Bleaching

Contemporary wool dyeing and finishing

Dr Rex Brady

Deakin University

Topics

1. The effect of sunlight on wool
2. Why bleach wool?
3. Why wool becomes yellow in sunlight
4. Oxidiative bleaches
5. Bleaching of pigmented wool
6. Reductive bleaches
7. Combined process ‘full’ bleaching
8. Photobleaching by light
9. Fluorescent brightening agents
10. Pastel shades with reductive bleach and FWA
11. The future for bleached wool

1. The effect of sunlight on wool

The effect of sunlight on wool

- Sunlight causes wool to change colour and lowers the strength and abrasion resistance of wool.
- Initially, wool is bleached by sunlight (photobleaching); subsequently, photoyellowing predominates.
- Prolonged exposure to sunlight leads to a loss in strength and abrasion resistance, resulting in photo-tendering.
- The shortest wavelengths present in solar radiation (290-320 nm) are the most damaging to wool, and they cause both photo-yellowing and photo-tendering.
- Although window glass cuts out the wavelengths below 320 nm, the transmitted UV light (320-400 nm) still causes photoyellowing and phototendering, at a reduced rate.

Poor light stability of wool limits the range of products in some areas of application

- The photo degradation of wool limits the use of wool in markets where requirements for light fastness are stringent.
- These include car upholstery, curtains, and apparel requiring bleached and lightfast bright pastel shades.
- Particularly with car upholstery, dyeing with selected 2:1 premetallised dyes (mostly cobalt complexes) in heavy to medium depths, enhances the light fastness and photo-stability of wool, but only a limited range of shades is available.
- Pale shades and particularly bright pale shades are limited to product areas where relatively low lightfastness can be tolerated.

2. Why bleach wool?

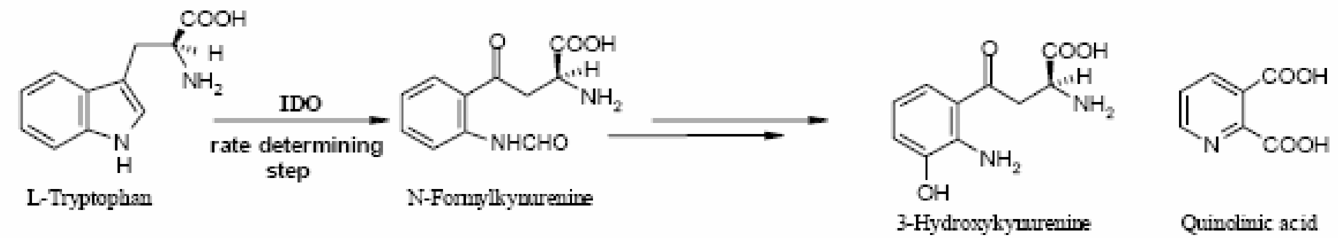
Why bleach wool?

- Very bright colours cannot be obtained on wool because it does not have a white base, and 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.
- Dyebath yellowing of wool may be counteracted by including a small amount of a reduction bleaching agent in the dyebath.
- At point of sale, some degree of brightness is desirable even if it is lost early during wear.
- A great deal of bleaching is carried out as a top-up whitening process in the scour. Hydrogen peroxide is added to the last bowl and some degree of bleaching takes place in the drier. This comes about because the whiteness of scoured wool is taken into consideration in determining the value of the product.

3. Why wool becomes yellow in sunlight

Why does wool become yellow?

- The most likely candidates for the formation of yellow chromaphores in wool are the amino acids with aromatic rings. Colouration theory tells us that conjugated systems are required for the development of colour.
- The most likely amino acid to be involved is tryptophan but phenylalanine, tyrosine and cystine residues are also involved. To date, 14 yellow chromophores (some of which have similar structures) have been identified within the proteins of yellowed wool.
- One of these compounds is 3-hydroxykynurenine. It is bright yellow and contains a chromophore that is utilised as a yellow pigment in nature, such as in brightly coloured butterfly wings.



Oxidative cleavage

Yellow

4. Oxidiative bleaches

Oxidative bleaching

- Oxidative bleaching usually gives the best whitening effect but oxidatively bleached wool yellows more readily than unbleached wool.
- Oxidative bleaching is usually carried out with:
  - hydrogen peroxide
  - sodium percarbonate.
- Oxidative bleaching is best carried out in the presence of:
  - stabilisers
  - activators.
- Oxidative bleaching always damages wool.

Bleaching with hydrogen peroxide

- Bleaching with hydrogen peroxide can be carried out by batch or continuous methods, and at room or higher temperatures. In addition, hydrogen peroxide is:
    - relatively inexpensive
    - does not release toxic chemicals or unpleasant odors, and
    - does not cause corrosion of equipment.
- The only by products released upon its complete decomposition are water and oxygen. When using hydrogen peroxide on fibres that are sensitive to oxidation, such as wool or cotton, damage can be kept to a minimum provided that the bleaching is carried out carefully under the recommended conditions (pH, temperature etc.).

Mechanism of peroxide bleaching

- **The mechanism** by which hydrogen peroxide acts as an oxidising agent is believed to take place through its **perhydroxy ion** (HO_2^-). When dissolved in water, hydrogen peroxide behaves as a very weak acid and dissociates according to:

  $H_20_2 \Leftrightarrow H^+ + HO_2^-$ (dissociation constant 10^{-12})
- The relatively unstable HO_2^- anion reacts with hydrogen peroxide to form hydroxyl and superoxide radicles:

  $$H0_2^- + H_2O_2 \Rightarrow OH^{\bullet} + {}^{\bullet}0_2^- + H_2O$$
- Bleaching most probably takes place via **the reaction of the radicals** (particularly the superoxide radical) **with coloured materials** which are oxidised into colorless compounds. Although the mechanisms are unknown the reactions must involve opening of conjugated rings.

