Objects

- The object is to remove from the grey fabric the size that has been applied during weaving and thus to make the fabric ready for further processes.
- The main ingredient in size that is not water-soluble is usually starch.
- Chemically starch is poly-glucopyranose in which straight chain and branched chain polymers are present.
- Both the constituents of starch are insoluble in water but they can be made soluble by hydrolysis of these long chain compounds to shorter ones.

Methods Of Desizing

- Grey cotton fabric contains both natural impurities as well as 'added matter'.
- The added matter is called 'size'. It is added by man in a process called 'sizing', as it facilitates weaving.
- The size contains substances such as starch, thin boiling starch, CMC, PVA, vegetable oil, mutton tallow, etc.
**Mechanism**

- The main ingredient in size that is not water-soluble is usually starch.
- Chemically starch is poly-glucopyranose in which straight chain and branched chain polymers are present.
- Both the constituents of starch are insoluble in water but they can be made soluble by hydrolysis of these long chain compounds to shorter ones.
- Thus, under suitable conditions, the following steps show the progressive hydrolysis of starch.

However, in desizing, the hydrolysis of starch is carried out only up to the soluble dextrin stage, as this can be removed off the desized fabric by means of an aqueous wash.

**Rot Steep..**

- This is the oldest and cheapest method of desizing.
- Here no special chemical is used.
- The cloth is first passed through warm water at 40°C in a padding mangle where the cloth is squeezed to about 100% expression.
- The cloth is then allowed to stand for 24 hours.
- The microorganisms, naturally present in water, multiply and secrete starch-liquefying (hydrolysing) enzymes, which break down the starch present in the size to water-soluble products.
- The cloth is then washed to remove these products.

**Rot steeping**

- Step 1: Wetting and squeezing in a 3-bowl padding mangle
- Step 2: Steeping of wet fabric in a storage tank
- Step 3: Washing in a rope washing machine

**Advantages**

- This is the oldest and cheapest method of desizing.
- Here no special chemical is used.
- The cloth is first passed through warm water at 40°C in a padding mangle where the cloth is squeezed to about 100% expression.
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- The cloth is then washed to remove these products.

**Disadvantages**

- A large floor space is required for this process.
- The process is slow, so desizing time is long.
- Mildew may attack the cloth during steeping and cause stains on the fabric.
Acid Desizing

- Dilute sulphuric acid or hydrochloric acid may be used to hydrolyse the starch from the sized fabric.
- A 0.25% - 0.5% solution of the acid at room temperature (30°C) is suitable for this process.
- The cloth is impregnated with the dilute acid solution in a two-bowl or three-bowl padding mangle and then stored for 8-12 hours in a closed concrete pit.

Advantages of acid desizing

- Acid desizing is an economical process.
- The process is effective and gives fairly uniform desizing, as it is a chemical-based process. It does not require specific conditions of pH and can be done at room temperature.
- It is a much quicker process than rot steep desizing.

Disadvantage of acid desizing

- The main disadvantage of the process is that mineral acid is harmful to cellulose fibres if proper care is not taken.
- Especially during the storage stage, the acid-wet fabric must not be allowed to dry.
- This would cause the formation of hydrocellulose, which will weaken the fibre.

Enzyme Desizing

- In enzyme desizing, specific enzymes are used to liquefy the starch in the fabric and make them soluble.
- Enzyme desizing is a very rapid and thorough method of desizing provided that the proper conditions of temperature and pH are maintained. The optimum temperature and pH of the different enzymes are given below.

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>Concentration (g/l)</th>
<th>Temperature (°C)</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malt Extract</td>
<td>3-20</td>
<td>50-60</td>
<td>6.75</td>
</tr>
<tr>
<td>Pancreatic</td>
<td>1-3</td>
<td>50-60</td>
<td>6.5-7.5</td>
</tr>
<tr>
<td>Bacterial</td>
<td>0.5-1</td>
<td>60-70</td>
<td>5.5-7.5</td>
</tr>
</tbody>
</table>

Continuous Desizing

- Enzyme solution is kept at a suitable temperature and pH to effect the process.
- The fabric is washed and treated with hot water.
- Washing in the rope-washing machine.
Advantages of enzyme desizing

- Time required for the desizing process is less.
- It is continuous process, so greater production can be achieved.
- Closely constructed fabric can be easily desized, due to the effective enzyme action.
- There is no chance for the cellulose to get hydrolysed, as in acid desizing.

Disadvantages

- If the conditions of temperature, pH and time are not properly maintained, the desizing activity of the enzymes is destroyed.

<table>
<thead>
<tr>
<th>Process</th>
<th>Concentration</th>
<th>Time (hour)</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rot-steepling</td>
<td>-</td>
<td>10-16</td>
<td>30-40</td>
</tr>
<tr>
<td>H₂SO₄-steepling</td>
<td>5-10</td>
<td>3-4</td>
<td>40</td>
</tr>
<tr>
<td>Malt Diastase</td>
<td>3-20</td>
<td>4.5-5.5</td>
<td>50-60</td>
</tr>
<tr>
<td>Pancreatic Diastase</td>
<td>1-3</td>
<td>6.8-7.5</td>
<td>50-60</td>
</tr>
<tr>
<td>Bacterial Diastase</td>
<td>0.5-1</td>
<td>6.5-7.5</td>
<td>60-70</td>
</tr>
</tbody>
</table>

Comparison of Process Conditions for Desizing

Desizing with Oxidizing agents

- Though the use of oxidants for desizing of cotton fabric is widely accepted but their large scale industrial application is yet to be exploited.
- The most important aspects of oxidizing agents are that they can be applicable to wide range of fabrics, the size content of which is often not known.

Table summarizes the necessary conditions for desizing starch in presence of some important oxidizing agents.

<table>
<thead>
<tr>
<th>Oxidising agent</th>
<th>Process</th>
<th>Additives</th>
<th>pH</th>
<th>Time (min)</th>
<th>Temp. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen peroxide</td>
<td>Pad-steepling</td>
<td>1-2 vol. H₂O₂, 7-15 g/l NaOH</td>
<td>8-9</td>
<td>1-5</td>
<td>90</td>
</tr>
<tr>
<td>Sodium bromite</td>
<td>Pad-batch (cold)</td>
<td>1-3 g/l active Br₂</td>
<td>7.5-8.5</td>
<td>15</td>
<td>20-40</td>
</tr>
<tr>
<td>Persulphate</td>
<td>Pad-steepling</td>
<td>3-6 g/l Na-per sulphate, 8-10 g/l Caustic soda, 5-10 g/l Wetting agent.</td>
<td>10-10.5</td>
<td>1.3</td>
<td>95-100</td>
</tr>
<tr>
<td>Persulphate + H₂O₂</td>
<td>Cold-batch</td>
<td>40 ml/l H₂O₂ (25%), 10 g/l Persulphate, 10 ml/l Water glass, 10 ml/l NaOH, 5 g/l Stabiliser, 5 g/l Wetting agent.</td>
<td>10-10.5</td>
<td>6-20</td>
<td>20-40</td>
</tr>
</tbody>
</table>