Dyes and Dyeing Glossary
A Glossary of Terms for Materials and Processes in Textile Dyeing for Artists

REVISION 3.0.0

Preface

This is a sort of cyclopedic glossary, containing a bit more information than the typical glossary. It is not intended to provide enough information by itself to serve as a guide for dyeing. Terms have been included here because they may appear in dyeing literature, and may be hard to find in ordinary dictionaries. Many chemical terms are included for this reason.

Most multi-word terms appear alphabetized according to the first word. Some, mostly those that may be unfamiliar, appear alphabetized based on the word considered by the author to be most significant. Starting with Revision 3, because of the growing size, some terms that appeared only for cross-referencing have been omitted. Try looking for terms with the same or similar terms in different order. For example, “strong acid” has been deleted, and only “acid, strong” remains. Similarly, some abbreviated forms have been omitted if they would appear immediately next to the long form. For example “thiox” has been deleted, since it immediately followed “thiourea dioxide”. The search feature in Acrobat® Reader can be helpful when viewing the PDF.

Some terms are described a being used in North America or in Britain. I apologize to those in other countries for not being able to cite appropriate usage.

Some terms included here may have quite different meanings outside the realm of textiles and dyeing.

NOTE! Throughout the glossary, words appear in italics. These cross-reference words, or similar words, are defined elsewhere in the glossary. It is often important that the cross-reference be checked, particularly for chemical terms, to complete the information or resolve confusion.

You don’t need to know or understand all the things in this glossary to enjoy dyeing!

Printing the PDF:

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AATCC - American Association of Textile Chemists and Colorists
Their web site is at www.aatcc.org**.**

A.B.S. (or ABS) - a plastic; acrylonitrile butadiene styrene
ABS plastic pipe is an alternative to *PVC* pipe for use in shibori. {Rev 2.0.0r}

acetate - see cellulose acetate

acetic acid - CH_3COOH; an *organic* acid; also called (rarely) ethanoic acid
Glacial acetic acid (GAA) is commonly sold for industrial purposes. It is almost pure acetic acid (that is, it contains almost no water), pungent smelling and flammable. It is called "glacial" because it will freeze at around 17°C. Concentrated solutions of acetic acid are dangerous, and must be handled with care. Acetic acid is used in many dyeing processes. It is much less expensive than *vinegar* where large amounts are required. Often a 56% solution (in water) is called for. Acetic acid is a *weak acid* (see acid, weak - this does not mean "mild"). {Rev 3.0.0r}

acid - a chemical that will produce a pH of less than 7 in water solution
Many acids are used in dyeing. They include *acetic acid*, *citric acid*, *formic acid*, *hydrochloric acid* and *sulfuric acid*. Several other compounds, such as *sodium bisulfate* and *ammonium sulfate* form acids in solution through *hydrolysis*. When making solutions of acids or when diluting concentrated acids, always add the acid to water, never the other way around. This is because some acids produce a great deal of heat when they mix with water - so much that a small amount of water added to a large amount of acid may actually boil and cause extremely dangerous spattering.

acid, strong - A strong acid virtually completely *ion*izes in solution.
All of the acid, represented by HA, exists in solution as H^+ (or H_30^+ - the hydrogen ion combines with a water molecule to make a ion called hydronium) and A^-. Hydrochloric acid and sulfuric acid are common strong acids. Note that even in very dilute solution, these are still regarded as strong acids. See *acid, weak*.

acid, weak - A weak acid is an one that does not fully *ion*ize in solution
Some of the acid remains in molecular form, rather than completely ionizing. If HA represents the acid, some would remain in solution as HA, and some would ionize to H^+ and A^-. Acetic acid and citric acid are commonly used weak acids. An acid may be technically weak, but still capable of causing serious skin burns. See *acid, strong*. See *base, weak* for more discussion of pH effects surrounding "weakness" (remembering that more acid lowers pH).

acid donor - a compound that *hydrolyzes* or breaks down to yield acid
In a number of dyeing and printing processes, primarily with acid dyes, there are advantages to starting with a bath or print paste that is pH neutral or only slightly acid, but that will become more strongly acid as boiling or steaming progresses. Acid donors, such as *ammonium sulfate* or ammonium tartrate are often used for this purpose. {Rev 3.0.0a}

acid dye - a large class of dyes that are applied from acidic solutions to *polyamide* fibres
These synthetic dyes are used for wool, silk and nylon. They are typically applied in a bath that may range from strongly acid to neutral, and usually at temperatures approaching boiling. Bonding between the dye and fibre can be complex. Some form *ionic bonds* between basic groups of the fibre and acid groups of the dye, but other bond types occur. There are a great many acid dyes, in a number of major sub-groups, with a wide variety of properties. Included are "washfast acid dyes", "*milling* dyes", "supermilling dyes", "*leveling* acid dyes", "1:1 *premetallized* dyes", "2:1 premetallized dyes" and others (the premetallized dyes are sometimes regarded as being in a class of their own, apart from acid dyes). The distinction between some of the groups is often vague. Acid dyes range from poor to excellent colorfastness, and from dull tones to brilliant shades. The choice of sub-group is often a compromise among the characteristics of colorfastness, leveling properties and shade availability. Acid dyes may not perform well in mixtures, even with dyes from the same general class, so care is required in selection. {Rev 3.0.0r}

acrylic - with reference to textiles, a synthetic *polymer* fibre made from acrylonitrile compounds

Acrylic is probably the most popular synthetic fibre for yarns for hand knitting. It is also used for fleece clothing. Modacrylic is acrylic that contains other monomers to alter some properties, such as flame retardancy. Acrylic is normally dyed with *basic dyes*. The process requires care get *level* results and to avoid damage to the fibre. {Rev 3.0.0r}

affinity - attraction between two items; in dyeing affinity essentially means the preferential attraction of the dye for the fibre rather than for the solution of the dyebath

A dye with high affinity readily leaves the dye solution of dispersion to attach to the to the fibre being dyed. This does not necessarily imply that the attachment of the dye to the fibre is strong. Technically, affinity is expressed in terms of energy. It is determined under standardized conditions, so it is incorrect to say that affinity is altered by auxiliary chemicals or the like. See *substantivity*. {Rev 3.0.0r}

alginate (or algin) - an extract of seaweed used as a thickener

"Sodium alginate" is used in textile printing pastes, and sometimes to thicken dye solutions for direct application. It is a preferred thickener for reactive dyes because it does not react with, and therefore use up, the dye. It comes in a number of variations that have somewhat different properties. "Low viscosity" types are appropriate for reducing migration of wet dye solutions for fine line work, while "high viscosity" are more suitable for making printing pastes. It can form gels at low pH or very high pH, so it is not suitable for some print paste formulations. {Rev 3.0.0r}

alkali - a subclass of *base*, though often used to refer to any base

Partly because the term "basic" is often rather confusing, "alkaline" is often used to refer to solutions that are basic - having *pH* greater than 7.

alum - a term for a variety of chemicals, with a lot of potential for confusion

There are several compounds that are called alum. One is aluminum potassium sulfate - pickling alum. Others include aluminum sulfate (the alum most used in textile arts, and used in municipal water filtration plants), aluminum ammonium sulfate (ammonia alum), chromium potassium sulfate (chrome alum), and more. Some alums are used as *mordants* in dyeing, primarily with natural (plant extract) dyes. Aluminum sulfate is often used in marbling. {Rev 2.0.0r}

aluminum (spelled aluminium in most English-speaking countries outside of North America); chemical symbol Al

Aluminum is included here because many pots are made of aluminum. In general, aluminum is not appropriate for dyeing vessels. It is attacked by both acids and bases, and explosive hydrogen is liberated in the process. Also watch out for aluminum rivets used to hold the handles on some *stainless steel* pots. {Rev 2.0.0r}

aluminum potassium sulfate - "pickling" *alum*; $AlK(SO_4)_2$

This is the alum available from the grocery store.

aluminum sulfate - $Al_2(SO_4)_3$; an "alum"

Aluminum sulfate is used in marbling with fabric paints. It will *hydrolyze* to become quite acid, which will destroy cellulosic fibres if given sufficient time, so it must be applied shortly before use, and rinsed out thoroughly afterwards.

ammonia - a gas, NH_3; often used to refer to a solution of ammonia in water, called aqua ammonia or ammonium hydroxide (NH_4OH)

Ammonium hydroxide is sometimes used for *pH* control, mostly where the desired pH is only moderately basic. It is used in some *stripping* processes for acid dyes and in rinses for reactive dyes on wool. Ammonia vapors are very irritating, and solutions should be handled carefully.

ammonium hydroxide - see *ammonia*

ammonium sulfate - $(NH_4)_2SO_4$

Ammonium sulfate is a solid chemical that is used most commonly with acid dyes and 2:1 premetallized dyes. It decomposes through *hydrolysis* as the bath temperature rises, slowly releasing acid. This helps produce *level*

results: at the start of dyeing the pH of the bath will be near neutral and will drop as dyeing progresses. Neutral conditions favor leveling, while more strongly acid conditions favor good *exhaustion*. {Rev 3.0.0r}

amylase - an *enzyme* that catalyzes the breakdown of *starch*

Use of amylase enzymes is now the industrially-preferred way of removing starch *sizing* from textiles. The reaction with the enzyme essentially converts starch to water-soluble sugar. Unfortunately, amylase enzyme is difficult for the textile artist to obtain.

amylose - a *starch* made of long unbranched chains a-D-glucopyranose (which is quite similar to glucose, $C_6H_{12}O_6$; the "a" should be the Greek letter alpha, but that character may not appear properly on all computers)

amylopectin - a *starch* made up of long branched chains of a-D-glucopyranose (which is quite similar to glucose, $C_6H_{12}O_6$)

aniline - C_6H_7N; also called aniline oil, benzeneamine, aminobenzene

Aniline used to be a very commonly used chemical in the synthesis of dyes. Sometimes the term 'aniline dye' is used as something of a catch-all term for synthetic dyes, though very few dyes still in production are actually aniline derivatives. Because of toxicity, aniline has been replaced with other compounds for most dye synthesis. {Rev 3.0.0r}

anion - a negatively charge *ion*

Many chemicals used in textile processing are described as anionic. This means that when the chemical ionizes in solution, the *ion* that is "functional" has a negative electrical charge. Most dyes are anionic. *Surfactants*, including some used as fabric softeners, may be anionic (others are *cationic* or non-ionic). {Rev 2.0.0r}

anhydrous - without water

Many "dry" chemicals may contain some water as part of the crystal structure. Although this can often be compensated for in making up formulas, it is often more convenient to use chemicals that contain no water, that is, that are anhydrous. Many dry chemicals are *hygroscopic*. See *hydration number*.

antichlor - a chemical used to neutralize chlorine bleach

It can be very difficult to completely rinse chlorine bleach out of fabric. The residual bleach can interfere with subsequent dyeing, or can eventually damage the fibre. A rinse in a solution of antichlor, most commonly *sodium bisulfite*, will quickly neutralize the bleach. Hydrogen peroxide also functions to neutralize chlorine bleach. A thorough rinse is required after using antichlor. All of the common antichlor compounds essentially convert free chlorine bleaching agents to hydrochloric acid. If enough acid is produced, it can cause liberation of free chlorine gas, which can be hazardous and is certainly very irritating. Sodium carbonate added to the antichlor rinse will neutralized the acid. ACID RINSES, SUCH AS VINEGAR IN WATER, SHOULD NOT BE USED TO STOP CHLORINE BLEACHING. For neutralization of chlorine in water used to make up dye baths, *sodium thiosulfate* is the preferred antichlor agent.

anti-migrant - an additive used in dye or pigment mixtures to prevent undesired movement or spreading of the wet dye on fabric

Anti-migrants are used in thickened dye solutions or dye pastes used for printing fabric so that the printed pattern will retain sharply defined edges. Sodium *alginate* is often used for this purpose for art processes. Anti-migrants are also used in commercial pad-batch dyeing to prevent uneven shading across the width of the fabric. {Rev 2.0 a}

azo - referring to a chemical compound which contains two nitrogen atoms with a double bond between them (-N=N-)

"Azo" is used for a class of dyes based on (this) chemical structure. Azo dyes may be found among direct, acid, basic, reactive and disperse dye classes. Dyes with one pair of nitrogen atoms azo bonded are often called monoazo. Those with two or three azo bonded pairs are called disazo (not diazo) and trisazo, respectively. Do not confuse azo with *azoic.* {Rev 3.0.0r}

azoic dye - a term generally applied to a class of dyes based on application method; sometimes called naphthol dyes

Azoic dyes are actually chemically synthesized inside the fibre, and are not truly dyes, but insoluble *pigments.* The soluble "naphthol" component is applied to the fibre, then a solution of "diazo salt" is used to develop the color. "Azoic" should be used only for this type of dye, not for *azo* dyes in general. These dyes are used commercially, especially for reds, but are not readily available to artists. The components used can be very toxic before they react to form the pigment. {Rev 3.0.0r}

baking soda - *sodium bicarbonate*

barré - a stripe-like or bar-like pattern in dyed fabric

The dye uptake of some synthetic fibres, notably *nylon*, can be influenced by minor variations in conditions when the fibres are made. If yarns with these variations are made into fabric, then dyed, the result may be a bar-like pattern of darker and lighter shades or slight hue differences. Sometimes nylon is dyed with *disperse dyes* rather than *acid dyes* because the former are better at covering barré.

base - a chemical compound that will produce *pH* of greater than 7 in water solutions; *alkali* is often used synonymously, though this is not strictly true (all alkalis are bases, not all bases are alkalis); essentially the "opposite" of an acid

By far the most common base used in dyeing is *sodium carbonate* (soda ash). Other bases used include *sodium bicarbonate* (baking soda), trisodium phosphate (*TSP*) and *sodium hydroxide*. Strong bases can cause serious skin burns.

base, strong - A strong base fully ionizes in solution.