Mechanism of peroxide bleaching

- Since the amount of HO_2^- at pH 7 is extremely small, neutral solutions of hydrogen peroxide are quite stable. Commercial solutions of hydrogen peroxide contain small amounts of stabilizers that prevent decomposition while in storage.
- Ions such as Mg^{2+} can act as stabilisers.
- In order to activate hydrogen peroxide for the bleaching reaction to take place, a base can be added to the bleaching bath. The base shifts the equilibrium dissociation to the right:

$$NaOH \quad + \quad H_20_2 \quad \Leftrightarrow \quad Na^+ \quad + \quad H0_2^- \quad + \quad H_20$$

- Decomposition of hydrogen peroxide is catalysed by the presence of transition metal ions (Fe^{2+}, Cu^{2+}, Mn^{2+}).

$$.O_2^- \quad + \quad H_2O_2 \quad \overset{M^{2+}}{?} \quad O_2 \quad + \quad OH^- \quad + \quad OH.$$

Stabilization of peroxide

- Stabilisers must be added to wool bleaching solutions. In the absence of stabilisers wool is yellowed by hydrogen peroxide.
- The reason 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 - $Na_2SiO_3.5H_2O$ 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 give the fabric a harsh handle, and may lead to unlevel dyeing.
- Many proprietary stabilisers are formulated with complexing agents and buffers 'built in', e.g. Tinoclarite WO (Ciba), Prestogen W (BASF).

Peroxide bleaching with Prestogen W

- This stabiliser from BASF 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. 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 add to the dyebath at the commencement of dyeing:
  - 2 g/l Prestogen W liquid and
  - 20-30 ml/l hydrogen peroxide (35%).
- A good whitening effect is obtained.
- Dyes should be checked for sensitivity to hydrogen peroxide.

Peroxide bleaching with Tinoclarite WO

- Set bath cold with:
  - Tinoclarite WO (Ciba) 4 g/l
  - run for 10 minutes, add
  - hydrogen peroxide (35%) 25 ml/l (pH 10-10.5).
- Raise temperature to 50°C and hold for 60 minutes.
- Drain and rinse.
- Acid sour.

5. Bleaching of pigmented wool

Activated bleaching process

Activated oxidative bleaching uses metal salts to speed up the rate of bleaching and also to bring about selective bleaching of melanin granules that occur in pigmented wool (and other animal) fibres.

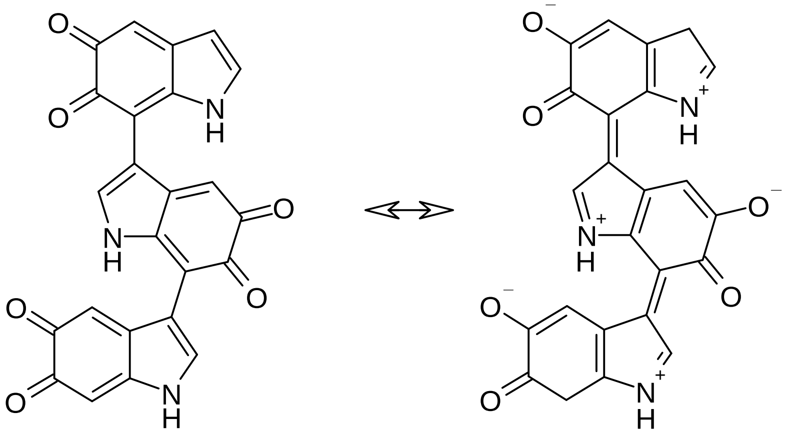
The process for bleaching melanin consists of three main steps:

- **mordanting with Fe^{2+}:**
  - $FeSO_4.7H_2O$ (10 g/l), HCOOH (6 g/l), nonionic wetting agent (0.5 g/l), 80ºC for 60 minutes.
- **rinsing:**
  - HCOOH (4 g/l) 80ºC for 20 minutes, 50-80ºC for 20 minutes, 50ºC at room temperature for 20 minutes.
- **bleaching with H_2O_2:**
  - H_2O_2 (30%w/w, 50-60 g/l), tetrasodium pyrophosphate (10 g/l), oxalic acid (4 g/l), sodium carbonate (5 g/l), nonionic wetting agent (0.5 g/l), 70ºC for 45-60 minutes. pH 8.0-8.5 with ammonia solution.

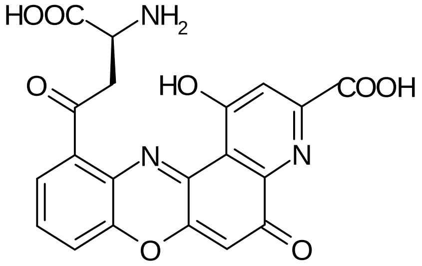
Pigmented wool and fine animal fibres

Brown pigmentation is due to the following types of melanin compounds.

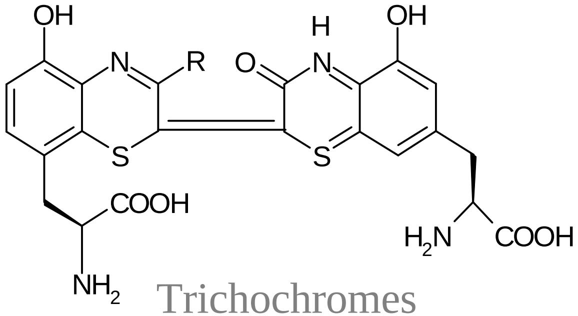
Eumelanin
(suggested structure)



Pheomelanin
(suggested structures)



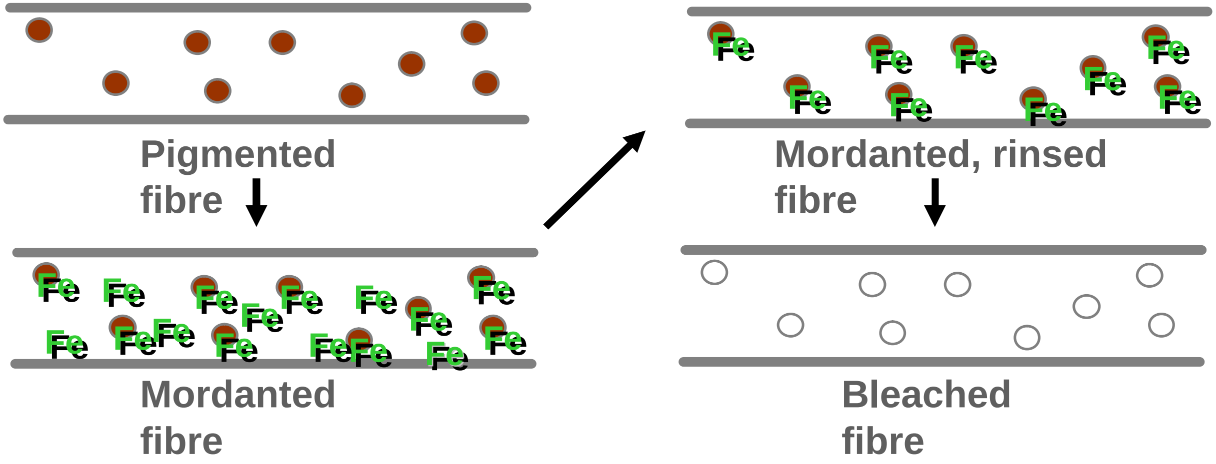
Xanthommatin



Trichochromes

Principle of mordant bleaching

- When the wool is treated (mordanted) with ferrous sulphate solution, ferrous ions become bound to the melanin granules in the pigmented fibres.
- The ferrous irons not bound to the pigment are removed by washing.
- When the wool is treated with hydrogen peroxide, the bleaching reaction is catalysed mainly within the melanin granules and they are bleached selectively.
- The melanin is broken down by hydroxyl radicals into colourless or less coloured compounds.



