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## Effect of Chemicals on Fabric Dyestuffs Likely to be Encountered by Dry Cleaners and Launderers



Stains caused by dyestuff are amongst the most difficult encountered by our business, the major problem being to remove the stain whilst avoiding colour change to the original fabric colour. This potential problem is relevant to almost any stain and dyed fabric, but dye stains particularly present difficulties since many dyestuffs react in similar ways and the removal treatment of one, may affect the other.

Fortunately, different groups or classes of dyestuffs are used for different fibres. Specific fabric types need to be dyed with different dyes e.g. good dye fastness to washing or dry-cleaning, or good fastness to the effect of light or heat. Such techniques used by the fabric dyer can cause difficulties in stain removal when confronted on an article containing more than one fibre or component pieces of fabric, each of which may have been dyed in a different manner, or with a different type of dyestuff.

The types of dyestuffs associated with the major groups of fibres are detailed below together with their reaction to some spotting methods, or chemicals.

### Fabric Dyeing Methods

#### Direct dyestuffs.



These are widely used and have limited wet fastness. This means that they are fairly easily removed during the wet cleaning process. They tend to "bleed" or reduce density, especially in alkaline conditions. This loss is accelerated with increasing temperature so caution is required using a steam gun in stain removal.

Many of these dyestuffs are affected by reducing agents and care must be taken when using Sodium Hydrosulphite. Direct dyestuffs are generally sensitive to acid and alkaline conditions.

Often a change in shade caused by alkali can be restored by treatment with an acetic acid and, visa-versa, using ammonia to restore acid induced colour change.

Direct dyes may be after treated (fixed) by the dyer to give better fastness to washing but even so they can so easily be affected by alkalis. Many are also de-coloured by oxidising bleaches.

#### Reactive dyestuffs.

These are so called because the dye molecules react chemically with the fibre. Because of this they impart high wet fastness properties to dyed fabric. They are however also very susceptible to the effects of oxidising agents and this can give rise to problems in spotting treatments.

Reactive dyestuffs are now widely used on table and bed linen dyed in bright shades and are used on cellulose and polyester/cellulose blends, which require good wash fastness.

#### Vat Dyestuffs.

Vat dyed fabrics have a very good wet fastness and are generally unaffected by oxidising bleaches, even sodium hypochlorite. They are also unaffected by reducing compounds which although produce an immediate colour change can be re-oxidised subsequently to the original colour.

Vat dyestuffs are fast to alkaline treatments but if reduced under alkaline conditions (e.g. ammonia and sodium Hydrosulphite) the reduced form of dyestuff, known as the "leuco" (soluble) colour, can be transferred to other fabrics. This transferred dyestuff when re-oxidised will produce a stain that is almost impossible to remove without causing damage to the original colour.

Other classes of dyestuffs are used on cellulose fibres, they are intermediate between the three classes above, as regard fastness properties etc., but are less likely to be encountered by spotters.



### Dyeing Polyester Fibres (e.g. Terylene, Dacron, Trevira)

Polyester fibres are usually dyed with disperse dyestuffs which are absorbed into the fibre. These dyestuffs have a very good wet fastness, and are generally resistant to chlorine bleaches. They may however be affected by reducing agents.

Polyester/cellulose fabrics are usually dyed by a two-stage method, the polyester being dyed at high temperature (130 °C), the cotton then being dyed with direct dyestuffs, reactive dyestuffs, or vat dyestuffs according to the wet fastness required.

### Dyeing Acetate Fibres (e.g. Tricel, Dixel)

Disperse dyestuffs are also used on acetate and triacetate fibres and fabrics. Generally, these dyestuffs on such fabrics have low fastness qualities to "dry" solvents such as Trichloroethylene, especially when warm. Additionally they are easily transferred to oily matter. Removing an oil stain from acetate or triacetate fabrics can often result in a serious fabric colour loss.

Continued on page 2

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Losses of dyestuffs can also occur by sublimation as a result of the action of heat. This is the property of some materials to change from a solid to a vapour phase, without passing through an intermediate liquid phase.

Certain disperse dyestuffs are very sensitive to burnt gas fumes, such as are produced by gas fires and heaters, these changes are irreversible and must not be confused with stains.