See *Base, weak*. Sodium hydroxide is the most common strong base in textile processing.

base, weak - A weak base does not fully ionize in solution.

Some of a weak base remains in solution in molecular form. If BOH represents the base, some would remain in solution as BOH, and some would ionize to B^+ and OH^-. This makes for something of a "reservoir" action - if some of the OH^- ions are used up in reactions, more of the BOH will ionize. Because of this, the *pH* of a solution of a weak base will change by less than one for a change in concentration of the base by a factor of 10 (for a strong base, which ionizes completely to B^+ and OH^-, increasing the concentration by a factor of 10 will increase the pH by 1). pH, unless very accurately measured, is a poor indication of how much of a weak base is in solution. Sodium carbonate and sodium bicarbonate are examples of weak bases (note that neither actually contains OH, but rather they *hydrolyze* to yield OH^-). {Rev 3.0.0r}

basic dye - dyes which reacts with acidic groups on fibres; sometimes called cationic dyes

Basic dyes are used primarily for *acrylic* fibres, though they can be used on some types of polyester and some types of nylon, and occasionally for protein fibres. A wide range of bright colors is available. Color fastness on acrylic is generally excellent; fastness on natural fibres is generally poor. {Rev 3.0.0r}

bast fibres - cellulosic fibres that come from the stem of a plant

Linen, from the stem of the flax plant, is probably the most common bast fibre used for fine textiles. Others include ramie, hemp and jute. {Rev 2.0.0a}

batch(ing) - leaving goods saturated with dye solution for some period of time, typically hours, and typically at "room temperature" for the dye to fix to the fibre

In commercial dyeing, batching often follows *padding*. In art dyeing techniques, batching is often used with direct application techniques such as tie dye, painting and printing. {Rev 3.0.0r}

bifunctional reactive dye - a reactive dye that has more than one type of reactive group in the molecule

These reactive dyes are designed to have the ability to react with the fibre in more than one way. This increases how much of the dye in the bath is actually fixed to the fibre, rather than being wasted through *hydrolysis*. Although the dye can react with the fibre in more than one way, the reaction does not happen as easily as with the popular *MX* family, so the temperature used is typically around 60°C (140°F). These dyes may be preferred to MX dyes by industrial users because of the lower waste (less effluent treatment cost) and lower reactivity, which can mean easier

process control. {Rev 2.0.0r}

binder - a material, usually nearly colorless, that is typically used to attach a *pigment* to fabric

Binders are more-or-less "glue" to hold the pigment in place. Paints consist of pigments mixed with binders. Many binders used in textile paints are acrylic polymers.

black

Black gets included in this glossary only because, in a way, it is a "problem" color. In many dye families, such as reactive dyes, there is no such thing as a "pure" black dye: blacks are made by using mixtures of other colors, often starting with a large proportion of a navy blue. To achieve a good dark black typically takes much more dye than for strong shades of other colors. It is not unusual to see recommendations between 6% and 10% *owg*. Because blacks are usually mixtures, *discharge* of black may yield unexpected results. Coppery colors are not uncommon. *Reducing agent* discharge may produce different results from *oxidizing agent* discharge. Some dye vendors offer black dyes that are specially formulated to discharge to almost white. *Sulfur dyes* are extensively used commercially for black cotton fabrics. {Rev 2.0.0r}

blacklight - "longwave" *ultraviolet* light; wavelength typically about 365 nanometers

Blacklight lamps made with a fluorescent tube that appears very dark purple can often be found reasonably inexpensively at novelty shops and even at stationery stores where they are sold for detecting counterfeit money. Blacklight lamps are useful for detecting *optical brighteners* in fabrics. {Rev 3.0.0r}

bleach, chlorine - a solution of *sodium hypochlorite* in water; an *oxidizing* bleach

Household chlorine bleach, about 5% sodium hypochlorite, suitably diluted, can be used for whitening cellulose fabrics prior to dyeing. It is also used in some art *discharge* processes (this author knows of no industrial use of chlorine bleach for discharge). Chlorine bleach can damage cellulose fibres, but is safe if strength and exposure time are limited, and the bath pH is maintained at about 9.5. Goods must be thoroughly scoured prior to chlorine bleaching, otherwise impurities may form compounds that are yellow and very difficult to remove. An *antichlor* should usually be used to assure complete neutralization of the bleach. DO NOT mix chlorine bleach with acids - chlorine gas will be liberated. Do not use chlorine bleach on wool, silk or spandex - fibre damage will result.

Industrially, chlorine dioxide is sometimes used for bleaching. Although it is less likely to cause cellulose fibre damage, it is not suitable for home use because the bath is very corrosive to metals, and there is significant risk of chlorine gas production. In general, chlorine bleaching is obsolescent for industrial textile preparation. {Rev 3.0.0r}

bleach, oxidizing - a bleach based on an *oxidizing agent*, such as *hydrogen peroxide* or *sodium hypochlorite*

Most general-purpose household bleaches belong to this class.

bleach, oxygen - a bleach based on *hydrogen peroxide* or a chemical derivative of hydrogen peroxide

Oxygen bleaches typically are less damaging to fibres than chlorine-based bleaches. Most "color safe" bleaches are of this type. Dry powder bleaches and detergents of this class usually use a "peroxygen" compound such as sodium perborate , sodium percarbonate or potassium monopersulfate.

bleach, reducing (or **reductive)** - a bleach or decolorizing compound that is based on a *reducing agent*

This type of bleach is typically used for *discharge* or *stripping*. Usually they are not harmful to fibres, though some processes require temperature or pH that may damage fibres. Wool is often bleached with reducing bleaches. *Thiourea dioxide* and *sodium hydrosulfite* are two compounds that find use as reductive bleaches. {Rev 3.0.0r}

boil - in general, to heat or maintain a solution at the temperature where the vapor pressure of a liquid equals atmospheric pressure, that is, its boiling point; in dyeing sometime called "atmospheric boil" to distinguish from boiling under pressure

In dyeing, unless otherwise specified, it is assumed that the solvent is water, so boiling occurs at 100°C (212°F), at sea level. At higher elevations the boiling point will be reduced. Dissolved solids (solutes) can increase the boiling point, but it is rare for dyeing or preparation liquors to contain enough solute to raise the boiling point by more than a few degrees. In order to get aqueous (water) solutions to a temperature higher than the normal boiling point, the pressure must be increased, using a closed vessel - a "pressure cooker". Closed pressure vessels are used extensively in dyeing of polyester with *disperse dyes*, and may be used in preparation processes such as *scouring* to

hasten the process. Operating temperature of around 130°C is quite common. {Rev 3.0.0a}

bond - see *hydrogen bond*, *ionic bond*, *covalent bond*; also see *van der Waals forces*
In general, of these bond types, hydrogen bonds are weakest, ionic bonds intermediate in strength, and covalent bonds are strongest. Van der Waals forces are something of a special case.

burn-out paste - see *etchant*

British gum - see *dextrin*

buffer - in chemistry, a compound that resists change in *pH* when moderate amounts of acid or base are added to a solution of it
Buffers help to keep the pH of a dyebath from changing significantly as the process progresses. *Sodium acetate* is one such buffer.

Calgon T - Albright & Wilson trade name for *sodium hexametaphosphate*
Calgon T from Albright & Wilson is sodium hexametaphosphate without additives. Water softener products sold at retail under the Calgon name usually contain additives such as fragrances and *surfactants*. {Rev 3.0.0r}

carbonizing - treatment of wool with acid and heat to remove plant materials
Preparation of wool sometimes include treatment of the wool with sulfuric acid, followed by partial drying and heating. The hot acid will degrade or 'carbonize' bits of plant matter in the wool, so that it is easily removed by subsequent mechanical methods. {Rev 3.0.0a}

carboxymethyl starch - a modified starch (starch ether)
Carboxymethyl starch has had some of the hydroxyl groups replaced with carboxymethyl groups, which improves solubility and the stability of pastes. This compound is suitable as a thickener for printing of disperse dyes and vat dyes. It also has some resistance to chlorine bleach, and may be used for thickening bleach for use in *discharge* techniques. *Monagum* is one trade name. {Rev 3.0.0a}

carrier - with respect to *disperse dyes*, a chemical that aids dyeing at moderate temperature
In order to dye polyester with disperse dye in a reasonable time at the boil, it is necessary to use a carrier. Exactly how the carrier works seems to be a matter of some controversy, but it may work by swelling the fibres so that the dye can penetrate. The carrier will eventually evaporate from the fibre after dyeing is complete. Carriers are obsolescent in industrial process, partly because they are quite noxious and environmentally undesirable. Be sure to read and understand the *MSDS* for any carrier chemical you contemplate using. {Rev 2.0.0a}

catalyst - a chemical that speeds up a reaction without itself being consumed in the reaction
Catalysts are not common in dyeing, but are used in fabric preparation and finishing.

cation - a positively charged *ion*
Many chemicals used in textile processing are described as cationic, meaning that when the compound ionizes in solution, it is the positively charged ion that is "functional". Many *surfactants* are cationic, as are many chemicals used as fabric finishes. (Also see *anion*.)

cationic dye - see *basic dye*

caustic - referring to a chemical that will "burn" skin; may be acid or alkali; in dyeing, caustic is also often used as an abbreviation for caustic soda (*sodium hydroxide*)

caustic soda - *sodium hydroxide*

cellulase - an *enzyme* that catalyzes the breakdown of cellulose
Cellulase enzymes are used for de-pilling and *defibrillation* of cotton fabrics. They can also be used to permanently soften cotton fabrics, as an aid in or replacement for stone washing of denim, and in methods for

"peaching" cotton fabrics. These enzymes are usually very difficult for the textile artist to obtain.

cellulose - a *polymer* of a very large numbers of units, each of the general formula $C_6H_{10}O_5$

Cellulose is a structural *polysaccharide* made by plants. Essentially, units very similar to glucose are assembled into huge molecules that form strong fibres. Among cellulose textiles are cotton, linen, ramie, jute and hemp. Rayon is a man-made cellulose fibre (actually regenerated cellulose - natural cellulose is the starting material). Each unit of the cellulose molecule has a number of hydroxyl (–OH) groups. These are the binding sites for *reactive dyes*.

cellulose acetate - cellulose in which most of the hydroxyl (-OH) groups of cellulose have been replaced with acetyl ($-OOCCH_3$) groups

Cellulose acetate is usually dyed with *disperse dyes* at a temperature of around 80°C to 90°C. It is quite easily damaged in alkaline conditions and loses its desirable lustre if boiled. {Rev 3.0.0a}

Celsius scale - a temperature scale which places the freezing point of water at zero degrees, and the boiling point of water 100 degrees; formerly called centigrade

To convert to Fahrenheit: °F = (°C x 9/5) + 32

To convert from Fahrenheit: °C = (°F - 32) x 5/9

chelating agent - see *sequestering agent* {Rev 3.0.0a}

chlorination of wool - treatment of wool with chlorine compounds to alter the surface to make the wool less prone to shrinkage in washing and to improve dye uptake

Chlorination, sometimes alone and sometime with subsequent application of special polymers, alters the surface of wool so that the scales are largely prevented from causing the "ratcheting" action that makes the motion of one strand of wool "one way" with respect to others whose scales point in the opposite direction. By preventing this ratcheting, wool fabric is much less likely to shrink when laundered. Chlorination also improves dye uptake in printing processes, but at the expense of washfastness. Chlorination is typically done using organic chlorine compounds, sometimes the same as those used for chlorination of small swimming pools. {Rev 3.0.0a}

chromophore - a color-bearing compound, typically meaning the part of a larger *organic* molecule that makes it appear colored

Dyes typically have a chromophore chemically bonded to other structures that impart desired characteristics such as *affinity* for the fibre and solubility in water. A particular chromophore structure may be found in a variety of dye classes and in *pigments*. {Rev3.0.0r}

chrome dyes - dyes for wool that use *chromium* compounds as *mordants*

These dyes are part of the broader category of *mordant dyes* for wool. {Rev 3.0.0a}

chromium - the metallic element that forms the basis of a number of compounds often used as *mordants*, or as part of the molecular structure of *pre-metallized dyes*

Potassium dichromate is a common mordant chemical. Chromium compounds are toxic and some are carcinogenic. They must be handled with care and understanding of the risks involved. {Rev 3.0.0r}

