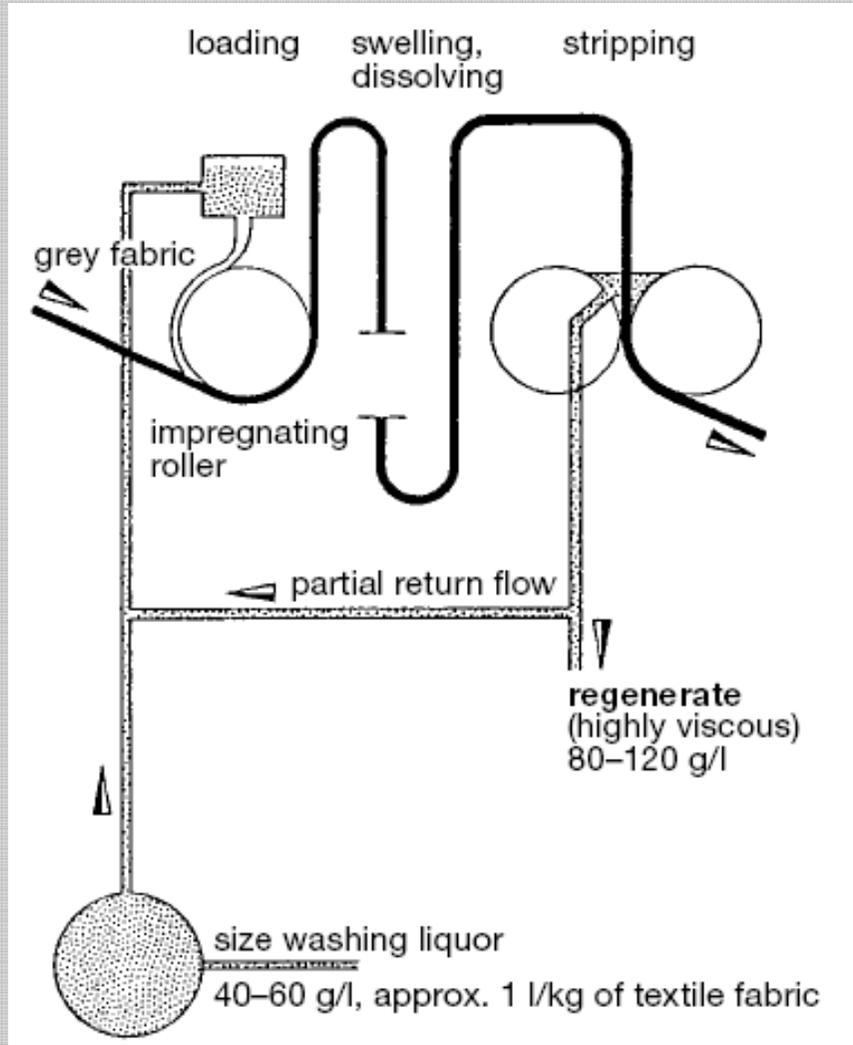


Since PVA's properties are not altered in desizing, the solids in the spent desizing liquor can be reused as warp size provided the concentration can be built back up to the level used in sizing warp yarns.

This can be accomplished by passing the spent liquor through a size recovery unit.



## HYGROSCOPIC UPGRADING OF DESIZING WASH LIQUORS IN THE CASE OF ACRYLATE SIZES



- The already high waste water loading in textile production (50–80% due to sizing agents) can be reduced by the co-application of polyacrylate sizes.

- Polyacrylate sizes in the filament field with low BOD5 values have good biodegradability.

- The degree of polymerization appears to influence the degradation behavior, so for example acrylic acid homopolymers with growing chain lengths are usually degraded slowly.



## DESIZING PROBLEMS

### **Group 1 (problems arising from pre-treatment):**

- Over-drying the sized warp,
- High content of fats with poor emulsion properties or waxes subsequently applied to the warp,
- High content of finishing auxiliaries released from the synthetic component during sizing of polyester/cotton products,
- High copper content from the size-hydrolyzation plant and size trough,
- High content of preservatives.

### **Group 2 (problems arising from the process itself):**

- Liquor uptake too low, because the impregnation box is too small or too little surfactant has been added.
- The swelling time (dwell time) is too short.
- Enzyme-toxic surfactant has been used.
- The wash power is too small for removing the hydrolyzed size.