### Colour discharge



After the removal of a stain it is sometimes found that colour of the fabric has been discharged or reduced. In some examples, a spot where perfume may have been spilled may have caused colour discharge and is only noticeable after dry cleaning or other treatment.

Colour may be revived by diluted acetic acid treatment. If this has no effect, the dried fabric may be touched up using coloured crayon or coloured water-soluble art pencils.

### Dyeing Wool



Wool may be dyed with a variety of dyes, all differing in their fastness properties.

a) Level dyeing acid colours. This class of dyestuffs has low wet fastness and they are often removed by alkalis, the colour loss increasing with an increase in temperature. Most are affected by reducing agents e.g. sodium Hydrosulphite, many of the reds and yellows being totally removed and the blues and greens partially removed. Many colours, particularly the blues, are sensitive to Sodium Perborate, which is a common bleaching constituent in household washing powders.

b) Milling Colours. These have a higher fastness, certainly on the wet-side than the level dyeing acid colours, especially to alkaline treatments, but they can still be affected by hot alkaline treatments. They may also be affected by reducing agents.

c) Pre-metallised dyes. These have a high wet fastness to alkaline treatments but are generally produced in dull shades.

d) Chrome dyestuffs. Generally used on suiting, they produce duller shades than the other dyestuff classes, but have a high wet fastness and are not usually affected by reducing agents. The complex affinity of the dyestuffs, fibre, and chrome can be broken by oxalic acid treatment (for removal of rust for example), which renders them less fast to subsequent alkaline treatment.

e) Reactive dyes. This class of dyestuffs has a good fastness to alkaline treatments as they are often used for bright shades. They can however be grossly affected by reducing agents.

### Dyeing Nylon

Nylon is usually dyed with wool dyestuffs, they can also be dyed with disperse dyestuffs and with direct dyestuffs. Generally the dyestuffs are not easily removed by alkaline treatment, although some loss may occur. Although affected by reducing agents, the effect is usually less severe than when the same dyestuff is used on wool.

### Acrylic Fibres

Acrylics are dyed with modified basic dyestuffs, which possess good wet fastness and light fastness properties, but many are affected by chlorine bleaches particularly at high temperatures. Acrylic fabrics are also affected by direct heat, which causes a yellow discoloration, which is irreversible.

### Medicinal dyestuffs

These dyestuffs are rarely used on fabrics, but are often used for identification purposes in medicinal preparations and these can cause bright, fast stains. Some basic dyestuffs can be removed with treatment using dilute acetic acid and alcohol (e.g. Methylated spirits/acetic acid).

Many are totally decolourised by sodium Hydrosulphite.



### Printed dyestuffs

Many dyestuffs are encountered in the form of prints, in which the dyestuff is applied in the form of a pattern on a fabric, instead of being overall colouring effect. Some prints have a poor rubbing fastness and they may be removed by friction. Before attempting to remove stains a check should always be made to ensure that the rubbing fastness, dry, with water, and with dry cleaning solvent is adequate.

In some cases designs are produced by a discharge print. In this technique the non-coloured area has either been bleached or has been originally treated with a substance, which does not allow dyestuffs to colour the fabric. Generally these prints may have a low rubbing fastness, particularly in the presence of reducing agents.

### Cautions

It can be seen from the previous notes that removal of any dye staining, especially dye staining from already dyed fabrics, can present problems. The utmost care should be exercised and correct testing carried out before the attempt to remove the visible staining.

Considerable problems can occur in dye stain removal if simple exploratory tests are not carried out first. For this, it is necessary to remove a snippet of fabric from an in-turned seam and apply the appropriate stain treatment to it. If damage occurs, do not proceed any further with this treatment. Consider further tests using alternative treatment chemicals.

Many dyestuffs are affected by bleaches, which either oxidise or reduce the chemical group in the dyestuffs responsible for the colour in the dyestuff compound.

The removal of dye stains is better explained as converting a coloured substance into a non-coloured substance. All bleaches work with a chemical action.

The Guild have a book on Stain Removal for Dry Cleaners and Launderers and you can obtain this from the Guild Secretariat E-Mail [enquiries@gcl.org.uk](mailto:enquiries@gcl.org.uk) priced at £20.00 including PP.