Cibacron® F and FN dye - a family of reactive dyes developed and manufactured by Ciba Specialty Chemicals

This family of dyes is less reactive than the MX family, and is intended for application typically between 50°C and 60°C. Industrially, they have some definite merits over the MX family, and there are still new family members being introduced. Unfortunately, they are generally less available to the textile artist, partly due to Ciba's corporate policies.

citric acid - a solid *organic* acid; $HOCCOOH(CH_2COOH)_2$ (or $C_6H_8O_7$); 2-hydroxy-1,2,3-propanetricarboxilic acid

Citric acid is sometimes used in dyeing as an alternative to other chemicals such as acetic acid. It is convenient to store and handle, but may be more expensive. It is a *weak acid* but can produce *pH* in the range of 2 to 3. It can act as a *sequestering agent* for some metals, so it may be inappropriate for some metal-containing dyes such as *pre-metallized* dyes. It is used as a *resist* in some printing processes with reactive dyes on cellulosic fibres, acting by maintaining a pH that prevents the dye from fixing to the fibre. {Rev 3.0.0a }

cloud point - the temperature at and above which a component will *precipitate* from solution

Most water soluble compounds become more soluble as temperature is increased, but some, such as non-ionic *surfactants* become less soluble with rising temperature. The solution will go from clear to cloudy at the cloud point temperature, and the surfactants effectiveness will drop. {Rev 3.0.0r}

Colour Index - a joint publication of the Society of Dyers and Colourists in Britain and the American Association of Textile Chemists and Colorists

The Colour Index contains information on dye structures, classifications, manufacturers and processes. Many "pure" dyes, that is, dyes which are a single color, rather than a mixture, have Colour Index names (for example, the reactive dye Turquoise MX-G is designated in the Colour Index as Reactive Blue 140). This name is normally independent of the manufacturer. The Colour Index is a multi-volume publication, priced at about one thousand US dollars (late 2000). {Rev 3.0.0r}

copper sulfate - $CuSO_4$; also called copper (II) sulfate (read copper two sulfate) or cupric sulfate

A copper compound sometimes used as a *mordant*, especially with natural dyes. Certain direct dyes are made more lightfast by after-dyeing treatment with copper sulfate. {Rev 3.0.0r}

covalent bond - a chemical bond where a pair of electrons is are shared relatively equally between two atoms in the compound

Covalent bonds are formed between the fibres and *reactive dyes*. These are the strongest type of chemical bond, and are responsible for the excellent *washfastness* of reactive dyes. {Rev 3.0.0r}

cream of tartar - see potassium bitartrate

crocking - transfer of color from dyed or pigmented fabric by rubbing

Wet crocking refers to transfer of color from a piece of dyed fabric to another piece of fabric, or to an undyed area of the same fabric, while the fabric is wet. Dry crocking means the same, except that the fabric is dry.

cyan - a greenish blue color

Cyan is "officially" the *subtractive* primary. It is the bluish color that is used in most printing processes, such as computer inkjet printing. The blue color that appears in those little colored squares that are sometimes found near the fold on advertising flyers, or on the bottom or flap of printed packages is cyan, or at least, cyan as approximated by the printing ink used. In the popular *MX reactive dye* family, Turquoise MX-G is a very good cyan.

defibrillation - removal of fibrils from the surface of a fabric

Individual fibres can become partially separated from the yarns that make up a fabric, poking up and degrading the appearance of the fabric. Fibrillation can result from long wet processing, especially if agitation is vigorous. With cellulose fibres, *cellulase* enzymes are now commonly used to remove fibrils from dyed garments.

density - as a measure of physical properties of a substance, the ratio of the mass (weight) of the substance to its volume

Knowing the density of something makes it possible to reasonably approximate a required weight of the substance by measuring volume, which is often more convenient. For example, fine granulated salt may have a density of about 1.25 grams per cubic centimeter.

depth of shade - ratio of weight of dye to weight of goods dyed, usually expressed as percentage; amount of dye *owg*

Depth of shade (DOS), in these terms, is not really a very good way of comparing the darkness or intensity of color of finished fabrics, due to inherent differences in the hues of different dyes within a family, differences between dye families, and differences due to the nature of the fabric. Dye manufacturers' shade cards are typically show one or two depths of shade for a particular dye, often between 1% and 4%, except for black, which is typically 3% to 6%.

desizing - removal of *size* from fabric

Desizing is an important step prior to dyeing fabric, since size can interfere with dye uptake. Some size materials wash out easily. *Starch* is commonly used for size, and can be quite difficult to remove. *Amylase* enzymes are often used industrially for starch removal. Some sizes can be readily removed by hot water washing. {Rev 3.0.0r}

devoré - a technique for "sculpting" fabric using *etchants* or burn-out paste

dextrin - a modified starch

Dextrin is used as a thickener for some textile printing processes, and as a *resist* for some *direct application* dyeing techniques (it generally isn't usable for immersion dyeing because it washes off too easily). It is made by partially breaking down *starch* to smaller molecules using acids and/or heat. There are several different dextrins with different properties. Dextrin may also called British gum, but some workers regard them as distinct.

diluent - a solid or liquid chemical used to dilute another

Sodium sulfate is a common diluent for dry dyes. Since the manufacturing of dyes does not always result in exactly the same strength of dye from batch to batch, manufactures routinely add a diluent to adjust the batch to a standardized strength. Diluents may make up a large portion of dyes designed to yield pale shades. For example, a dye that yields dark red at 2% *o.w.g.* may be diluted to yield a pale pink using 2% o.w.g. of the diluted dye. Diluting dry dyes in the way is done primarily as a convenience to the dyer.

direct application - usually used to mean a method where a dye solution is locally applied to areas of fabric, such as by painting, squirting, spraying, stamping, etc.

direct dye - a dye class based on application method, which is essentially by immersion of the fibre in a solution of dye without the need for other chemicals to bond the dye to the fibre (though other chemicals may aid *exhaustion*)

Direct dyes have high *substantivity*, but bond weakly to fibres, and therefore usually have poor *washfastness*. *Lightfastness* varies from poor to very good. A post-dyeing *fixative* is often used to improve washfastness. Brightness can be limited in direct dyes, because brightness often is associated with small molecules and small molecules tend to make poor direct dyes. "Household" dyes, of the sort that are sold in grocery stores, typically are *union dyes* which contain a direct dye and an acid dye. {Rev 3.0.0r}

discharge - localized removal of dye from fabric

Discharge is used to remove dye from fabric in printing and similar processes. Often another *illuminating dye* is applied to the area that is discharged. Sometimes the new color is included in the discharge paste. Some dyes are quite easy to discharge, others are very difficult to discharge. This can be the case even within a single dye family. (Commercially dyed black fabric is notorious for producing unpredictable results in discharge. This is because most black dyes are mixtures of several colors.) Industrial discharge processes use *reducing agents* such as *thiourea dioxide*, *sodium formaldehyde sulfoxylate, zinc formaldehyde sulfoxylate* or *tin chloride*. Art dyers will often use household *chlorine bleach* for discharge techniques (this author knows of no commercial use of chlorine bleach for discharge). Some discharge techniques decolorize the dye but leave remnants fixed to the fibre, while others break the bond between the dye and the fibre. {Rev 3.0.0r}

disperse dye - a dye that is almost totally insoluble in water

Disperse dyes exist in the dye bath as a suspension or dispersion of microscopic particles, with only a tiny amount in true solution at any time. They are the only dyes that are effective for "normal" *polyester*. Some types are used for nylon and acetate. Polyester is dyed with disperse dyes by boiling with *carrier* chemicals, or by heating the liquor to about 130°C, which requires elevated pressure (like a pressure cooker). Thermosol dyeing, where the fabric is padded with dye liquor then dried and heated to about 200°C for about 90 seconds, is also used for polyester and for coloring the polyester component of poly-cotton blends. Disperse dyes on polyester are generally very *washfast* and resistant to bleaching. Nylon can be dyed at or below 100°C without the use of a carrier, but washfastness is only moderate. Disperse dyes are also used for *sublimation* printing of synthetic fibres, and are the colorant used in crayons and inks sold for making "iron-on" transfers. {Rev3.0.0r}

dope dyeing - coloration of the polymer prior to manufacture of the fibre

This is really a misnomer, since the colorants are almost always *pigments*: “mass pigmentation” is a more accurate term. Some synthetic polymers such as *polypropylene* cannot be dyed after being made into fibres, and coloration by adding pigments to the melted material is the only method available. Pigmenting prior to making fibres can also produce *washfastness* and *lightfastness* that is higher than can be obtained with any dyeing process. {Rev 3.0.0}

DOS - *depth of shade* {Rev 2.0.0a}

dye - in textile terms, a soluble colorant that attaches in molecular form to the fibres, as opposed to a *pigment*, which exists as much large particles that are attached to the fibre with a *binder*

Dyes get classified by the application technique used, and by their chemical structure. A class of dye based on chemical structure may have members in several different application classes. See *acid dye, azoic dye, basic dye, direct dye, disperse dye, reactive dye, sulfur dye, vat dye*. All commercial dyes are *organic* chemicals.

dye activator - one dye seller’s name for an *alkali* intended for use with reactive dyes; believed to be pure *soda ash*

This term is somewhat misleading: in the case of most reactive dyes on cellulosic fibres, it is the fibre, not the dye, that is “activated” (an exception to this is *vinyl sulfone* dyes). {Rev 3.0.0r}

EDTA - ethylenediaminetetraacetic acid (read as ‘ethylene diamine tetra-acetic acid’)

EDTA as the acid form or as various sodium salts, is a powerful s*equestering* or *chelating agent* used primarily where metals such as iron or copper are present in water and may interfere with preparation or dyeing processes. It is sometimes used to sequester hardness ions such as calcium and magnesium. EDTA may not be suitable for use with premetallized dyes, since it may be capable of removing the metal from the dye. {Rev 3.0.0a}

electrolyte - a substance that makes an electrically conductive solution when it is dissolved in water

Electrolytes dissociate to form *ions* in solution. Fibres immersed in water develop a negative electrical charge at their surface. Most dyes are *anionic*, so the fibre tends to repel the dye. The presence of electrolytes in the dye bath helps to overcome this repulsion so that the dye can gain access to the surface of the fibre. The most common electrolyte in dyeing is *sodium chloride* (common salt). *Sodium sulfate* is used sometimes. The acids used with acid dyes also behave as electrolytes. {Rev 3.0.0r}

enzyme - a protein that acts as a catalyst in a biochemical reaction

Enzymes are now extensively used in textile processing. *Amylase* enzymes are used for *desizing*, and *cellulase* enzymes are used for modification of cellulosic fabrics such as de-pilling or permanent softening. Enzymes have recently found application is wash-off of fabric dyed with reactive dyes, to conserve energy and water. Most enzymes used in textile processing are produced by fungi or bacteria grown in culture. None are readily available to textile artists. {Rev 3.0.0r}

enzyme washing - a process used to treat dyed fabric or garments to give it a worn or aged appearance

Cellulase *enzymes* are used, often on finished garments of cotton denim, to make the garment appear like it has been worn and washed repeatedly. Prior to the use of enzymes, similar effects were produced with acids and/or sand or stone washing where the garments were tumbled with pumice stones. {Rev 3.0.0a}

etchant - in textile terms, a chemical that is used to break down fibres so that they can be removed for purposes of patterning; often called “burn-out” solution or paste

A velvet that has rayon pile and silk base fabric may be etched to remove patterns of pile in a technique called devoré. This would require an acid etchant that would attack the rayon, but not the silk. Etchants for cellulose fibres are often based on *sulfuric acid* or *sodium bisulfate*, with a thickener added to improve control in application. Etchants for protein fibres are made from strong bases such as *sodium hydroxide*. All fibre etchants are likely to be quite *caustic*, and should be handled carefully.

exhaust dyeing - generally meaning the use of a dye bath of moderately large *liquor to goods ratio*, in which the fibre is immersed for some time, allowing the dye molecules to leave the bath and attach to the fibres

Exhaust dyeing is the typical process for most commercial fabric dyeing. It depends of dye *substantivity*. See *padding* for a different method. {Rev 3.0.0r}

exhaustion - the leaving of a dye from the dye bath and attachment to the fibre being dyed

The ideal dye would exhaust totally - all the dye in the dye bath would end up on the fibre. Exhaustion is sometimes specified as a percentage. For example, 60% exhaustion would mean that 60% of the total amount of dye has attached to the fibre, and 40% is still in solution. Reactive dyes generally show moderate exhaustion while many acid dyes exhaust to the point that the dye liquor becomes nearly colorless. Dye that has exhausted onto the fibre is not necessarily "permanently" bonded to the fibre. See *affinity*, *substantivity* and *fixation*. {Rev 3.0.0r}

fast acid dyes - acid or premetallized dyes with high *washfastness*

Dyes for wool that are called fast or washfast may come from a variety of dye classes such as *milling*, *reactive* or *premetallized* {Rev 3.0.0a}

FBA - fluorescent brightening agent; see *optical brightener* {Rev 2.0.0a}

ferrous, ferric - see iron; in modern use these are replaced with iron (II) and iron (III) (iron two, iron 3), respectively

fibre reactive dye - see *reactive dye*

fixation - formation of the "final" bond between the dye and fibre

The bond type formed between the fibre and the dye varies with the type of dye and the fibre. As examples, reactive dyes fix by covalent bonding while acid dyes fix by a variety of mechanisms such as ionic bonding and hydrophobic forces. Disperse and vat dyes are fixed in the fibre largely by physical entrapment of insoluble dye within the fibre. The bond that causes final fixation is not necessarily the same type of bond is first made as the dye *exhausts* onto the fibre. {Rev 3.0.0r}

fixative - in dyeing, a chemical that helps improve washfastness of dyed fabric

Some types of dye do not bond strongly to fibres, and will wash out over time. *Direct dyes* are notorious for this. Fixatives applied after dyeing can help, although some will degrade lightfastness or cause shade changes. Some fixative contain a small amount of formaldehyde, which is now regarded as carcinogenic. Much care is warranted in use of these fixatives, and garments should be thoroughly washed before being worn. Many of the newer fixatives do not contain formaldehyde. The mechanisms by which fixatives work vary, but typically form large, relatively insoluble complexes with dye molecules inside the fibre.