Activated bleaching of Alpaca fibre

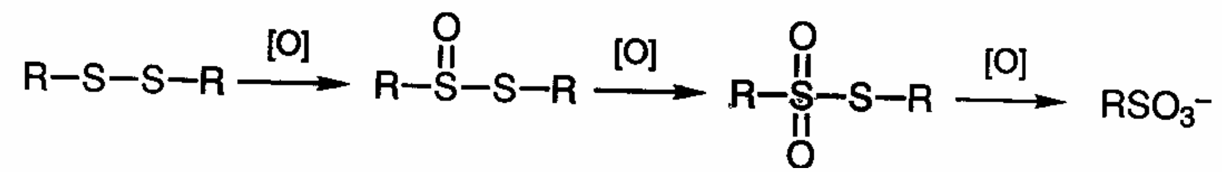
Method II used slightly higher concentrations of reagents.

Oxidation bleaching with sodium percarbonate

- Another source of hydrogen peroxide is sodium percarbonate: $2Na_2CO_3.3H_2O_2$.
- 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.
- The main disadvantage of this chemical 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.
- This is caused by progressive oxidation of disulphide bonds to cysteic acid residues. Destruction of disulphide crosslinks in keratin produces loss of fibre strength.
- Subsequent dyeing processes can aggravate this initial damage so pre-bleached wool should be dyed at as low a temperature as possible.
- Since pastel shades are normally produced on bleached grounds, dyeing at around 80°C is adequate.
- Oxidatively bleached wool should not be boiled since it undergoes hydrothermal yellowing at a greater rate than unbleached wool.



$$R{-}S{-}S{-}R \xrightarrow{[O]} R{-}\overset{\overset{O}{\|}}{S}{-}S{-}R \xrightarrow{[O]} R{-}\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}{-}S{-}R \xrightarrow{[O]} RSO_3^-$$

6. Reductive bleaches

Reductive bleaching

- The most commonly used compounds are:
  - sodium dithionite (hydrosulphite),
  - sodium and zinc formaldehyde sulphoxylate (e.g. Formosul)
  - sodium metabisulphite (e.g. Erioclarite B)
  - hydroxylamine sulphate (e.g. Lanalbin B)
  - thiourea dioxide
  - sodium tetraborate.
- The whitening effect is not as great as with oxidation bleaching but the bleached colour is more durable.

Hydroxylamine sulphate $(NH_3OH)_2\ SO_4$

- This has a mild bleaching action and it can be used to facilitate the dyeing of bright paler colours.
- Lanalbin B (Clariant):
  - its application level is 1.0-2.0% depending on the colour of the wool. Its reaction is acidic and it may be necessary to adjust the pH with ammonia or sodium acetate when applying neutral-dyeing dyes.
- Lanalbin BE (Clariant):
  - this product is similar to Lanalbin B but does not need to be neutralised. The application level is 1.0-4.0%
  - when applying reactive dyes, Lanalbin B or Lanalbin BE should be added to the exhausted dyebath rather than at the start of dyeing, to avoid adverse effects on fastness and shade.
- Lufibrol FW (BASF) is a mild reducing agent with complexing properties. Quantities of 0.5-1.0 % are added at the start of dyeing. Most acid dyes are unaffected but *BASF Technical Information Bulletin No. TX177* lists a few that are.

Sodium metabisulphite

- Erioclarite B (Ciba) is a mixture of sodium metabisulphite with the sodium salt of ethylenediamine tetraacetic acid (EDTA).
- The recommended application level of Erioclarite B is 0.5 - 1.0 g/l.
- Dyeing at 80-85°C is recommended for pale shades.
- If higher dyeing temperatures or prolonged treatment are necessary, a further addition of 0.5 g/l Erioclarite B may be required.
- To maintain maximum fastness of Lanasol reactive dyes, Erioclarite B should not be added until the bath has been at maximum temperature for 15-20 minutes.

Sodium dithionite (hydrosulphite)

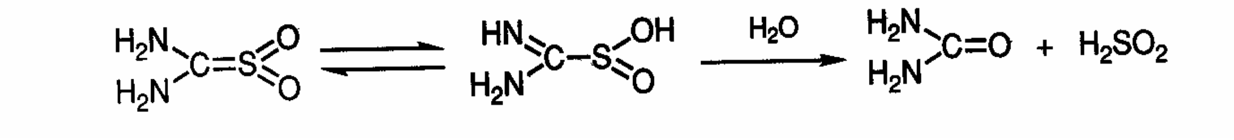
- **$Na_2S_2O_4$ CI Reducing Agent 1**
- This is the most common compound for wool reductive bleaching. Many companies offer stabilised products optimised for use on wool.
- Typical recipe:
    - 2-5 g/1 stabilised dithionite (Hydros)
    - 0.5 g/l wetting agent
    - pH 5-6
    - 45-65°C
    - up to one hour
- Typical products
    - Blankit AN (BASF)
    - Blankit IN (BASF). Binds iron and heavy-metal ions and leaves wool soft
    - Leucophor PC (Clariant).

Sodium and zinc formaldehyde sulphoxylates

- Bleaching is usually carried out at pH 3, with the temperature raised to 90°C and maintained at this level for 30 minutes.
- This process tends to harshen the handle of the wool fibre and also leaves a sulphurous odour.
- These products are commonly used for discharge printing on wool.

Thiourea dioxide reductive bleach

- Thiourea dioxide (Thiox) is applied at 70-80°C at pH 7 for one hour (1-3 g/1) at pH 6.5.
- A sequestering agent such as EDTA (0.25 g/l) must be included in the bath to prevent heavy metal-catalysed decomposition of this reducing bleach.
- This compound is claimed to have less effect on the physical properties of the fibre than other reducing bleaches.
- The active bleaching species in thiourea dioxide bleaching is sulphinic acid (H2SO2).



