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**The Provision, Storage and handling of Dyes in Dyeing and Finishing Plants**

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Abstract

The important factors to be considered in the provision, storage and handling of dyes and chemicals are discussed and related to their contribution to the efficient use of production resources in modern dyeing and finishing plants. The conditions necessary for optimum storage of materials in the dye‐store are outlined and the advantages and limitations of bulk storage systems and methods of stock control are briefly summarized. Dispensing methods for dyes and chemicals in the colour kitchen are briefly reviewed in the light of recent developments and related to improvements in process and quality control. In addition, some general views on health and safety and on the selection and training of operatives for colour kitchens are presented.

**Citing Literature**



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**Chemicals - Safe use and handling**

* [What are the problems?](https://www.hse.gov.uk/textiles/chemicals.htm#a1)
* [Bulk delivery](https://www.hse.gov.uk/textiles/chemicals.htm#a2)
* [Storage](https://www.hse.gov.uk/textiles/chemicals.htm#a3)
* [Dispensing](https://www.hse.gov.uk/textiles/chemicals.htm#a4)
* [Transport by bucket](https://www.hse.gov.uk/textiles/chemicals.htm#a5)
* [Piped delivery systems](https://www.hse.gov.uk/textiles/chemicals.htm#a6)
* [Spotting solvents](https://www.hse.gov.uk/textiles/chemicals.htm#a7)
* [Further information](https://www.hse.gov.uk/textiles/chemicals.htm#furtherinfo)

**What are the problems?**

* [Some chemicals can cause fires or explosions](https://www.hse.gov.uk/textiles/fire-explosion.htm)
* Corrosive chemicals can cause serious burns and may react dangerously with other chemicals
* Violent reactions may be caused by substances that are dangerous when they get wet, such as 'Hydros'
* Hot liquids can scald
* Some chemicals react in a hazardous way when they are mixed, eg they may react violently, generate a lot of heat or produce toxic gases
* Some chemicals can cause skin irritation, itchy, stuffy noses, sneezing and sore eyes, eg formaldehyde-based resins, ammonia, acetic acid, some shrink-resist chemicals and optical whiteners, soda ash and bleach

**Bulk delivery**

Tanks may be overfilled or filled with the wrong product.  To reduce the risk of this happening:

* Label tanks clearly with their contents
* Agree a written procedure with the supplier, so there is no uncertainty about who does what; keep the supplier and driver up to date with any changes and make sure that someone is around when the delivery arrives.  The procedure should:
	+ cover every stage: from the arrival of the road tanker at the premises to when it leaves
	+ include a description of the route to the relevant filling inlet point
	+ identify the filling inlet point and the tank to be filled
	+ include checking that ullage space (the free space above the liquid contained in a barrel, drum, or tank, provided to accommodate expansion of the liquid) is adequate; and appropriate coupling, discharging, uncoupling, hose draining and cleaning routines

**Storage**

Some chemicals may react in a hazardous way when they are mixed together, eg they may react violently, generate a lot of heat or develop toxic gases:

* Make sure you know which chemicals in your inventory are incompatible
* Read and take into consideration the safety data sheet from your supplier
* As a rule of thumb, acids should be kept separate from alkalis and oxidising agents from reducing agents. However, incompatibilities within the same class of chemical also exist
* Organise your store so that incompatible chemicals are kept in segregated, marked product bays

Fire may arise from ignition of stored flammable substances.  The precautions that you need to take will depend on the degree of flammability of the substances in question:

* Small quantities of flammable liquids may be stored in the workroom in a fire-resisting cupboard or bin.  Mark the outside of the cupboard or bin to show it contains flammables
* Store larger quantities of flammable liquids either in the open air or in an outside store or in a separate fire-resisting room constructed in accordance with the guidance given in "[Storage of dangerous substances](https://www.hse.gov.uk/pubns/books/l135.htm)"
* Smoking should not be allowed, particularly in any area where flammables are stored
* Provide adequate ventilation at low levels in storage areas, to disperse heavy vapours
* Make sure there is an adequate means of escape from the store

An existing fire may be made considerably worse if an oxidising agent is involved.  When heated in a fire, many of these substances can break down and the liberation of oxygen can cause an increase in the rate of burning:

