in the process is recovered and therefore, there is no effluent disposal problem as in the case of aqueous system.

(ii) In a solvent system, drying of the material is quicker as compared to that in the aqueous system because the specific heat and heat of evaporation of the solvent are considerably lower than that of water; there is saving in energy also.

(iii) Less floor space is required for drying the material in a solvent system than in the aqueous system because of the compact solvent recovery plant.

(iv) When water is used as a medium, there is possibility of shrinkage of the fabric; in solvent system, there is no shrinkage of the fabric during finishing.

(v) There is no fibre swelling when finishing is carried in solvents and therefore such fibres and fabric constructions which are sensitive to water can be conveniently finished.

Disadvantages of Solvent Finishing

(i) Water is cheap and readily available, this is not so with solvents.

(ii) Solvents cannot be used in many finishing processes; for instance, water has to be used for certain finishing agents like starches. Water cannot be replaced completely by pure solvents in cross-linking treatments of cotton goods since swelling of the fibres is essential to get proper distribution of cross-links and this is not induced by solvents.

(iii) Some finishing processes in use today are based on ionic reactions which cannot be carried out in the absence of water.

FOAM FINISHING

Foam is nothing but a collection of small bubbles formed on or in a liquid by agitation, fermentation etc. In foam finishing, small bubbles are generated in the finishing liquor and these bubbles are deposited on the fabric by a suitable applicator. When these bubbles come in contact with the surface of the fabric (in dry or wet condition) they burst or collapse and form a blanket of foam and the fabric is thus wetted progressively

as the bubbles burst; the liquid is absorbed by the fibres and penetrates the inter-fibre spaces by capillary action. This, in brief, forms the basis of foam finishing.

Object of Foam Finishing

In the conventional machines like the padding mangle, the fabric is impregnated with the liquor and squeezed; even after squeezing, about 60% liquor (depending on the percentage expression) is left on the cloth; this liquid picked by the fabric (with high wet pick-up) has to be removed by evaporation in drying. To remove 1 kg of water 1.6 kg of steam is required. Thus, during drying there is a high consumption of energy. In foam finishing, the fabric is not impregnated with the finishing liquor but bubbles are deposited on it using a limited quantity of liquor which means that its wet pick-up is very low i.e. it contains very little water. Obviously, such a foam treated fabric requires less heat or less energy to remove this water in drying as compared to the energy required to remove water from the fabric with a high wet pick-up. This is the main object of foam finishing. One great advantage of foam finishing, therefore, is considerable saving in energy consumption. In fact, foam finishing is one of the two methods used to reduce the wet pick-up in which a limited quantity of the liquor is applied to the fabric, the other method being to remove the liquor to a greater extent by higher expression i.e. by greater squeezing using special rollers like the Roberto roll.

Generation of Foam and Foaming Auxiliaries

Compressed air is used for generating foam. Foam generators which consist of a series of blades rotating in a closed chamber are used to mix the liquor and air which are accurately metered and the foam is delivered through a smooth hose pipe to the point where it is to be applied. A wetting agent and a foaming agent are added to the finishing liquor to generate a light or dense foam. More wetting agent and less foaming agent produces a light foam and less wetting agent and more foaming agent produces a dense foam. Tightly woven and heavy fabrics require light foam whereas loosely woven fabrics i.e. fabrics with high porosity require dense foam. Soaps such as sodium laurate and sodium myristate are good foaming agents. Sodium lauryl sulphate is one of the most effective foaming agents and is commonly used in foaming preparations

to the extent of 3%. Foam stabilizers are also used in order to regulate flow of the foam. Methyl cellulose and hydroxy ethyl cellulose are the most effective foam stabilizers which are used in the range of 0.2 - 0.5%. All the components in the mixture have to be compatible with one another.

The foam is generated to a desired limit called the 'blow ratio' i.e. the extent to which the volume of the liquor can be expanded; it is a ratio of the volume of foam to that of the liquid. A blow ratio of 1:5 means that the system contains 1 part of liquid diluted with 5 equal parts of air. A blow ratio in the range of 1:10 to 1:12 is commonly used in foam preparations.

Foam Preparation and its Application

Uniform application of foam is very important; if the foam is unstable, it will collapse prematurely and will produce blotches and streaks. If the foam is too stable it will not collapse evenly on the fabric. Its viscosity should be uniform and its rate of flow should be such as to ensure uniform application.

A typical recipe recommended for foam preparation of a durable press finish incorporating a softening agent, is as under:

DMDHU	:	300 parts
Hydroxy ethyl cellulose	:	2 parts
Polyethylene emulsion	:	70 parts
Sodium lauryl sulphate	:	30 parts
Magnesium chloride (catalyst)	:	75 parts

made up to 1000 parts with water.

Method of Application of Foam

The foam generated in the foam generator is deposited by means of a hose-pipe on the surface of the fabric and its thickness is regulated as desired with a doctor knife; the foam then passes through the nip of two rollers so that it collapses completely. In the case of thick fabrics, a padding mangle (horizontal padder) is used and the foam is applied to both the surfaces of the fabric.

Advantages of Foam Finishing

(i) Since only a limited quantity of the finishing liquor is used for foam finishing, there is no wastage of liquor. Further since the water content of the fabric is reduced considerably before drying, there is considerable saving in energy consumption during drying. Since the drying time is reduced the rate of production is increased.

(ii) With liquids it is difficult to distribute even a small quantity evenly in every fibre throughout its thickness but when foam is produced by diluting the liquid with compressed air and is deposited on the fabric, it spreads evenly in every fibre giving uniform finish.

(iii) As the liquor pick-up in foam finishing is not dependent on the moisture content of the fabric, wet-on-wet application of the foam is possible.

Disadvantages of Foam Finishing

(i) If the foam is unstable, it collapses prematurely giving streaky and uneven finish; also if the foam is too stable, it does not collapse evenly on the fabric giving uneven finish.

(ii) When foam is deposited on the surface of a fabric, the surface fibres in immediate contact with the foam will absorb a higher quantity of the finishing agent than the underlying fibres; also, the moisture absorbed by the surface fibres is greater leading to migration during subsequent drying. This affects even distribution of the finishing agent throughout the fabric.

(iii) Those resins and cross-linking agents which affect or have an adverse effect on the foaming properties including catalysts and softeners cannot be used as they will defoam the preparation. If all the components of the preparation are not compatible with one another they inhibit the foaming properties.

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