Sodium borohydride bleach

- COLORCLEAR® SOLUTION (Rohm and Haas) is a solution of stabilised sodium borohydride, $NaBH_4$.
- Sodium borohydride as a source of the nucleophile H^- (hydride), which attacks partially positively charged carbonyl carbon atoms of aldehydes and ketones and converts them to alcohols. One mole of sodium borohydride supplies four moles of hydride.
- Recently it has been reported that sodium borohydride is superior to both thiourea dioxide and sodium hydrosulphite bleaching systems on wool, chlorine/Hercosett wool and wool/cotton fabric.
- The best bleached white was produced on wool and chlorine/Hercosett wool with a combined oxidative/reductive procedure using the new technology in the reductive step.
- The reducing agent technology gave acceptable damage on wool, which was comparable with bisulphite bleaching.

Sodium borohydride bleach

- ColorClear Method (Rohm and Haas).
- Set bath at 40°C with:
  - ColorClear 2.0 g/l
  - catalyst 100 8.0 g/l
  - wetting agent/detergent 0.5 g/l
  - acetic acid to pH 5.5.
- Run 10 minutes.
- Raise temperature to 60°C and hold for 60 minutes.
- Drain and rinse.

7. Combined process ‘full’ bleaching

Combined oxidation and reduction bleaching

- The textile industry prefers the neutral white colour obtained by an oxidation bleach followed by a reduction bleaching step (so-called ‘full’ bleach). Peroxide-bleached wools often have a reddish cast whereas reductive-bleached wools have a greenish tinge so the net result is a more neutral white.
- The greatest problem is the poor lightfastness of the white produced.
- Arifoglu and Marmer have described a novel oxidative-reductive bleaching system which involves first bleaching with hydrogen peroxide and then adding thiourea to generate thiourea dioxide in situ.

Combined oxidation and reduction bleaching

- The best available technology at present for producing a bleached white on wool and chlorine/Hercosett wool is with a combined oxidative/reductive procedure using Tinoclarite WO and hydrogen peroxide (as recommended by Woolmark), followed by the ColorClear reductive bleaching treatment (Rohm and Haas).
- Both methods have been given in previous slides.

Ref: 'ColorClear technology, a new method of whitening of wool, machine washable wool and wool/cotton blends', S. M. Smith, D. J. Westmoreland & H. P. Schoots, *Proc 11th Int. Wool Text Conf.*, Leeds, UK (2005).

8. Photobleaching by light

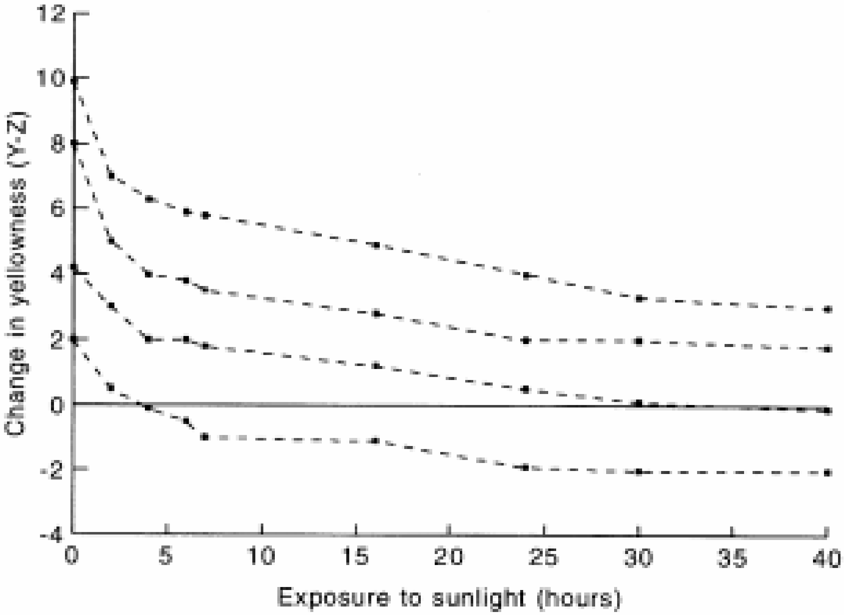
Photobleaching by light

The problem of 'first fade'

- All wools become bleached to some extent when exposed to sunlight, even behind glass.
- Such photobleaching may be perceptible within a few hours of exposure.
- This is a particular problem with carpets if the shade is sensitive to small changes in the light yellow colour of the wool.
- Photoyellowing is also caused by ultraviolet light, but this is an unrelated problem, so photobleached wools re-yellow slowly on prolonged exposure to light behind glass.

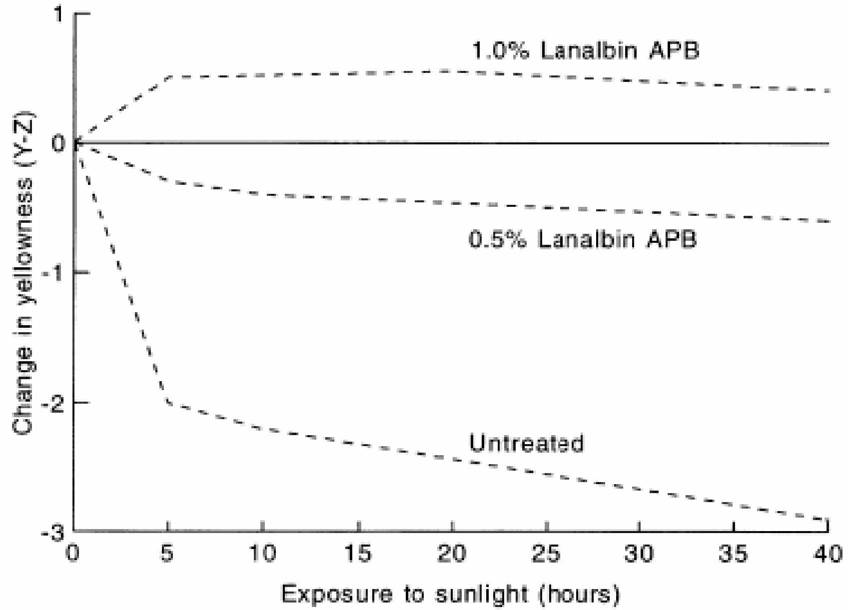
Photobleaching by light

- The figure shows the rate of photobleaching of a number of wools with different initial yellowness indices, when exposed to sunlight.
- A change in yellowness index (Y-Z) of 1.5 or more is easily apparent to the human eye, so it is clear the yellower wools, if used in ecru or pale colours, are likely to give rise to consumer complaints.
- The initial rate of bleaching is relatively rapid.
- The yellower the wool, the greater the total change in yellowness.