Soda ash is sometimes called a fixative for reactive dyes, but it actually creates the high-pH conditions that allow the reactive dye to bond directly to cellulose fibres, and is not a fixative in the accepted sense.

fluorescent brightener or fluorescent brightening agent - see *optical brightener*

food grade - a term applied to chemicals that are of quality suitable for use in food (in the U.S.A., the letters "F.C.C", for Food Chemicals Codex, may appear on the label)

Food grade chemicals are often similar in purity to *technical grade* products, but might be somewhat better, and will have been processed to avoid impurities and contamination that would be detrimental in food. The cost is often just a bit more than technical grade. Packaging, for dry products, is often in bags in the range of 25kg or 50 pounds. Food grade products are suitable for use in dyeing, and may be more readily available from industrial suppliers than technical grade, depending on what local industries use. Also see *grades of chemicals* {Rev 3.0.0a}

formic acid - HCOOH; an organic *weak acid*

Formic acid is commercially often used with acid dyes for wool. It produces a pH lower than that of acetic acid, but higher than that of sulfuric acid. It is a pungent, flammable liquid. Formic acid is not easy for art dyers to procure. {Rev 3.0.0a}

Formosul - a trade name for *sodium formaldehyde sulfoxylate*

fuchsia - a bluish-red color named after a flower named after Herr Fuchs

see *magenta*

gallon, US - in the USA, a gallon is approximately 3.79 litres
A US gallon of water weighs approximately 8.3 pounds.

gallon, imperial - in Britain and Canada, a gallon is approximately 4.55 litres
An imperial gallon of water weighs approximately 10 pounds.

gassing - an industrial *defibrillation* process for yarn, where yarn traveling at high speed passes through a gas flame in order to burn off fibres which poke out
The term gassing is usually reserved for treatment of yarn. *Singeing* is the term usually used for fabric. {Rev 3.0.0r}

Glauber's salt - *sodium sulfate*
In the dye industry, some use "sodium sulfate" to refer to the *anhydrous* form, and "Glauber's salt" only to refer to the decahydrate form ($Na_2SO_4 \bullet 10H_20$). {Rev 3.0.0r}

glass transition temperature - the temperature above which a material changes from a brittle, "glassy" nature to a rubbery nature; on cooling, the material changes back to glassy
Synthetic fibres, such as polyester and nylon show this change of physical character. The rate of dye uptake increases dramatically when the fibre is near or above the glass transition temperature. If the glass transition temperature is above the boiling point of water, as it is with polyester, the dyeing rate is extremely slow even at the *boil*. {Rev 3.0.0a}

grades of chemicals -
Chemicals are graded according to purity and appropriateness for end use. Common grades include "reagent" or "analytical" (very pure, for laboratory work, very expensive, often in small packages), "U.S.P." or "B.P." (United States Pharmacopeia or British Pharmacopeia, usually for use in or as drugs, quite high purity, medium price, small to very large packages), "*food grade*" and "*technical grade*". Dyes for textile use are rarely graded, and are often quite crude and impure, compared with other chemicals. {Rev 3.0.0a}

grain - as a unit of mass (weight), approximately 64.8 milligrams

gray - see *grey* and *greige*

greige - grey-beige; North American equivalent to British *grey*
In North America, greige is often used to describe loom state fabric that is unbleached, contains *size* and lubricants, and may be a bit dirty. Greige goods are made ready for dyeing by *singeing*, *desizing*, *scouring* and usually bleaching.

grey - British term equivalent to North American *greige*

guar - a plant-derived gum
Guar gum is used as a thickener in some printing pastes for acid dyes and in *etching* paste for cellulose fibres. It is reasonably resistant to acids. Guar is unsuitable for use with reactive dyes since it will itself react with the dye. Modified guar gums are also used. {Rev 3.0.0a}

halo - off-shade color fringe effect often seen in *direct application* dyeing when used mixed-color dyes
It is common for different color dyes of the same family to migrate at different rates when solutions are applied to fabric. For example, a purple made by mixing Red MX-8B (usually called fuchsia) and Turquoise MX-G tends to produce strong turquoise halos. If a drop of dye solution is applied to soda ash pre-soaked fabric, the red component quickly stops moving outward, but the turquoise continues to migrate outward much longer, resulting in a too-red centre with a turquoise halo. This can be very difficult to control, other than by selection of the dyes used for mixtures. Because black dyes are almost always mixtures, haloing often occurs with black. {Rev 3.0.0a}

hand - (or handle) the feel of a fabric
Hand of a fabric is quite subjective, and often difficult to describe. Both chemical and mechanical treatments

are frequently used to alter the hand of a fabric. See *softener* and *hand-builder*.

hand-builder - a treatment that makes a fabric feel firmer or stiffer

Hand builders are essentially the opposite of fabric softeners. They may be applied to make a fabric easier to manage in sewing, or to make it feel more robust (as for work clothing). Hand builders may be temporary, such as starch, or permanent, such as polymer resins. Hand builders can interfere with dyeing. Some are impossible to remove.

hardness - with respect to water, a measure of the content of minerals that impart certain properties

Calcium and magnesium ions are main cause of hardness in tap water. They can interfere with some chemical processes in preparation and dyeing. Soap, for example, forms insoluble compounds when it reacts with hardness minerals. Calcium carbonate or calcium hydroxide, formed when *soda ash* or *sodium hydroxide* is added to hard water, are quite insoluble and will *precipitate* from solution. The precipitate can be deposited on fabric, adversely effecting the *hand* of the fabric. *Sequestrant* chemicals can be added to hard water to reduce the effect of the hardness ions. *Sodium hexametaphosphate* is generally the preferred chemical for this purpose for many dyeing processes.{Rev 3.0.0r}

head dye - see *illuminating dye*

humectant - a chemical that helps retain moisture

In some dyeing techniques, such as direct application, it is necessary to prevent the dye solution applied to the fabric from drying out before the dye has time to fix to the fibres. A humectant, often *urea* or occasionally glycerine, may be used for this purpose. Humectants may be unnecessary if it is possible to wrap the fabric in plastic sheeting or put it in a closed plastic container to keep it from drying out. {Rev 3.0.0r}

hydration number - a value indicating how many water molecules are associated with each molecule of some other compound in a crystal of that compound

Many chemicals have one or more water molecules associated with each chemical molecule in the commercially-sold form of that chemical. For example, *sodium carbonate* (soda ash) may be sold as *anhydrous* (containing no water molecules), monohydrate (one water molecule per sodium carbonate molecule, written as $Na_2CO_3 \cdot H_2O$) or decahydrate (ten water molecules per sodium carbonate molecule - $Na_2CO_3 \cdot 10H_2O$). This water is not visibly present as water - it does not cause dampness, though it may change the appearance of the dry chemical. The hydration state must be considered when measuring the chemical by weight. For example, 1 gram of sodium carbonate decahydrate contains about 0.37 grams of sodium carbonate, and 0.63 grams of water. If chemicals are exposed to air for long periods, the hydration may either increase or decrease depending on conditions . See *hygroscopic*. {Rev 3.0.0r}

hydro - (hydros in Britain) dyehouse term for *sodium hydrosulfite* {Rev 2.0.0r}

hydrochloric acid - a strong inorganic acid; solution of HCl in water, typically about 37%; often called muriatic acid

Hydrochloric acid is not much used in dyeing, but is used in some processes to strip certain finishes from fabric. It can cause skin burns, and the fumes are very noxious. Handle and store it with great care. It is a *strong acid*.

hydrogen bond - a chemical bond in which hydrogen that is already covalently bonded to one atom is electrically attracted to a lone pair of electrons on another atom

Some atoms such as oxygen are said to be very electronegative, which means that they strongly draw bonding electrons toward themselves. If hydrogen is bonded to such an atom, the hydrogen “appears” to have some positive charge. Lone pairs (that is, not involved in bonding to other atoms) of electronegative atoms tend to attract hydrogen from other molecules, but a new compound is not formed. Hydrogen bonds are weak to moderate in strength, but there can be very large numbers of hydrogen bonds between molecules of compounds like *cellulose*. It is hydrogen bonds between cellulose molecules that keep the molecules together as fibres (and it is because they are easily broken and re-formed that cotton wrinkles). Hydrogen bonds play a role in dyeing with direct dyes, and may be present as “temporary” bonds with other dye types. {Rev 3.0.0a}

hydrogen peroxide - H_20_2, normally as a solution in water

Hydrogen peroxide is extensively used in commercial bleaching of textiles, especially cellulose fibres and wool. It is effective and non-polluting. The hydrogen peroxide sold in drug and grocery stores is about a 3% solution. Industrial strength hydrogen peroxide may be 35%, 50% or 70%. At these strengths it is quite dangerous to handle, and spills can cause fires. Hydrogen peroxide can behave as either an *oxidizing agent* or a *reducing agent*. It is sometimes used as an *antichlor*. *Sodium percarbonate* and *potassium monopersulfate* are dry chemicals derived from hydrogen peroxide. {Rev 2.0.0r}

hydrolysis - in general, the decomposition of a chemical by reaction with water

Some chemicals, such as *MX* dyes, are effectively destroyed by hydrolysis. Others, such as soda ash, are made useful because of hydrolysis. Hydrolysis will occur when susceptible compounds are in aqueous solution, but can also occur because of water absorbed from moist air, without the compound ever appearing wet or damp. This is why many dry chemicals must be kept in sealed containers. See *hygroscopic*. {Rev 3.0.0r}

hygroscopic - having a tendency to absorb water (usually meaning absorbing it from air)

Some of the commonly used chemicals in dyeing are hygroscopic. If they are left exposed to moist air, they will absorb water from the air. This may lead to caking, and increases the ratio of weight to volume of the chemical. For many chemicals, there are no visual signs that water has been absorbed. For others (such as copper sulfate), the color will change. Some, such as *sodium hydroxide* are deliquescent - they will absorb so much water from air that a liquid solution will form. Hygroscopic chemicals should be stored in tightly sealed, moisture proof containers. {Rev 3.0.0r}

hypo - British textile industry term for hypochlorite bleach (see *bleach, chlorine*)

Don't confuse this use of "hypo" with the use in photographic processing where it means something very different - sodium hyposulfate (more commonly called sodium thiosulfate). {Rev 2.0.0a}

hypochlorous acid - produced by *hydrolysis* of *sodium hypochlorite* under *pH* neutral to slightly acid conditions.

