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GUILD OF CLEANERS AND LAUNDERERS

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Wool in the aftercare market - Wool fibre is a natural protein fibre, which is used for the manufacturing of garments because of its excellent fire retardancy, stain-resistance, antistatic and odour control properties along with exceptional warmth and resilience. However, wool fibres extensively shrink during washing. To overcome this problem, wool fibres, especially those used in clothing, are frequently shrink-resist treated to make them machine-washable. A range of treatments have been developed over the years to make wool fabric felt and shrink resistant. Of all the treatments the chlorination treatment followed by coating with a polyamide-epichlorohydrin resin (known as chlorine-Hercosett treatment) is undoubtedly the most effective, and the cheapest shrink-resist treatment and it is believed that approximately 70% of all wool labelled as fully machine-washable is treated by the chlorine-Hercosett process.

Usually very bright colours cannot be obtained on wool because it does not start by having a white base, and it also yellows readily in sunlight, especially when wet. As a result, markets requiring vivid colours, bright whites and pastel shades such as women's wear, baby wear, sports and leisure wear are dominated by polyester, nylon, acrylic and cotton, and are almost totally lost to wool. Nonetheless, around 10% of the total world production of wool is bleached before sale.

At point of sale, some degree of brightness is desirable even if it is lost early during wear and a great deal of bleaching is carried out as a top-up whitening process in the "scour" which is the preparation process for wool. Normally Hydrogen peroxide is added to the last rinse in preparation and then some degree of bleaching takes place in the drier. This is done because the whiteness of scoured wool is taken into consideration in determining the value of the final fibre product before making up into garments.

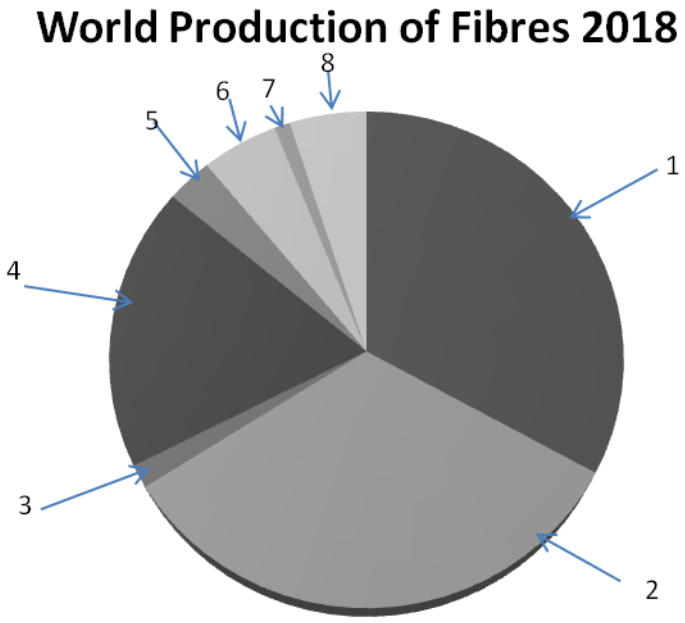
Oxidative bleaching - In the fibre preparation oxidative bleaching usually gives the best whitening effect but oxidatively bleached wool yellows in use more readily than unbleached wool. Oxidative bleaching is usually carried out with Hydrogen peroxide or sodium percarbonate. Oxidative bleaching is also carried out in the presence of stabilisers, and activators. Oxidative bleaching always damages wool. - Bleaching with hydrogen peroxide can be carried out by batch or continuous methods, and at room or even higher temperatures. Why do they do this? Hydrogen peroxide is relatively inexpensive, does not release toxic chemicals or unpleasant odours, and does not cause corrosion of the preparation equipment making it a popular choice. The only by products released by this process are its decomposition into water and oxygen. When using hydrogen peroxide on fibres that are sensitive to oxidation, such as wool or cotton, damage can be, and in practice is usually, kept to a minimum provided that the bleaching is carried out carefully under the recommended conditions, in terms of pH, temperature etc.

Stabilisation of peroxide - Why do they need to add Stabilisers to wool bleaching solutions?

In the absence of stabilisers wool is yellowed by hydrogen peroxide. The reason being is that wool usually contains small amounts of transition metal ions that catalyse decomposition of hydrogen peroxide and prevent it from reacting with the wool. Stabilisers are metal complexing (sequestering) agents such as sodium silicate, EDTA and phosphates. Sodium silicate can be used as a stabiliser for peroxide bleaching because apart from its ability to sequester transition metal ions, it acts as a buffer at the proper pH of 10.5 -11.5, but insoluble deposits can be formed on the goods as well as on the dyeing equipment. These deposits can give the fabric a harsh handle, and may lead to unlevel dyeing, and many proprietary stabilisers used are formulated with complexing agents and buffers 'built in' and these consists of a combination of organic and inorganic salts in aqueous solution which enables acid hydrogen peroxide solutions to be used for bleaching wool at neutral or acid pH.

Continued on page 2

Continued from page 1



World Production of Fibres In 2018

1 = 33% cotton

2 = 33% Filament Polyester

3 = 1.5% Silk and Wool

4 = 18.5% Spun Polyester

5 = 3% Acrylic

6 = 5% Nylon

7 = 1% Others

8 = 5% Semi Synthetic

This minimises damage to the wool that could take place in alkaline solution and permits combined dyeing and bleaching in the same bath.The procedure is to put additives to the dye bath at the commencement of dyeing and 20-30 ml/l hydrogen peroxide (at 35% solution). A good whitening effect is obtained although the Dyes used are usually checked beforehand for sensitivity to hydrogen peroxide.