Treatment to counteract the effects of photobleaching

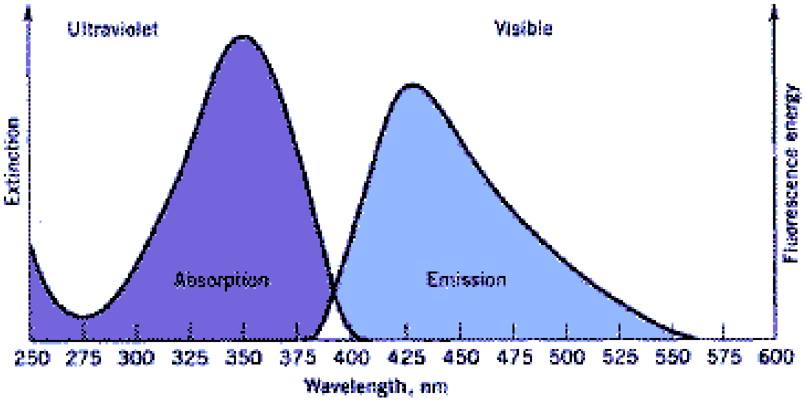
- Lanalbin APB (Clariant) is a colourless dye, was developed by WRONZ, to eliminate the problem of photobleaching by undergoing a photoyellowing reaction which counteracts the photobleaching effect.
- The add-on of Lanalbin APB is adjusted in the range 0.5%-1.0%, depending on the initial wool colour, the depth of shade and the hue of any dyestuffs present.
- The efficacy of the treatment is illustrated in the figure, the change in yellowness of the fabric can be restricted during initial exposure of the wool.



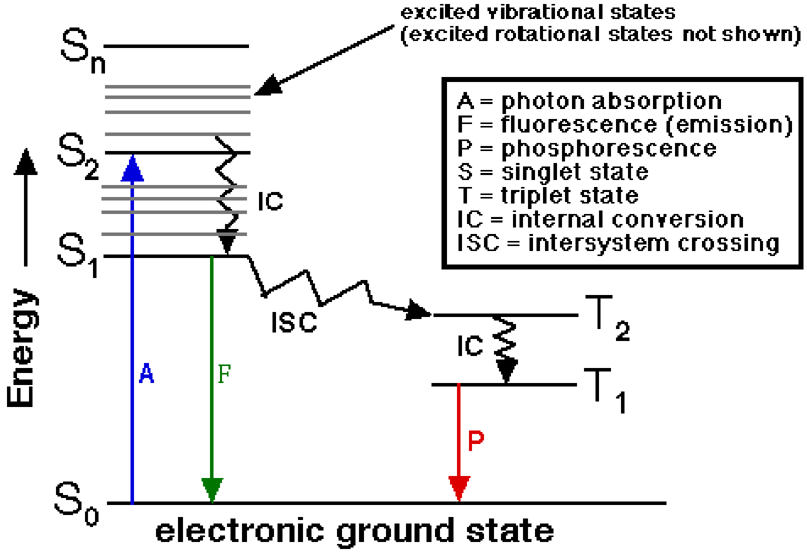
9. Fluorescent brightening agents

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.



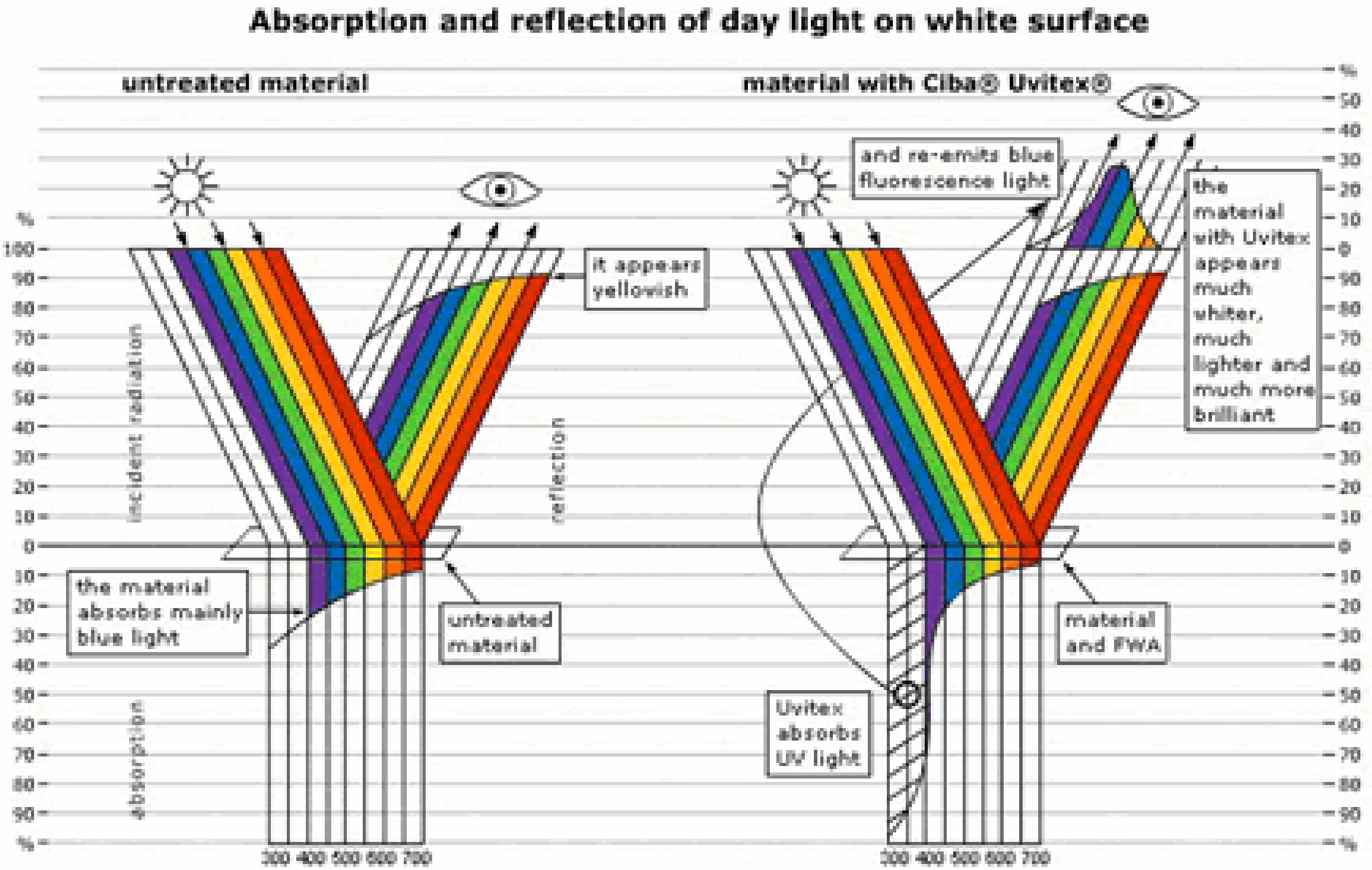
- Fluorescent compounds used for whitening have the property of absorbing ultra-violet light in the range of 330-380 nm and re-emitting energy in the form of visible violet-blue light. A part of the original UV energy absorbed is transformed into heat.