* Store oxidising agents away from reducing agents and from flammable and combustible materials
* Do not exceed the storage time limits, particularly for solid oxidising agents, since this increases the likelihood of decomposition

Some substances, such as sodium hydrosulphite (Hydros), may react violently if contaminated with a small amount of water.  To reduce the risk of this happening:

* Substances that are dangerous when wet should be stored under cover and off the floor
* Container lids should always be kept on
* [See also "Hydros" in dyes and dyeing](https://www.hse.gov.uk/textiles/dyes-dyeing.htm)

**Serious consequences may arise from accidental spillages**

* Where liquids are stored in bulk tanks, provide a catchment area, suitably lined and capable of containing the total volume of the tank. Any drainage outlet from a bunded area should be arranged so it cannot be left open by accident
* In product bays where liquids are stored in small containers, provide sills to hold back spillage. These should be ramped to ensure ease of transport over them
* Provide enough drainage to cope with regular hosing down and inadvertent spillage
* Remember to take into account possible environmental risks
* Lay down safe systems of work for coping with major spillages, particularly of flammables or corrosives

**Dispensing**

It is often convenient to put dispensing points around the factory to reduce travel distances to machines.  However, these need to be planned and well laid-out, with plenty of space to work in.

Splashes of chemicals or very hot water may cause burns.  Therefore:

* Consider your overall strategy for dispensing hazardous substances. If not already in use, consider introducing enclosed chemical handling systems
* Do not pour acids and other corrosives straight from small chemical containers into buckets and jugs. It is difficult to pour in a controlled way and the liquid is likely to splash back as air tries to replace the displaced volume in the container. Instead, use proper discharge valves, powered or hand pumps, which will make sure there is adequate venting. Or, mount the container on a pivoting cradle so tipping can be controlled
* Always add acids and corrosives to water, never the other way around
* Provide appropriate personal protective equipment. This includes gloves, overalls or aprons, work boots and eye protection, all of which should be chemical resistant
* Instruct employees how to use the equipment you provide properly; give unambiguous rules as to when it must be used; and then ensure equipment is used
* Consider how you would provide emergency first aid in the event of a chemical splash. For example, is there a plentiful supply of running water near each dispensing point that could be used to douse a casualty in an emergency?

Chemical cross-contamination of incompatible substances may result in a violent reaction.  Therefore, always use clean and dry scoops and buckets

People may suffer ill health if exposed to airborne chemicals with irritant or other toxic properties:

* Consider how you would provide emergency first aid in the event of a chemical splash. For example, check that there a plentiful supply of running water near each dispensing point that could be used to douse.
* Keep containers of chemicals, such as ammonia and formaldehyde-based resins, closed
* Make sure ventilation in the chemical handling area is adequate to remove any gases or vapours released

Dermatitis may result from prolonged exposure of the skin to chemicals and water:

* Make sure suitable gloves are worn to prevent skin contact with chemicals
* Provide washing facilities of a good standard
* Provide and encourage the use of a conditioning cream to replace oil and moisture in the skin after washing
* Do not allow organic solvent or neat hypochlorite bleach to clean dye stains from the skin. Use sodium hydrosulphite solution or a cleansing cream containing sodium hydrosulphite (unless the stains are from a dye which may regenerate a carcinogen if treated with a reducing agent).  If staining is very stubborn, use diluted bleach, providing the skin is then neutralised with sodium hydrosulphite and rinsed thoroughly
* Inform employees of the characteristic signs of dermatitis; encourage them to inspect their own skin and report any symptoms
* Refer any suspected cases of dermatitis promptly to an occupational health adviser or family doctor

**Transport by bucket**

Splashes from buckets may result in burns.  Therefore:

* Use lidded buckets when carrying hot or corrosive liquids any distance
* Keep floors in good repair to avoid tripping hazards; floors of tile or brick are less prone to chemical corrosion than concrete
* Provide spillage trays at dispensing points
* Chemical-resistant overalls or a long apron should cover the top of open-topped work boots to deflect spillages

**Piped delivery systems**

Many of these risks with dispensing and transport can be avoided if a piped delivery system is used to convey chemicals directly from bulk storage to process points. However, these systems can present risks of their own.