Hypochlorous acid, though effective at bleaching, is also believed to be very damaging to cellulose. For this reason, chlorine bleach baths are maintained at pH between about 9 and 11. {Rev 2.0.0r}

illuminating dye - dye mixed with discharge paste in printing techniques; also called head dye

In some *discharge* printing techniques, dye is mixed with the discharge paste, so that the discharged area is given a new color. Illuminating dyes must be selected carefully, since they must resist the effects of the discharge chemicals. {Rev 3.0.0a}

indigo - a natural or synthetic *vat dye*; designated Colour Index Vat Blue 1

Indigo is probably one of the oldest colorants used for textiles. Originally it was extracted from plants, but now it is usually synthetic. It is of low *substantivity*, so multiple 'dips' are required to produce strong shades. Unlike other vat dyes, it exhibits quite poor *washfastness*. Natural and synthetic indigo are chemically the same. {Rev 3.0.0a}

ion - an electrically charged particle resulting from adding or removing electrons to an atom or a group of bonded atoms

Many chemicals ionize in solutions in water. For example sodium chloride in solution ionizes to positively charged sodium ions (Na^+) and negatively charged chlorine ions (Cl^-) - one electron that was shared between the sodium and the chlorine in the molecular form of salt leaves the chlorine and goes with the sodium (sodium chloride is actually an ionic solid). Some chemicals used in dyeing, such as *acetic acid* and *sodium carbonate*, partially ionize in solution, with some remaining in intact molecular form. With chemicals of this nature, if some of the ions in solution are used up in reactions, more of the molecules will ionize. {Rev 3.0.0r}

ionic bond - a chemical bond as a result of electrical attraction between positive and negative ions; also called salt linkage

In ionic bonding, typically an electron is transferred from one atom to another, leaving one with a positive charge and one with a negative charge. These electrical charges produce strong attraction between the differently

charged ions. Ionic bonds are quite strong, but not generally as strong as covalent bonds (where pairs of electrons are shared equally) between nuclei. Such bonds are important with acid dyes and basic (cationic) dyes.

iron sulfate (iron (II) sulfate, read iron two sulfate), ferrous sulfate, $FeSO_4$ (archaic terms include copperas, green vitriol and iron vitriol)

Iron (II) sulfate is a common *mordant* for natural dyes. Solutions are not very stable, since reaction with air will cause precipitation of insoluble iron oxide. Fabric can be colored by dipping into a solution of iron sulfate, then hanging in a moist environment to allow conversion to iron oxide (rust). Post-treatments such as *tannic acid* can be used to alter the color. {Rev 3.0.0a}

kilogram - a unit of mass (weight) in the metric system; approximately equal to 2.2 pounds avoirdupois

One litre of water weighs one kilogram, which makes calculations such as percentage of a chemical *owb*, or *liquor ratio*, etc. easy.

leuco - refers to vat dyes in the reduced form; in general a prefix meaning white

Vat dyes are converted from the insoluble pigment form to the soluble leuco dye form by means of a *reducing agent* and an alkali, often *sodium hydrosulfite* and *sodium hydroxide*. *Sulfur dyes* are also converted to leuco form for application. Once on the fibre, the leuco form is converted back to the insoluble pigment by *oxidation*. In spite of the formal definition of leuco as a prefix, dyes are often still colored in the leuco form (for example, leuco indigo is yellow-green). {Rev 3.0.0a}

level - uniform in shade over the surface of a piece of dyed fabric or along the length of dyed yarn

Level dyeing is usually the objective in commercial processes. Some dyes, such as leveling acid dyes, are easy to accomplish level results with. They do not bind tightly to the fabric in the dye bath, and dye can leave the fibre and re-enter the dye bath. Other dyes, such as reactive dyes, don't level as easily, and greater care is required to achieve level results. In general, level dyeing is promoted by good agitation, careful control of the rate of rise of the temperature of the dye bath, control of pH, and sometimes by use of special leveling agents or *retarders*. It is often the case that the dyes that level most easily are the least *washfast*. {Rev 3.0.0r}

leveling acid dye - a class of acid dyes

Leveling acid dyes typically offer bright colors and *level* easily. Unfortunately, the same property that makes it easy to get level results causes *washfastness* that is not as good as that of many other acid dye classes. Leveling acid dyes are often used for wool. {Rev 3.0.0r}

leveling agent - a dyebath additive to promote level dyeing; see *retarder* {Rev 3.0.0a}

lightfastness - a measure of how resistant a coloring material, such as dye, is to fading due to exposure to light

There are a number of textile industry standard methods for evaluating how lightfast dyed fabric is. Differences in the lightfastness of individual dyes mixed to make a specific color can result in a color shift over time as the dyes of lesser fastness fade while others fade much less. Lightfastness mostly depends on the molecular structure of the dye itself, but can be influenced by the fibre or contaminants. {Rev 3.0.0r}

lignin - a mixture of natural aromatic organic compounds found in woody and grassy plant material

Lignin occurs in *bast* fibres such as linen. Lignins are normally removed from fabric to be dyed, since they may dye easily but with poor fastness. Lignins extracted from wood pulp used to make paper are used to make some types of *surfactants*. {Rev 3.0.0a}

liquor - a solution of dye and/or other chemicals

liquor ratio (or **liquor to goods ratio**) - the ratio of the weight of the dyebath or other processing bath to the weight of the goods being dyed or processed

For immersion dyeing in art dyeing processes, a common liquor to goods ratio is 20:1. That is, for each kilogram of fibre to be dyed, 20 kilograms of dyebath are used. In the metric system, this is easy to calculate, since one litre of water weighs one kilogram. High liquor ratios are generally avoided, since they often cause poor *exhaustion* of the dye, though this is not true for all dye types. Modern commercial dyeing equipment often works

with low liquor ratios. Very low ratios may be used for methods where essentially all of the dye solution is to be absorbed by the fibre, such as *padding*. {Rev 3.0.0r}

litre - (typically spelled 'liter' in the U.S.A.) - a metric volume equal to 1 cubic decimetre (1000 cubic centimetres)
One litre is approximately 1.06 US liquid quarts, or 0.88 imperial quarts. One litre of water weighs, for practical purposes, 1 kilogram. {Rev 3.0.0r}

loom state - fabric as it comes from the loom, usually unbleached, containing *size*, and maybe a bit dirty
Loom state is essentially synonymous with *greige* or *grey*. Sometime it may imply that the fabric has not been inspected for flaws. {Rev 3.0.0a}

low water immersion - a dyeing technique where the *liquor ratio* is very low, with the intent of producing non-uniform mottled appearance
LWI is popular for fabrics for quilting. Typically, a piece of fabric is stuffed fairly snugly into a container, and enough dye solution to barely wet the fabric is poured in. The container and contents are set aside to *batch* for some time. Sometimes multiple colors are used. This is an art dyeing technique that is not used commercially.

lubricant - a material used to reduce friction between surfaces
Lubricants are often applied to yarns that are used for knitted fabrics such as jersey. They help protect the yarn from damage and the machinery from wear. Lubricants can interfere with dye uptake and must be removed by thorough *scouring*.

Ludigol® - BASF tradename for *sodium m-nitrobenzenesulfonic acid* {Rev 3.0.0r}

LWI - *low water immersion*

lye - *sodium hydroxide* (rarely, potassium hydroxide)

lyocell - a regenerated cellulose fibre made from wood pulp
Lyocell is produced with a process that is environmentally friendly in that the chemicals used are nearly completely recoverable and reusable in the process. It is stronger, both wet and dry, than other regenerated cellulose fibres such as viscose rayon, and is also stronger than cotton. In general, lyocell can be dyed much like any other cellulosic fibre. *TENCEL*® is one brand-name lyocell fibre. {Rev 3.0.0r}

***m*-nitrobenzene sulfonic acid, sodium salt** - see sodium *m*-nitrobenzene sulfonate

magenta - a bluish-red color
Magenta is the "official" *subtractive* reddish color. (Comments paralleling those for *cyan* apply.) In the *MX* reactive dye family, Red MX-8B and Red MX-5B are good magentas. Many dye sellers in the textile arts market call this "fuchsia".

Manofast - a trade name for *thiourea dioxide* {Rev 3.0.0a}

Mercerization - treatment of cotton yarn or fabric with a strong solution of *sodium hydroxide*; named after its inventor, John Mercer
Mercerizing cotton can significantly improve its dye uptake, especially if there are immature fibres present. If yarn or fabric is held under tension during the process, a sheen will be imparted. "Slack" mercerizing, which does not require tension, but causes the fabric to shrink, can be done at home, but requires a great deal of care because of the caustic used. Typically it is done using about 20% to 25% sodium hydroxide solution at around 20°C. Fabric becomes very stiff and hard to handle until the solution is all washed out. {Rev 2.0.0r}

metal complex dye (or metallized dye) - dye in which typically one or two dye molecules form a close permanent association or "complex" with a metal atom
The metal associated with the dye is held by what is more or less electrical charge attraction of more than one part of the dye molecule for the electrons of the metal atom. The metal is often copper, chromium or cobalt. Metal

complex dyes are found in many application classes such as direct, reactive and acid. See premetallized dye. {Rev 3.0.0a}

metric system (of measurement) - in general terms, a system that is internationally consistent, and is based on units that are related to others by powers of ten (for example, a millilitre is 1/1000 of a litre)

The international consistency of this system and the general ease of calculations makes it vastly superior to systems with pounds and quarts and feet, etc., which define different quantities in different countries. Also see *SI.*

milling dye - a class of *acid dye*

There is no clear distinction between milling acid dyes and *supermilling* acid dyes. They come in a range of colors, including some bright shades and a large choice of "pure" (as opposed to mixtures) colors. *Washfastness* is generally quite good. *Lightfastness* varies from poor to very good. *Retarders* are usually used to help achieve *level* results. Application temperature is typically at or near the boil. These dyes are used on wool and *polyamide* (nylon). The term "milling" is said to refer to a process of making wool felt; milling dyes don't wash out badly in the process. {Rev 2.0.0r}

mole - essentially, an amount of a chemical equal to its molecular mass, but measured in grams, rather than atomic mass units; (more formally, amount of a substance containing approximately 6.02×10^{23} molecules or formula units)

For example, sodium chloride has an *molecular weight* of approximately 28. Twenty eight grams of sodium chloride would be one mole. If this was dissolved enough water to make one litre of solution, the solution would be said to be 1 molar sodium chloride.

molecular weight - the weight of a molecule; the sum of all atomic weights of all the atoms in the molecule; expressed in atomic mass units (defined as exactly one twelfth the mass of a carbon-12 atom); this term is obsolete an should be replaced with molecular mass or relative molecular mass (r.m.m.)

Water, for example, has a molecular weight of about 16 (for the oxygen) plus 2 (for the two hydrogens), or 18. The molecular weight of cellulose is in the millions. The concepts of molecular weight and *moles* are useful in understanding, among other things, *pH* and variations in effectiveness of different *hydration states* of a compound.

Monagum - a trade name for *carboxymethyl starch*, a starch ether {Rev 3.0.0a}

mordant - a chemical that aids attachment of a dyestuff to fibres by bonding to both the fibre and the dye

A mordant must have high *affinity* for both the dye and the fibre, acting to attach the dyestuff to the fibre. Mordants are necessary for dyes that have very low or no natural affinity for the fibre. They are often salts of metals such as chromium, copper, tin or iron. Mordants may be applied before, with or after the dye, depending on the nature of the dye, the fibre and the mordant. Some mordants, especially chromium compounds, are very serious health hazards. {Rev 2.0.0r}

mordant dye - a dyestuff that requires the use of a *mordant*

There are very few synthetic dyestuffs currently in use that require a separate mordant, except for some dyes for wool, where mordant dyes are still quite popular. Since *chromium* is almost exclusively used as the mordant on wool, *chrome dye* has become essentially synonymous with mordant dye. Many natural dyes (plant extracts, etc.) require a mordant. The mordant used can significantly influence the hue produced with a particular dyestuff. {Rev 3.0.0r}

MSDS - Material Safety Data Sheet

This is a reasonably detailed specification for the possible safety hazards associated with a product. They are prepared by the manufacturer of the product. Unfortunately, they are often not available for products that are regarded as "consumer" products, even if the product poses serious safety hazards.
For an excellent Internet resource for MSDS and other safety information, try www.siri.org/msds or www.hazard.com/msds {Rev 3.0.0r}

muriatic acid - an antiquated but much-used term for *hydrochloric acid*

Most muriatic acid sold in hardware stores is as strong as commercial hydrochloric acid sold for laboratory purposes. Sometimes it is somewhat diluted, but still is dangerous and must be handled with great care.