Fluorescent brightening agents

- 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



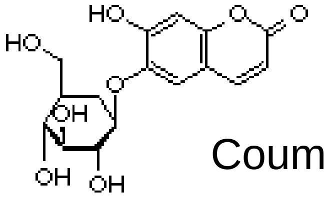
Absorption and reflection of day light on white surface

Chemical structures of optical brighteners

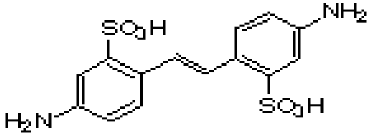
Fluorescent brightening agents for wool are essentially colourless acid dyes which are applied usually in reductive bleaching process (e.g. hydrosulphite or thiourea dioxide at around 80°C) or together with dyes.

There are two main classes of FWAs:

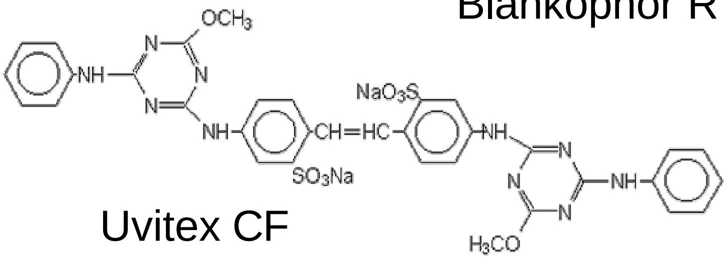
- coumarin derivatives, now largely superceded because of their poor lightfastness
- stilbene or bis-stilbine derivatives, which make up the majority of brightening agents.



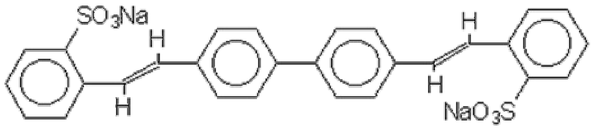
Coumarin type



Blankophor R



Uvitex CF



Uvitex NFW

Lightfastness of bleached and optically brightened wool

- 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 bis-stilbenes.
- However, stilbene derivatives contain an aliphatic carbon-carbon double bond (C=C outside the aromatic rings) which is sensitive to sunlight, oxidation, weathering, etc. Therefore, these compounds do not have good light fastness properties, and tend to loose their effectiveness rapidly in use.

Why does wool yellow in sunlight?

- The role of free-radical mechanisms in the photoyellowing 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, such as tryptophan, phenylalanine, tyrosine and cystine. These residues produce photo-oxidation products such as kynurenine, N-formylkynurenine, 3-hydroxykynurenine, o-tyrosine, m-tyrosine, and 3, 4-dihydroxyphenylalanine that are possible contributors to the yellow chromophores in irradiated wool.
- Yellowing is accelerated by FWAs. Oxygen must also be present. The suggested mechanism is:

$$FWA \xrightarrow{h\nu} {}^{1}FWA^{*}$$

$${}^{1}FWA^{*} \rightarrow FWA^{+\cdot} + e^{-}$$

$$O_2 + e^{-} \rightarrow O_2^{-\cdot}$$

$$O_2^{-\cdot} + 2H^{+} + e^{-} \rightarrow H_2O_2$$

10. Pastel shades with reductive bleach and FWA

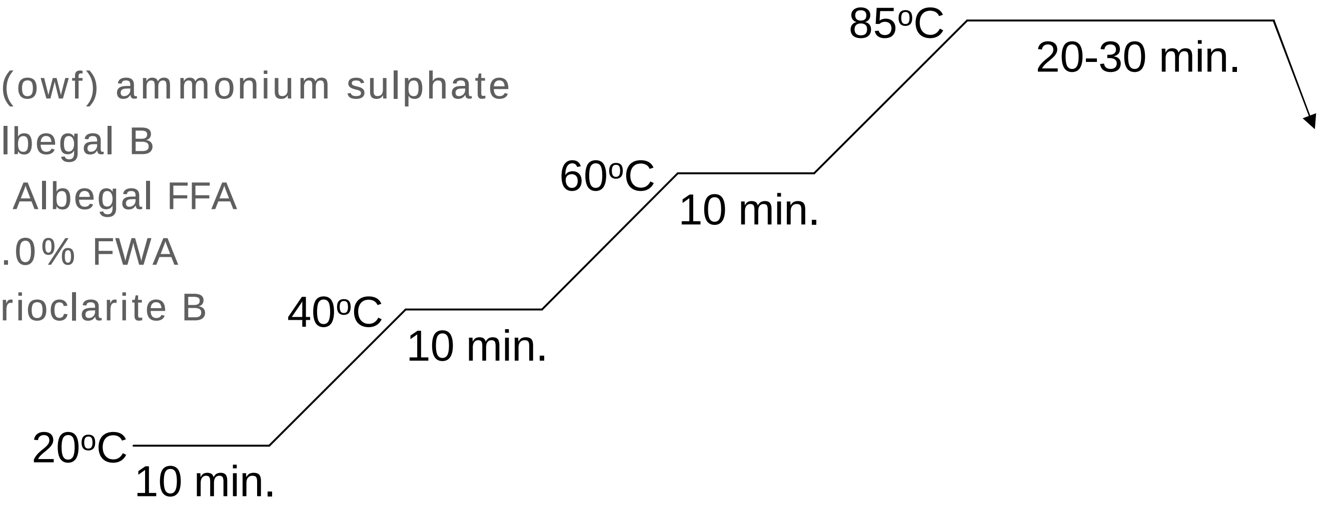
The current situation with pastel colours

- 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 a reduvtive bleach and to simiItaneously apply a FWA.
- A typical procedure and the results obtained are illustrated in the next few slides.