Oxidation bleaching wool with sodium percarbonate Another source of hydrogen peroxide is sodium percarbonate. When this solid is dissolved in water it dissociates into sodium carbonate and hydrogen Peroxide. A 1% solution of sodium percarbonate has a pH of 10.5 which is appropriate for bleaching. A main disadvantage of sodium percarbonate is that it will slowly decompose during storage if exposed to moisture, thus releasing the oxygen prematurely.

Damage caused by oxidative bleaching - Hydrogen peroxide and peroxy compounds damage wool fibres as a side effect to their bleaching reactions and this is caused by progressive oxidation of disulphide bonds to cysteic acid residues. Destruction of disulphide crosslinks in keratin producing loss of fibre strength. Subsequent dyeing processes can aggravate this initial damage therefore pre-bleached wool is usually dyed at as low a temperature as possible. Since pastel shades are normally produced on bleached grounds, dyeing at around 80°C is normal.

An alternative is Reductive bleaching- The most commonly used compounds are sodium dithionite (hydrosulphite), sodium and zinc formaldehyde sulphoxylate, sodium metabisulphite, hydroxylamine sulphate, thiourea dioxide, sodium tetraborate.

The whitening effect is not as great as with oxidation bleaching but the bleached colour is more durable.

Sodium dithionite (hydrosulphite) Reducing Agent This is the most common compound for wool reductive bleaching and many bleaching company suppliers offer stabilised products optimised for use on wool that leaves wool soft.

Combined oxidation and reduction bleaching The best available technology at present for producing a bleached white on wool is chlorine/Hercosett, and it is believed that approximately 70% of all wool labelled as “fully machine-washable” is treated by the chlorine-Hercosett process which has been introduced, is with a combined oxidative/reductive procedure and is recommended by Woolmark, followed by a method known as ColorClear reductive bleaching treatment.

There areTreatments to counteract the effects of photo bleaching

Lanalbin APB (Clariant) is a colourless dye, has been developed to eliminate the problem of photo bleaching by undergoing a photo yellowing reaction which counteracts the photo bleaching effect.

Continued on page 3

Continued from page 2

The bleacher/dyer will have an additive known as Lanalbin APB which is adjusted in the range 0.5%-1.0%, depending on the initial wool colour, the depth of shade and the hue of any dyestuffs present. The change in yellowness of the fabric can be restricted during initial exposure to sunlight of the wool.

Fluorescent brightening agents Fluorescent brightening agents (FBAs), also called optical brightening agents (OBAs), increase the apparent whiteness or brightness of a wide range of materials including textiles, paper, plastics and paints. Fluorescent compounds used for whitening have the property of absorbing ultra-violet light in the range of 330-380 nm and re-emitting energy in the form of visible violet-blue light. A part of the original UV energy absorbed is transformed into heat.
Fabric that appears yellow absorbs blue light, and reflects the rest of the visible spectrum. When blue light emitted from an optical brightener is added to the reflected yellow light, the colour of the fabric will appear white or bluish white. Therefore, the whitening produced by optical brighteners is an additive effect, in which emitted blue light is added to the reflected yellow light. FBAs are effective in ordinary daylight or under artificial light from daylight fluorescent tubes but are not effective in tungsten light, because this light does not contain sufficient ultra-violet radiation.
Fluorescent brightening agents for wool are essentially colourless acid dyes which are applied usually in reductive bleaching process (e.g. hydrosulphite or thiourea dioxide at
around 80°C) or together with dyes. There are two main classes of FWAs: coumarin derivatives, now largely superseded because of their poor light fastness, and stilbene or bis-stilbine derivatives, which make up the majority of brightening agents. Some fluorescent whiteners, such as the coumarin derivatives, give white wools that have light fastness ratings of 1 on the SDC blue scale. The most stable products (maximum light fastness rating 2-3) seem to be based on bisstilbenes

Why does wool yellow in sunlight?
The role of free-radical mechanisms in the photo yellowing of wool, especially bleached and FWA-treated wool has been extensively studied. As with normal wool, yellowing appears to be the result of reactions with specific amino acid residues in the wool protein structure. These residues produce photo-oxidation products that are possible contributors to the yellow chromophores in irradiated wool. Yellowing is accelerated by FWAs although oxygen must also be present.

The current situation with pastel colours
A completely effective solution to the problem of rapid yellowing of bleached, and particularly bleached and optically whitened, wool in sunlight of has not been found.
The best current technology is to dye pastel shades in the presence of reductive bleach and to simultaneously apply a FWA

Bright future for wool garments
A treatment to eliminate free radicals seems to offer the prospect that a white wool garment could stay just that - white. Since FWAs seem necessary to obtain a good white and bright pastel shade, hopefully any method of protecting the wool should also protect the FWAs. Because parents prefer bright whites and pastel shades, kids' clothing and baby wear tends to be regularly washed, any treatment to prevent yellowing by sunlight has to be permanent to many laundering cycles.

Wool Innovation has started to promote research on permanent bright whites and pastel shades on wool fabrics, which it is hoped that the development of stable whites and bright coloureds will enable wool to regain market share in leisure, baby and kids wear which has been lost over the last 30 to 40 years.