MX dye - a family of "cold" *reactive dyes*, first developed by Imperial Chemical Industries of Britain, and designated "Procion MX"; chemically MX dyes belong to the dichlorotriazene family

A number of companies now manufacture MX dyes. They are by far the most popular dyes for textile artists working with cellulose fibres. They can also be used for wool and nylon in processes where they behave as acid dyes. There are around a dozen "pure" MX dyes in common use, and all can be used quite successful in mixtures with each other. There are magenta, yellow and cyan shades that are excellent "subtractive primary" colors. MX dyes are less popular with industrial dyers than some other reactive dyes, partly because their very high reactivity makes the dye process harder to control, partly because they are fairly expensive, and partly because goods require extensive washing after dyeing to remove hydrolyzed and unfixed dye. Care should be taken to avoid breathing MX dye dust, since it is known to cause respiratory allergies. The use of "Procion" alone to denote MX dyes is incorrect since there are other *Procion* dye families. {Rev 3.0.0r}

non-ionic - descriptive of a chemical that does not ionize in solution, but remains in intact molecular form

Some *surfactants* are non-ionic. {Rev 3.0.0}

nylon - a *polyamide* used for fibres and solid plastic

There are several different types of nylon, each having different properties. Two common ones, based on molecular structure are nylon 6 and nylon 6,6 (nylon six six). Nylon is the oldest synthetic polymer used for textiles. It is usually dyed with *acid dyes*, but can be dyed with *disperse dyes*, particularly if *barré* is a problem. For acid dyeing, nylon can be formulated specifically to take up only a little dye, "normal" amounts of dye, or large amounts of dye. {Rev 3.0.0r}

omb, omf, omg - see *owf, owb, owb,* respectively; the 'm' stands for 'mass', which is preferred to 'weight' in modern scientific language {Rev 3.0.0a}

optical brightener - a fluorescent dye used to make white textiles appear brighter; often called just "optical" in dye industry; also called fluorescent brighteners or fluorescent brightening agents (FBA)

Optical brighteners are colorless dyes that work by emitting visible light, typically in bluish hue, when exposed to invisible *ultraviolet* light. This bluish tint helps mask the residual yellowish cast of bleached cellulosic fibres and wool, making the fabric appear a more neutral white. Most fully-bleached commercial white fabrics have been treated with these brighteners. Fabrics and garments that are truly *prepared for dyeing* should not contain brighteners. Optical brighteners can interfere with some dyes by competing for the "dye sites" on the fibres. It is almost impossible to remove brighteners once they are applied. Most commercial laundry detergents contain optical brighteners, which is primarily the reason that they are not the best choice for scouring fabric prior to dyeing. When detergent containing optical brighteners is used to wash brightener-free fabric that has been dyed to pale shades, noticeable shade change may occur. {Rev 3.0.0r}

organic - In this glossary, this term carries the chemist's meaning: a chemical that is derived from carbon and hydrogen. It does not imply that the chemical had a biological origin, or that it is not dangerous.

ounce (fluid) - volume equal to approximately 29.57 millilitres in the US, or 28.41 millilitres in Canada and Britain

ounce (weight, avoirdupois) - approximately 28.35 grams

owb (or o.w.b.) - on weight of bath; usually expressed as percentage; omb is on mass of bath - preferred modern usage

The amount of some constituent of a dyebath or other process bath based on the weight of the bath. For example, something specified as 6% owb would require 0.06 pounds of that item per pound of bath. Since the bath is invariably mostly water, which weighs 1 kilogram per litre, calculations in the metric system are much easier.

owf (or o.w.f.) - on weight of fibre, usually expressed as percentage; omf is on mass of fibre - preferred modern usage

Often this is synonymous with *owg* but distinction may be appropriate when considering a particular fibre in a blend. (Rev 3.0.0r)

owg (or o.w.g) - on weight of goods; usually specified as percentage; omg is on mass of goods - preferred modern usage

The amount of dye or auxiliary chemicals used is often based on ratio to the weight of the goods to be dyed. For example, if a formula calls for 3% dye owg, and 400 grams of fabric are to be dyed, the required amount of dye would be 3% of 400 grams, or 12 grams. *Owf* may be more accurate when blended fibres are considered.

OxiClean ® -

OxiClean is a proprietary product, so full details are unknown to this author. The label reveals that it contains *sodium percarbonate* and *sodium carbonate*. It probably also contains special activators that make the percarbonate more effective at low temperature. {Rev 3.0.0r}

oxidizing agent - a chemist's term for any chemical that causes loss of electrons from another chemical with which it reacts; the oxidizing agent is itself reduced (see *reducing agent*) in the process

Oxygen is the oxidizing agent whence the name comes. Chlorine is another strong oxidizing agent. As an example, when sodium reacts with chlorine, sodium chloride (common salt) is formed. Sodium loses an electron in the process (going from Na to Na^+), and chlorine gains an electron (going from Cl to Cl^-). Strong oxidizing agents must be handled with care, since contact with substances that burn may cause fire.

padding - a dyeing method with very low *liquor to goods ratio*, where typically only enough strong dye solution is used to saturate the fabric

Padding can have the advantage of high dye yield. Padded goods are usually "batched" - wrapped in plastic and left for some period of time for the dye to attach to the fibre, or steamed to fix the dye quickly. Padding methods are sometimes used for other textile processes such as bleaching.

Pantone® - a company and its trademark

The Pantone company produces a wide range of color guides useful in almost any industry dealing with color. The colors in the guide are widely accepted as standards. Colors are sometime seen described as a Pantone number: Pantone applies a unique number to each color.

paraffin - a wax extracted from crude (petroleum) oil (North American usage; in Britain, paraffin means kerosene)

Paraffin wax (actually a number of waxes with somewhat different characteristics) is used, by itself or in mixtures with other waxes such as beeswax, as a dye *resist* in batik. It quite brittle and cracks easily. "Canning wax", sold in North America (and elsewhere, presumably) for sealing home-made jam and jelly and the like, is paraffin. Most candle wax, other than beeswax, is paraffin.

peroxide - with reference to textile processes, usually used to mean *hydrogen peroxide*, though there are many organic and inorganic peroxides

p.f.d. (or pfd) - *prepared for dyeing*

p.f.p. (or pfp) - *prepared for printing*

pH - a measure of the concentration of hydronium (H_3O^+, H^+ attached to a molecule or water) in a solution; $pH = -\log[H_30^+]$ (that is, the negative base-10 logarithm of the concentration of hydronium)

Acids have pHs less than 7; bases have pHs greater than 7. A pH of 7 is neutral. The normal pH range is 0 to 14. Note that although the pH scale is logarithmic, it does not mean that 10 times as much of a base/acid in solution will increase/decrease the pH by 1 unit. This is true for *strong acids* and *strong bases*, but is not true for *weak acids* and *weak bases*. {Rev 3.0.0r}

pH Down - as a spa or swimming pool additive, a chemical to reduce pH

pH Down is almost always *sodium bisulfate,* which is typically in the form of tiny spherical beads

pH Up - as a spa or swimming pool additive, a chemical to increase pH

pH Up is usually "pure" *sodium carbonate* (soda ash). Because it can often be purchased at grocery or hardware stores, usually reasonably cheaply, it may a good alternative to buying soda ash from a dye vendor. Sometimes *sodium bicarbonate* is sold for increasing pool pH. It is not equivalent to soda ash. {Rev 2.0.0r}

pigment - a colored substance that is insoluble in water, usually in the form of a fine powder

Pigments are used to color many types of paint, including some textile paints, and almost all "inks" used for screen printing ("silkscreen" printing). Pigments need some sort of *binder* to hold them onto fabric. Azoic dyes and vat dyes actually form pigment inside fibres. These pigments are physically trapped inside the fibre, so no binder is necessary. Inorganic pigments are often oxides of metals, such as iron oxide or titanium dioxide. Many organic pigments are chemically similar to parts of dye molecules, but lack the necessary features to make them soluble and to bond, unaided, to the fibre. {Rev 3.0.0r}

pigment dyeing - coloring fabric with *pigments* mixed with a *binder*; this term is considered to be improper, since 'dyeing' is generally restricted to application of colorants that are soluble, and pigments are insoluble

Some pigment application processes are much like dipping the fabric in a dilute paint. Newer processes involve pretreating the fabric with *substantivity*-producing agents that actually make the process more like true dyeing, where the pigment preferentially leaves the bath and attaches to the treated fabric. So-called pigment dyed fabrics often have, by design, poor washfastness, to produce an aged appearance. Commercially, pigment dyeing is generally used more for finished garments than for fabrics. {Rev 3.0.0r}

plastisol - with reference to textile arts, a type of screen printing ('silkscreen') ink which consists of a colored *pigment*, fine particles of *polyvinyl chloride*, and a plasticizer

Plastisol ink does not dry. It must be heated to the point where the PVC particles melt and mix with the plasticizer and pigment to form a flexible colored plastic film. Plastisol ink stays on fabric simply because is surrounds and encapsulates the fibres mechanically. This is by far the most popular type of ink for commercial screen printing of t-shirts and the like.

pOH - a measure of the concentration of hydroxide ions (OH^-) in solution

$pOH = -\log[OH^-] = (14 - pH)$; see *pH*

polyamide - a synthetic *polymer* family used for fibres and solid plastics; protein fibres are also technically polyamides, but the term is almost always used only for synthetic materials

Nylon is a polyamide, and the oldest of the commercial synthetic polymers. Polyamide can be dyed with *acid dyes* or *disperse dyes*. Some *MX* dyes will also work well for nylon if applied as if they were acid dyes (at acid pH and high temperature). {Rev 2.0.0r}

polyester - a somewhat generic term used for a variety of synthetic *polymers* used both for solid plastics and for fibres; polyethylene terephthalate is probably the most common

Polyester is are harder to dye than many other fibre polymers. It is dyed almost exclusively with *disperse dyes*. Because of its *high glass transition temperature*, dyeing is usually done at high temperature (around 130°C) in a pressure vessel. *Carriers* can be used for dyeing at the boil. Washfastness of polyester is very high because it is almost impenetrable to water even at the boil. Some polyester is formulated to allow dyeing with *basic dyes*. Polyester containers (often labeled PET or PETE), very popular for beverages, can be used for dye solutions, at least for short term storage. Polyester is attacked by strong alkalis. A few stitches of brightly-colored polyester thread can be handy for 'labeling' items being dyed in almost any process other than disperse dyeing, because they will retain their original color. {Rev 3.0.0r}

polyethylene - a synthetic "olefin" *polymer* (plastic)

Polyethylene, particularly high-density polyethylene (HDPE), is a good choice for containers for many dyeing processes. It has good chemical resistance, but generally should not be subjected to boiling water (see *polypropylene* for an alternative). A great deal of the commercial packaging for household chemicals and food products is made from polyethylene. Some fabric *sizing* compounds and softening compounds are polyethylene derivatives.

polymer - a chemical in which molecules are made up of a large number of smaller repeating units

Some examples include natural polymers such *starches* and *cellulose*, which are made up of glucose-like units and synthetic polymers, such as *polyethylene* made up of ethylene (a gas) units. Chemical formulas are often expressed as $(monomer)_n$, where monomer is the repeating unit and the subscript n is the number of repetitions of the monomer. A starch might be written as $(C_6H_{10}O_5)_{2000}$, meaning that it is made up of 2000 joined $C_6H_{10}O_5$ units. N is rarely an exact number. {Rev 3.0.0r}

polypropylene - a synthetic "olefin" polymer (plastic)

Polypropylene containers are a good choice for many dyeing processes. Polypropylene has excellent resistance to most chemicals used in dyeing, with the possible exception of some disperse dye *carriers*. It can be used at the boiling point of water, though it can't be used on a stove top. A great many household plastic containers are made from this polymer. Polypropylene is also used for fibres, mostly for carpets, but finds some use in garments. It cannot conventionally dyed so it is colored by "*dope dyeing*" (pigments are added to the raw material). {Rev 3.0.0r}

polysaccharide - bio-*polymers* made up of ten or more simple sugar (like glucose) units

Starches and cellulose are polysaccharides. (Below 10 sugar units, a specific numerical prefix is usually used, such as in "disaccharide".) {Rev 3.0.0r}

polystyrene - a synthetic polymer (plastic)

Polystyrene is extensively used for disposable food service and packaging items. Solid polystyrene is used for disposable cutlery, glasses and portion cups. Foamed polystyrene is used for plates, packaging trays, coffee cups and the like. Polystyrene has poor resistance to many organic chemicals. Do not use it for storage of dry dyes. Polystyrene items are very convenient for short-term handling dye powders when weighing or mixing dyes. {Rev 3.0.0r}

polyvinyl chloride - a synthetic polymer (plastic)

Polyvinyl chloride (PVC) is a very widely used plastic that varies from rigid to very flexible, depending upon additives. It has quite good resistance to most dyeing chemicals, with the exception of carriers for disperse dyes. PVC pipe, intended for plumbing use, is popular for 'forms' around which to wrap fabric for direct dye application techniques such as shibori. Temperature resistance depends on additives and varies considerably. PVC is used extensively as water-proofing coatings on fabrics and for imitation leather. {Rev 3.0.0r}

potassium bitartrate - cream of tartar, potassium acid tartrate, potassium hydrogen tartrate, $KHC_4H_4O_6$

Potassium bitartrate is often used with other chemicals as mordant for natural dyes.

potassium dichromate - also called potassium bichromate; $K_2Cr_2O_7$

Potassium dichromate is the most commonly used chromium ('chrome') *mordant* in wool dyeing, both with synthetic and natural dyes. In terms of health risks of repeated exposure, IT IS ONE OF THE MOST HAZARDOUS CHEMICALS USED BY TEXTILE ART DYERS. It is corrosive to tissues and can cause ulceration. It is known to be a human carcinogen. It poses serious disposal problems. DO NOT USE THIS CHEMICAL UNLESS YOU HAVE CONSULTED AND UNDERSTOOD A MATERIAL SAFETY DATA SHEET (*MSDS*) FOR IT, AND HAVE THE NECESSARY SAFETY EQUIPMENT. {Rev 2.0.0a}

potassium monopersulfate - a "peroxygen" compound

Potassium monopersulfate can be used as an alternative to *hydrogen peroxide* for bleaching. It is quite expensive, but a reasonably stable and safe-to-handle dry chemical. Some "non-chlorine shock" chemicals for swimming pools are based on this compound.

potassium permanganate - $KMnO_4$

Potassium permanganate is a powerful *oxidizing agent* which has been used in garment washing *indigo*-dyed denim to produce a worn, faded appearance. It has also found some use in discharge printing of indigo. It is no longer favored by industry because of environmental concerns. It is quite hazardous, and can be caustic to skin. Care must be used when mixing it with organic materials because it can cause spontaneous combustion. Consult an *MSDS* if you contemplate using it. {Rev 3.0.0a}

pint - a volume measure equal to half a quart; in the US, 1 pint is equal to 16 fluid ounces, in Canada and Britain, 1 pint equals 20 fluid ounces

pound - weight equal to 0.455 kilograms

precipitate - in chemistry, a solid formed by a reaction in a solution or as a result of physical changes, such a temperature, of the solution

A precipitate has low solubility in the solution from which it was formed, giving a cloudy appearance, or actually settling out of solution. (Rev 3.0.0r)

pre-metallized dye - a dye that is a complex of dye molecules with a metal atom; *metal complex dye*

The term "pre-metallized" is used primarily to refer to classes of *acid dyes*, although sometimes considered as apart from acid dyes. The metal is part of the dye structure as it comes from the manufacturer. There are 1:1 metallized dyes, having one dye molecule per metal atom, and 2:1 types, with two dye molecules per metal atom (use is inconsistent here 2:1 and 1:2 mean the same thing). The metal in the complex helps the dye attach to the fibre, typically wool or polyamide. These dyes have excellent *washfastness,* but *leveling* may be difficult. There is a wide range of "pure" colors (as opposed to mixtures) available, though the brightness is the lowest of the acid dye subgroups. Application temperature is typically at or near the boil. 1:1 types are usually applied at very low pH, often with formic or sulfuric acid in quite large quantities, while 2:1, sometimes called "neutral dyeing", are often applied using *acid donor* chemicals, so the bath is nearly neutral at the start an becomes more acid with continued boiling. {Rev 3.0.0r}

prepared for dyeing - a fabric or garment that is specially made to be dyed; sometimes "preferred for dyeing"; usually abbreviated pfd or p.f.d.