Pastel shades with reductive bleach and FWA

CSIRO process

- Prescour:
  - 1% (owf) nonionic detergent
  - 2% (owf) ammonia
  - 70oC, 15 minutes
  - LR 30:1
- Dye:
  - 10% (owf) ammonium sulphate
  - 1% Albegal B
  - 0.3% Albegal FFA
  - 0.2-1.0% FWA
  - 4% Erioclarite B



20^{o}C

10 min.

40^{o}C

10 min.

60^{o}C

10 min.

85^{o}C

20-30 min.

Pastel shades with reductive bleach and FWA

Dye	% (o.w.f.)	Xenotest	Sunlight dry	Sunlight wet	Machine washing fastness	Alkaline perspiration
Lanasol Bed B	0.015	4	4	3	3	5
Lanasol Red 6G	0.01	4	3-4	3	3-4	5
Lanasol Blue 3G	0.05	4	4	3-4	3	5
Reactofil Turquoise Blue 8058 80%	0.2	3-4	3-4	1-2	3	5

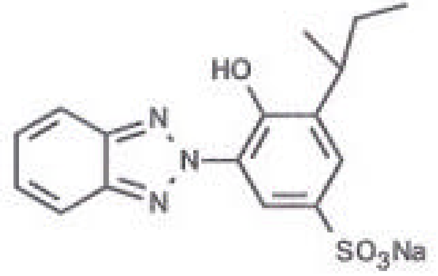
These results are about the best obtainable as far as lightfastness is concerned.

The dyeing temperature is kept low to minimise heat yellowing of the wool during dyeing.

The FWA sensitises the dye to increased wet fading – particularly with turquoises.

Combination of reductive bleach with FWA

- The following are examples of commercial products for combined bleaching and optical brightening of wool:
  - Blankit DA contains a reduction bleaching agent containing optical brighteners for wool, PA and cellulosic fibres
  - Blankit AR contains stabilised dithionite and a fluorescent brightener. It is stable to hard water, phosphate-free, and the organic components are readily biodegradable. The bleached colour and fluorescent brightening has a reddish-white shade. It has been developed especially for wool. The light fastness of the brightened effect is unsurpassed.
- At present the combination of a mild reduction bleach with a selected FWA seems the best available technology, but is it good enough?



Cibafast W (Ciba)

- This compound absorbs UV light at wavelengths that are damaging to wool.
- The effectiveness of this compound was discovered by workers at CSIRO Division of Protein Chemistry.
- The compound is applied together with dyes.
- Light fastness of dyeings with selected metal complex and acid dyes in dark and pale shades is improved.
- Fibre damage on prolonged exposure at high ambient temperatures is reduced.
- The rate of yellowing of unbleached and bleached wool is reduced.

Cibafast W

Characteristics

- Very good exhaustion and even uptake under the usual dyeing conditions for wool.
- Miscible with water, non-foaming, low viscosity, stable in the dye bath, good storage stability.

Required amount

- exhaustion:
  - 3-4 % CIBAFAST® W liquid, depending on liquor ratio and requirements
- continuous steaming:
  - 7.5 g/l CIBAFAST® W liquid, at 400% pick-up
- aftertreatment:
  - 3-4 % CIBAFAST® W liquid.

Cibafast W

Dyeing addition	Lightfastness			
	Pale grey	Rose	Pale violet	Pale blue
None	5	4-5	4-5	4-5
+ *2%* Cibafast W	6	6	6	6

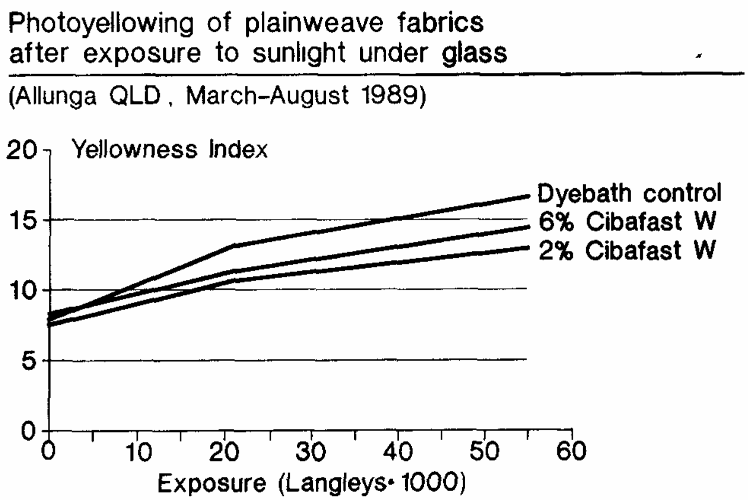
Shade	Dyes	% (owf)
Pale grey	Lanaset Grey G Lanaset Bordeaux B	0.04 0.004
Rose	Polar Red RLS 200 Polar Brilliant Blue RLS 160 Polar Yellow 4G 160	0.04 0.0025 0.002
Pale violet	Polar Brilliant Blue RLS 160 Polar Red RLS 200	0.01 0.005
Pale blue	Erionyl Blue M-RW Erionyl Blue 7G 200	0.02 0.02

There is an increase in lightfastness of pale shades of 1 to 1.5 rating points in the presence of Cibafast W.

In practice, the actual improvement depends on the dye and the initial yellowness of the wool.

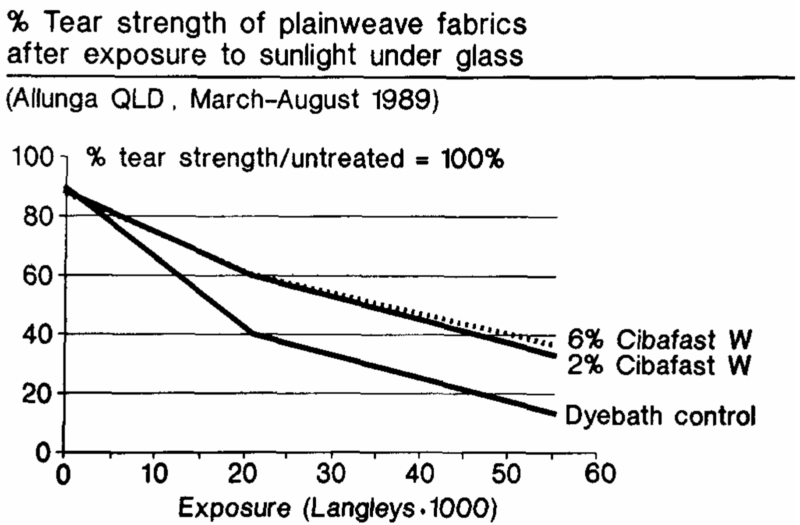
Mosimann et al., *Proc. 8th Int. Wool Text. Conf. Christchurch*, **IV** (1990) 239.