Pipes and joints may leak.  To reduce the risk of this happening:

* Use industrial pipe work and fittings of suitable material and type for the substance being conveyed. Do not use push-fit connections or domestic compression fittings
* Pipe work should be adequately supported. Protect any sections which may be vulnerable to mechanical damage
* Use spring-loaded valves which cannot be left open
* Accidents can occur if mistakes are made during maintenance work upon the system.  Therefore:
	+ Label clearly or colour mark the pipe work according to the chemical it conveys.
	+ When breaking into transfer lines and during maintenance work, safety relies on people following a number of steps in sequence. These should ensure that workers wear suitable protective equipment and that the plant being worked on is effectively drained and isolated. Where such tasks are routinely undertaken, prepare written procedures and consider instituting a permit-to-work system.

**Spotting solvents**

Spotting solvents are used in textile and clothing manufacture to remove stains from fabrics.  These can be caused by such things as loom and machine oils, felt pens, coffee, grease and finger marks.

Spotting solvents are usually applied to the fabric by spray gun, but a cloth soaked in solvent may also be used. Typically, the fabric is left to dry by natural evaporation, but a compressed air jet can sometimes be used to help drying.

Two main groups of spotting solvents are used – halogentated hydrocarbons and olefins.

* Halogentated hydrocarbons include trichloroethylene, which has been identified as a Substance of Very High Concern (SVHC) under [REACH](https://www.hse.gov.uk/reach/index.htm), bromochloromethane and dichloromethane.
* Olefins include aliphatic hydrocarbon solvent blends and isoparafinic hydrocarbon blends

**Exposure and health effects**

People can be exposed to spotting solvents by inhaling mist and vapour and by solvent being absorbed through the skin.  Solvents can also enter the body through handling food and drink and by smoking.

The main effects are irritation of the skin, eyes and lungs, headache, nausea, dizziness and light-headedness. Repeated or prolonged skin contact can cause dermatitis. Solvents can also impair co-ordination and this can lead to accidents. Other effects on health vary according to the solvent being used.

**Working without solvents?**

Look at how stains happen - could a change in production methods help to prevent or minimise staining?  Experience has shown that a quality improvement programme can reduce considerably the need for spot cleaning.

Could solvent-free agents such as household type water-based cleaning products be used, even if just for some stains?  Note that some water-based agents also have health risks - these need to be assessed and balanced against the risks from spotting solvents.

**Further information**

**Storing chemicals**

Information about storing chemicals safely can be found at the links given below.

* [General storage – COSHH Essentials G101 (PDF)- Portable Document Format](http://coshh-tool.hse.gov.uk/assets/live/G101.pdf)
* [Storing chemical products (small scale) – COSHH Essentials SR24 (PDF)- Portable Document Format](http://coshh-tool.hse.gov.uk/assets/live/SR24.pdf)
* [Information about storing and working safely with flammable chemicals](https://www.hse.gov.uk/textiles/fire-explosion.htm)
* [Storage of dangerous substances](https://www.hse.gov.uk/pubns/books/l135.htm)

**Working safely with chemicals**

Many chemicals are classed as substances hazardous to health.

Information and guidance on working safely with chemicals and other substances hazardous to health can be found on the following web pages:

* [Diluting chemical concentrates (PDF)- Portable Document Format](http://coshh-tool.hse.gov.uk/assets/live/SR02.pdf)
* [What you need to do](https://www.hse.gov.uk/coshh/basics/whatdo.htm)
* [Working with substances hazardous to health](https://www.hse.gov.uk/pubns/indg136.htm)
* [Control of Substances Hazardous to Health (COSHH)](https://www.hse.gov.uk/coshh/index.htm)
* [Principles of good control practice](https://www.hse.gov.uk/coshh/detail/goodpractice.htm)
* [Control measures to prevent or limit exposure to hazardous substances](https://www.hse.gov.uk/coshh/basics/control.htm)
* [Substance substitution](https://www.hse.gov.uk/coshh/basics/substitution.htm)
* [Workplace exposure limits](https://www.hse.gov.uk/coshh/basics/exposurelimits.htm)
* [Chemical safety data sheets](https://www.hse.gov.uk/coshh/basics/datasheets.htm)
* [What is a hazardous substance?](https://www.hse.gov.uk/coshh/basics/substance.htm)