PFD fabrics have been *desized*, *scoured*, and fully bleached, but have been processed without *optical brighteners* or softeners which can interfere with dye uptake. Often called 'prepared for garment dyeing' or PFGD, such fabrics are usually only carried by specialty suppliers. Most fabric is prepared for dyeing at the same facility that does dyeing. Any fabric can be prepared for dyeing and sold as such, but types other than cotton are extremely rare, and often available only by special order of large quantities. PFD cotton garments are made with PFD fabrics and sewn with cotton thread, so that the thread will dye similarly to the fabric. Sometimes they are made oversize to allow for shrinkage in dyeing processes. A few large manufactures of t-shirts offer PFD shirts. Other PFD garments are quite rare, though Dharma Trading in California has quite a good range. It may be advisable to wash PFD products before dyeing, mostly as a hedge against contaminants picked up in handling or to remove thread lubrication oils that might have been used in garment construction. {Rev 3.0.0r}

prepared for printing - a fabric that has been processed to be ready for printing, usually meaning printing with dye

PFP cotton will be very similar to PFD cotton, but is almost always *mercerized* to improve the color uptake. Wool fabrics are usually chlorinated in preparation for printing. {Rev 3.0.0a}

Procion® - a trade name, originally belonging to Imperial Chemical Industries of Britain, now to Dystar of Germany, and used for their lines of *reactive dyes*, including the very popular *MX* family.

Although it is often seen in art and hobby dyeing publications, the term 'Procion dye' is incorrect because it omits the name of the specific family such as MX (usually what is meant) or H or H-E. Dystar apparently no longer manufactures Procion MX, but others, not entitled to use the Procion name, do manufacture "MX" type dyes. {Rev 3.0.0}

protein - biological *polymers* made up of amino acids

All hair-based fibres (wool, mohair, etc.) are protein based. Silk is also a protein fibre. *Acid dyes* are the most common type used for protein fibres. *Reactive dyes* are used in some cases. *Basic dyes* can be used, but generally produce very poor fastness on protein fibres. {Rev 3.0.0r}

PVC - *polyvinyl chloride*

quart - a measure of volume; in the US a liquid quart is 32 fluid ounces or approximately 946 millilitres; in Canada and Britain, a quart is 40 fluid ounces, or approximately 1137 millilitres

reaction rate - a measure of how fast a chemical reaction occurs

Many factors affect reaction rates. One very big factor is temperature. Although the range is large, many reaction rates approximately double for each 10°C temperature rise. For example, a reaction may be 4 times as fast at 50°C as it is at 30°C. This is the reason that many dye processes are done at high temperature.

reactive dye - a dye which attaches to the fibre by forming a *covalent* bond; also called fibre reactive dye

Reactive dyes are known for their bright colors and very good to excellent lightfastness and washfastness, though poor resistance to chlorine bleach. There are several broad classes of reactive dyes. Most are intended for *cellulose* fibres, but some are intended specifically for wool. The most popular reactive dye family for textile artists is the *Procion® MX* family. Other reactive dye families reasonably available to art dyers include Procion® H, Procion® H-E, *Remazol®*, and *Cibacron®* F (equivalents to the MX, H, H-E and some of the Remazol® lines are available from many dye manufacturers; note that Procion®, Remazol® and Cibacron® are trade names of specific companies). Reactive dyes may be more expensive than other dye families suitable for the same fibres, especially when very dark or dull colors are considered. They are the newest class of textile dyes, first introduced commercially, for cellulosic fibres, in 1956 , one hundred years after the development of the first synthetic dye. Within a family, the range of colors available as "pure" dyes (as opposed to mixtures) is typically quite small - a dozen or fewer. Against this, reactive dyes of the same family can generally be mixed to produce a very wide range of colors, while retaining good application characteristics and brightness. The reactivity among families varies widely, so some are easily applied at room temperature, some at boiling temperature and others at intermediate temperature. All types are suitable for *exhaust* dyeing, and many types are suitable for pad-batch (see *padding*) dyeing and for printing. Apart from cost, the biggest commercial drawbacks to reactive dyes are that they require large amounts of *electrolyte* (salt) in most processes, and extensive rinsing and hot washing after dyeing to remove unfixed and *hydrolyzed* dye. {Rev 3.0.0r}

reducing agent - a chemist's term for any chemical that causes gain of electrons by another chemical with which it reacts; the reducing agent is itself oxidized (see *oxidizing agent*) in the process

Many reducing agents are used in dyeing processes. They include *thiourea dioxide*, *sodium bisulfite*, *sodium formaldehyde sulfoxylate*, *sodium hydrosulfite* and others. They are often used in *discharge* and *stripping* processes, and are used for converting insoluble *vat* or *sulfur* dyes to the soluble form. Solid-chemical reducing agents are often flammable. {Rev 2.0.0a}

reduction clearing - removal of disperse dye on the surface of fabric by use of a *reducing agent*

Fine particles of *disperse dye* often remain on the surface of dyed fabric. These particles can cause wash fastness problems, yet are hard to fully remove by washing alone. For polyester, a mixture of about 2 grams per litre each of *sodium hydrosulfite* and *sodium carbonate* is used at about 70 degrees Celsius for about 20 minutes. Dye inside the fibre is not effected by this treatment. {Rev 3.0.0a}

reserving agent - also called restraining agents; a dye bath auxiliary that is typically used to prevent one fibre in a blend from taking up dye intended for the other fibre, or to equalize the uptake

When blends are dyed, one fibre may be truly dyed while the other is stained (colored, but with very poor fastness). Reserving agents can be used to significantly reduced the undesired staining. In blends such as wool-nylon, reserving agents can act to reduce the dye uptake by the nylon, so that the nylon and wool ultimately are colored similarly. {Rev 3.0.0a}

resist - in dyeing (and some other processes), something applied to fabric to prevent dye from coloring it

Resists such as waxes used in batik simply prevent dye from gaining access to the fibre. Tie-dyeing and shibori employ what amount to mechanical resist methods to limit dye access. Chemical resists allow the dye to gain physical access to the fibre, but prevent fixation of the dye to the fibre. These include sulfites such as sodium bisulfite, as a resist for *vinyl sulfone* dyes, *citric acid* as a resist for many *reactive dyes* for cellulosic fibres, and *sulfamic acid* as a resist for acid dyes on wool. {Rev 3.0.0r}

resist salt - an *oxidizing agent* added to dye baths or print pastes to prevent *reduction* damage to dyes

Under some conditions, especially where air is excluded, such as in steam fixation of dye, some of the dye may be decomposed by *reduction* (often the fibre itself acting as the reducing agent). Resist salts, such as *sodium m-nitrobenzene sulfonate*, generally used in alkaline conditions, or *sodium chlorate*, generally used in acid conditions,

may be added to prevent this. Resist salts are also sometimes applied to fabric before printing with discharge pastes to protect the ground color dye and/or improve the sharpness of edges of the discharge. This term is a bit misleading: don't confuse resist salts with chemicals used to keep dye from fixing to the fibre. {Rev 3.0.0a}

retarder - a chemical added to a dye bath to reduce the rate at which dye attaches to the fibre; also called leveling agents

A retarder may be required to prevent a dye from attaching to fibres so quickly that it would be very difficult to achieve *level* dyeing. Retarders are often used with acid dyes. They may work by quickly attaching to the fibre thereby temporarily keeping the dye from attaching, or by quickly attaching to the dye, temporarily keeping the fibre from attaching to the dye. Simple chemicals such as *sodium sulfate* may act as retarders for some dyes in some conditions. There are many retarders on the market that are proprietary mixtures of chemicals, often formulated to be companions for specific dye families. *Reserving agents* can be thought of as a special class of retarder. The availability to art dyers of retarders is limited. {Rev 3.0.0r}

Remazol® - a family of *vinyl sulfone* reactive dyes; tradename of Dystar of Germany {Rev 3.0.0a}

roman numerals in chemical names

Many ions can assume different electrical charges in different compounds. For example, iron can have a charge of +2 or +3. For example, in old use, iron chloride ($FeCl_2$) where the iron has a charge of +2, would be called "ferrous chloride", while $FeCl_3$, where the iron has a charge of +3, would be called "ferric chloride". In modern use, $FeCl_2$ would be called "iron (II) chloride" (read as iron two chloride) and $FeCl_3$ would be called "iron (III) chloride" (read as iron three chloride). The roman numerals directly indicate the charge. In dyeing, this is most likely to be found in aluminum, chromium, copper, iron, tin and zinc compounds.

Rongalit C® - BASF tradename for *sodium formaldehyde sulfoxylate*; sometimes seen spelled "Rongalite"

r.m.m. - relative molecular mass; proper modern term instead of *molecular weight*

'Relative' is used because the mass is in proportion to one twelfth the mass as carbon-12. {Rev 3.0.0a}

salt - an ionic compound that is formed by a neutralization reaction (reaction of an *acid* with a *base*)

The best known salt, common salt, or sodium chloride (NaCl) is extensively used as an *electrolyte* in dyeing. *Sodium sulfate* is also used for this purpose. Many of the chemicals used in dyeing are technically salts, including many dyes. {Rev 3.0.0a}

salt linkage - see *ionic bond* {Rev 3.0.0a}

scour - essentially, thoroughly washing fibres or fabric to remove contaminants

Yarns and fabrics may be dirty, contain natural waxes or oils, or have been treated with *size* or *lubricants* used in spinning, weaving or knitting. These can all interfere with dyeing, often leading to non-*level* results. Scouring is a large topic, and the process used depends on the fibre type and its condition. "True" scouring of *greige* cellulosic fabrics is typically done, after *desizing*, at the boil or at higher temperature in pressure vessels, with as much as 10 grams *sodium hydroxide* per litre of water, plus surfactants, and the process may last for several hours. Commercial scouring of wool may use solvents, similar to dry cleaning, as part of the process. White fabrics sold at retail have normally be scoured at the mill; "natural" fabrics usually have not (some "natural" fabrics have been scoured but not bleached).

Art dyeing literature often refers to what amounts to laundering as scouring. This is inadequate for greige fabrics, but often quite acceptable for "white goods". A long machine wash with the hottest water possible, about a gram of *soda ash* per litre of water (about a teaspoon per gallon) and some (preferably *optical brightener* free) detergent, followed by two rinses is usually acceptable. *Sodium hexametaphosphate* may be helpful if the water is hard. Woven white cottons often contain starch that will not be removed by such a limited process. {Rev 3.0.0r}

SDC - Society of Dyers and Colourists (British)

Their web site is at www.sdc.org.uk {Rev 2.0.0r}

sequestering agent (or sequestrant) - a chemical compound that tends to bind some 'species' such as metal ions and keep them from being available to participate in other chemical reactions; also called chelating agents

Chemicals such as *sodium hexametaphosphate*, *citric acid* or *EDTA* , the choice depending on considerations such as pH and dye type, are used to sequester hardness ions such as calcium and magnesium and metal ions such as iron and copper. Care must be taken with *pre-metallized dyes*, since some powerful sequestering agents can actually remove the metal from the dye complex. {Rev 3.0.0a}

shelf life - the period of time some product can be stored "on the shelf" before it degrades to some point of reduced effectiveness

Some chemicals, including dyes, have limited shelf life. They degrade over time, eventually becoming completely useless for their intended purpose. Useful shelf life may range from hours to hundreds of years. For example, an *enzyme* used for *desizing* might be specified as losing about 10% of its strength after storage at 20°C for six months - it is still very useful, just slightly weaker. Shelf life is generally maximized by storage at low temperature (sometimes even freezing, but this can damage some products). Chemicals should also usually be protected from long exposure to bright light, and dry chemicals should be protected from humidity by storage in tightly closed moisture-proof containers.

shibori - a Japanese tie-dyeing technique

In shibori, fabric, usually silk, is folded or twisted or tied or wrapped around a bamboo pole (often substituted with *PVC* or *ABS* pipe), and dye is directly applied. This simple statement does not do justice to the craft and its beautiful results.