Cibafast W



Photoyellowing of plainweave fabrics after exposure to sunlight under glass

(Allunga QLD, March-August 1989)



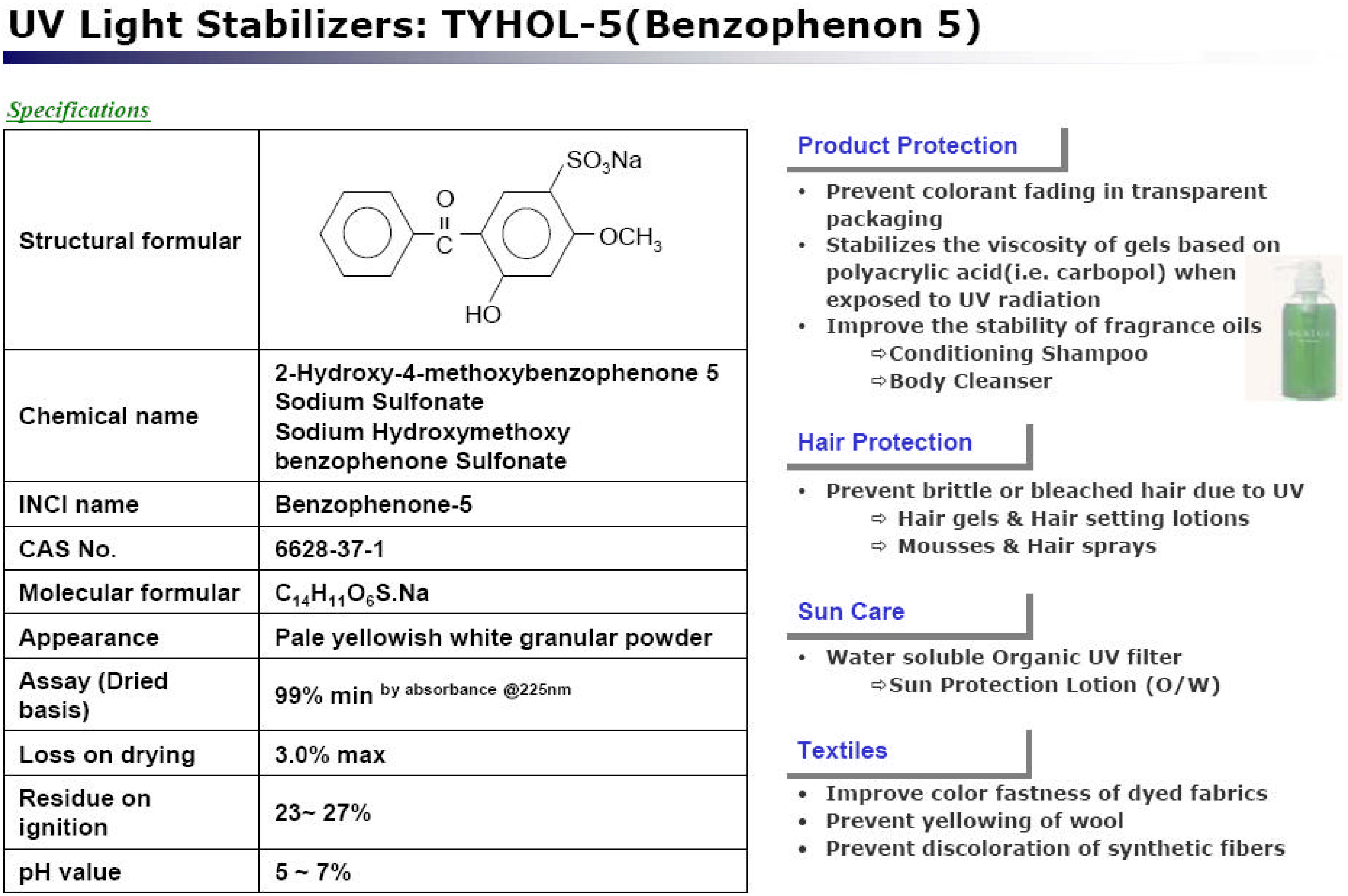
% Tear strength of plainweave fabrics after exposure to sunlight under glass

(Allunga QLD, March-August 1989)

With Cibafast W treatment:

- photoyellowing is reduced
- tear strength is lost more slowly after sunlight exposure.

Other sulphonated phenolic compounds, similar to Cibafast W, are available from other sources



UV Light Stabilizers: TYHOL-5(Benzophenon 5)

Specifications

Structural formular	
Chemical name	2-Hydroxy-4-methoxybenzophenone 5 Sodium Sulfonate Sodium Hydroxymethoxy benzophenone Sulfonate
INCI name	Benzophenone-5
CAS No.	6628-37-1
Molecular formular	$C_{14}H_{11}O_6S.Na$
Appearance	Pale yellowish white granular powder
Assay (Dried basis)	99% min by absorbance @225nm
Loss on drying	3.0% max
Residue on ignition	23~ 27%
pH value	5 ~ 7%

Product Protection

- Prevent colorant fading in transparent packaging
- Stabilizes the viscosity of gels based on polyacrylic acid(i.e. carbopol) when exposed to UV radiation
- Improve the stability of fragrance oils
  - ⇨Conditioning Shampoo
  - ⇨Body Cleanser

Hair Protection

- Prevent brittle or bleached hair due to UV
  - ⇨ Hair gels & Hair setting lotions
  - ⇨ Mousses & Hair sprays

Sun Care

- Water soluble Organic UV filter
  - ⇨Sun Protection Lotion (O/W)

Textiles

- Improve color fastness of dyed fabrics
- Prevent yellowing of wool
- Prevent discoloration of synthetic fibers

11. The future for bleached wool

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 shades, 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.
- Australian Wool Innovation started The Pure Bright Wool Program in 2001 to promote research on permanent bright whites and pastel shades on wool fabrics.
- 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 years.