SHMP - *sodium hexametaphosphate*

SI - "Le Système International d'Unités" or International System of Units; a modern metric system in which meters, kilograms, seconds, amperes, candelas and moles are the base units

singeing - an industrial *defibrillation* process where rapidly-moving fabric passes over a flame or a very hot plate in order to burn away fibres poking up from the surface. Also see *gassing*.

size (or sizing) - in textiles, a material applied to yarns or fabrics to make them stiffer or temporarily bind fibres together

Sizing is used extensively, especially for cellulose fibres, to make them easier to process or protect them from damage during high-speed weaving or the like. A wide variety of compounds, including starches and other plant derivatives, and synthetic organic compounds, such as polyvinyl alcohol, are used for sizing. Sizing materials can interfere with dyeing, so it is important that they are removed by *desizing*, usually prior to *scouring* but sometimes as part of the scouring process. {Rev 3.0.0r}

soaping (or soaping off) - with respect to dyeing, the process of washing dyed fabric with very hot (often boiling) water with *surfactants*, rarely actually soap, to remove dye that is not fixed to the fibre.

Soaping off is important particularly with some *reactive dyes*, since a good deal of *hydrolyzed* dye is loosely bonded to the fabric, and must be removed to avoid staining of other garments or fabric in laundering. Soaping is also important in vat dyeing, where there are actual changes, including in hue, in the dye in the fibre. Though surfactants are often used, they may actually contribute almost nothing to the effectiveness of the process. {Rev 3.0.0r}

soda ash - *sodium carbonate*; an antiquated but much-used term

sodium acetate - CH_3COONa; a *buffer*

In dyeing, sodium acetate is almost always used together with acetic acid in moderately acid processes (that is, sodium acetate is rarely used without acetic acid, but acetic acid may often be used without sodium acetate).

sodium bicarbonate - $NaHCO_3$; more properly called sodium hydrogen carbonate; also called sodium acid carbonate, and most commonly, baking soda

Sodium bicarbonate is used as a *weak base* (alkali) in some dyeing processes, often with reactive dye that is *padded* onto fabric, then *batched* for many hours. It has limited stability in solution, decomposing to sodium carbonate, carbon dioxide and water, especially at high temperature, so solutions generally should be made shortly before use. Sometimes this decomposition is used deliberately, usually with highly reactive dyes such as *MX*. A print paste made with sodium bicarbonate will have a pH around 8, and at this pH the dye will not *hydrolyze* rapidly and hence become useless. When the printed fabric is steamed, the sodium bicarbonate will decompose and the pH will rise to around 11, facilitating reaction of the dye with the fibre. {Rev 3.0.0r}

sodium bisulfate - $NaHSO_4$; also called sodium hydrogen sulfate or sodium acid sulfate

Sodium bisulfate *hydrolyzes* in water solution, and acts much like sulfuric acid. It can sometimes be used as substitute for sulfuric acid, and because it is a dry chemical, it can be safer to handle, though care is still necessary. Sodium bisulfate is often the basis for *etchant* pastes for *devoré* of cotton. "pH Down" for spas and swimming pools is usually sodium bisulfate. Do not confuse this with *sodium bisulfite*.

sodium bisulfite - $NaHSO_3$; a mild *reducing agent*, most used in dyeing as an *antichlor*; often actually sodium metabisulfite ($Na_2S_20_5$), which behaves the same way

As an antichlor, sodium (meta)bisulfite reacts with *sodium hypochlorite* and *hypochlorous acid*, to almost immediately stop bleaching action. The product of the reaction is two acids which need to be thoroughly rinsed from the fabric. Typical use is about a gram (approximately 1/4 tsp) per litre of room-temperature water. Solutions should be prepared shortly before use (preferably within an hour) and with gentle stirring, since oxygen dissolved in the solution will destroy its effectiveness. Discard used solutions. Do not confuse this chemical with *sodium bisulfate*.

CAUTION! Some people develop very serious sensitivity to sulfite compounds.

sodium carbonate - soda ash; Na_2CO_3; a *weak base*

Sodium carbonate is an extensively-used *alkali* in textile preparation and dyeing. It is typically used to adjust the *pH* of solutions to about 11. It is also used in *scouring* cellulose fibres. The most common industrial form is the *anhydrous* type. Sodium carbonate monohydrate ($Na_2CO_3•H_20$) is the most common form sold for photographic use. *Washing soda*, if "pure", is usually sodium carbonate decahydrate ($Na_2CO_3•10H_20$). Soda ash is *hygroscopic*, so it should be stored in a tightly-closed moisture-proof container. If so protected, it will keep indefinitely. See also *pH Up* and *hydration state*. {Rev 3.0.0a}

sodium chlorate - $NaClO_3$

An *oxidizing agent*, sometime used as a *resist salt* to protect dyes from *reduction* in printing processes under acid conditions. {Rev 3.0.0a}

sodium chloride - NaCl; common salt

Sodium chloride is used in large quantities as an *electrolyte* in application of *direct dyes* and *reactive dyes*.

sodium dithionite - *sodium hydrosulfite*; dithionite is technically more correct {Rev 3.0.0r}

sodium formaldehyde sulfoxylate - a *reducing agent* used in *discharge* techniques and for *stripping* dye; Formosul and Rongalit C are trade names; designated in Colour Index as Reducing Agent 2

This chemical is useful for discharge on cellulose and silk, but not usually on wool. It requires alkaline conditions that may damage wool (alkaline conditions can also reduce the sheen of silk). It does not contain free formaldehyde. Also see *zinc formaldehyde sulfoxylate*.

sodium hexametaphosphate - $Na_{(x+2)}P_xO_{(3x+1)}$, where x = 6 to 21; a *sequestrant* used to treat hard water; SHMP, often referred to in art dyeing literature as "metaphos"

Sodium hexametaphosphate softens water by sequestering calcium and magnesium, effectively making them unavailable to participate in other reactions. Typical use would be about 0.5 grams per litre of water. *Calgon T* is one trade name for sodium hexametaphosphate, though retail Calgon products contain other chemicals, and are not the preferred products for dyeing applications. {Rev 3.0.0r}

sodium hydroxide - NaOH; a *strong base*; commonly sold as beads or flakes, or as a 50% solution; also called caustic soda or lye, often just called "caustic" in dyeing

Sodium hydroxide is used in some dyeing processes requiring very high *pH*. A solution of 4 grams per litre will have a pH of 13. It is common in *vat dyeing*, some *reactive dye* methods, and is used in *mercerizing* cotton. It is commonly used for industrial *scouring* of cotton. Sodium hydroxide must be handled with great care, since it will cause severe skin burns. It should be dissolved by SLOWLY adding it to stirred VERY COLD water, since a great deal of heat is liberated as it dissolves. Never use aluminum vessels or tools with NaOH: they will be corroded, and explosive hydrogen will be generated. Sodium hydroxide is deliquescent - extremely *hygroscopic*.

sodium hydrosulfite - $Na_2S_20_4$; a *reducing agent* used in *discharge* techniques, dye *stripping*, and in *vat dyeing*; more properly called sodium dithionite; dyehouse term is "hydro" or "hydros"

For stripping, it is usually used in an alkaline solution at a temperature near the boiling point of water. This is the active ingredient in some of the "whiteners" or "dye removers" sold in small packages like the "household" dyes in the grocery store. It produces a rather strong sulfurous smell. Sodium hydrosulfite is a flammable powder, and must be handled with care. Do not confuse this with sodium hydrosulfide, which is used with sulfur dyes. {Rev 3.0.0r}

sodium hypochlorite - NaOCl

Household type chlorine laundry bleach contains about 5% sodium hypochlorite as the active ingredient. Stronger solutions are available for industrial use. See *bleach, chlorine* {Rev 3.0.0r}

sodium *m*-nitrobenzene sulfonate - often referred to by BASF's tradename Ludigol®

This chemical is a mild *oxidizing agent* that is sometimes used to protect dyes from degradation caused by *reducing* conditions that exist at high pH and high temperature, especially where air is excluded from the dyeing vessel. Such conditions are quite common in processes for some of the low-reactivity dyes, but very rare in processes for MX dyes, except in steam fixing. Recommended amounts for protecting dyes from reduction range from 1 to 10 grams per litre of dyebath. When used in printing it is sometimes called a *resist salt*. It is also used as an oxidizing agent for some *vat* dyes. {Rev 3.0.0r}

sodium metabisulfite - see *sodium bisulfite*

sodium silicate - $Na_2Si_3O_7$ and similar compounds, usually as a solution in water

Sodium silicate is used as a stabilizer in *hydrogen peroxide* bleaching. It can also be used in *direct application* of reactive dyes to cellulose fibres. Here it is applied essentially full-strength after the dye is applied, acting as an alkali to cause the dye to fix to the fibre. Because it is a syrupy liquid, it makes the dye spread less than other post-applied alkalies. Care must be take to avoid making solutions of sodium silicate acidic, since this will result in a water-insoluble gel that is extremely difficult to remove. Sodium silicate solution is also called water glass. It can be very irritating to skin. {Rev 3.0.0r}

sodium perborate - $NaBO_3$

This is the bleaching compound that is most commonly found in laundry detergents that contain "color safe" bleach. Such detergents often contain special activators that make the perborate work more effectively at moderate temperatures. {Rev 3.0.0r}

sodium percarbonate - a dry chemical made by reacting *sodium carbonate* with *hydrogen peroxide*

Sodium percarbonate can be used as an alternative to *hydrogen peroxide* for oxidizing bleaching. It is considerably more expensive, but is safer to handle (relative to industrial-strength hydrogen peroxide). Oxi Clean® is a retail cleaning compound believed to be primarily sodium percarbonate. {Rev 3.0.0r}

sodium sulfate - Glauber's salt; Na_2SO_4

Sodium sulfate is used as an alternative to common salt (sodium chloride) in some dyeing processes, such as those involving MX turquoise where it is a simple *electrolyte*. When used with some acid dyes for wool, it may act as either an electrolyte to enhance *exhaustion*, or as a *retarder* to aid leveling, depending on conditions such as pH. It is also used as a *diluent* for many dyes. Sodium sulfate is often sold in *anhydrous* form. It will absorb water from

the air, so it should be stored in tightly closed containers. In the dye industry, some use “sodium sulfate” only to refer to the *anhydrous* form, and “Glauber’s salt” to refer to the decahydrate form ($Na_2SO_4 \bullet 10H_20$).

sodium thiosulfate - $Na_2S_2O_3$, a chemical used to neutralize chlorine in water for dye baths

The chlorine present in tap water can actually destroy small amounts of dye. This can be a problem, particularly when dyeing very pale shades where loss of a little dye can influence the final shade noticeably. Sodium thiosulfate is preferred for neutralizing chlorine for this application. Typical use would be about 0.15 grams per litre of bath. Sodium thiosulfate is the main ingredient in fixer (types sold as dry powder mixture) for black and white photographic processing. Most antichlor products for aquarium use are sodium thiosulfate. {Rev 3.0.0r}

softener (fabric softener) - a chemical or chemical mixture intended to give fabric a soft *hand*

Softeners act primarily as lubricants for fibres, allowing them to slide over each other more easily, giving a softer feel. Some also help reduce static electric charge build up, and some are antimicrobial. Many softeners are *surfactants*, and they may be *cationic*, *anionic* or *non-ionic*. Household laundry softeners are often based on cationic surfactants. Softeners can interfere with dyeing, so they should be removed by *scouring*. Some, such as silicones, can be quite difficult to remove.

softener (water softener) - chemical(s) added to water to prevent hardness ions from interfering with other solutes

Sodium hexametaphosphate (SHMP) is commonly used as a softener in dyeing. It will hold moderate amounts of hardness ions in solution. Soda ash will soften water, but it does it by formation of insoluble precipitates that can deposit on fabric or equipment, so SHMP is often added before soda ash to prevent this. Water softening systems which use common salt exchange hardness cations for sodium. {Rev 3.0.0r}

spandex - an synthetic elastic fibre of polyurethane

LYCRA® (Invista, formerly Dupont) is a well-known brand of spandex. Spandex is found in fabrics either as bare fine filaments or covered with another fibre. Spandex can be dyed with disperse dyes and some acid dyes. Usually where bare filaments are used, they are quite inconspicuous even if they are not dyed to match the fabric. Spandex will withstand most preparation and dyeing processes without damage, but is damaged by chlorine bleach. {Rev 3.0.0a}

stainless steel - a broad class of corrosion-resistant iron alloys

Stainless steel is often recommended for vessels for dyeing. It is made of iron alloyed with metals such as chromium, molybdenum, nickel, and others. There are a great many stainless steel alloys. The best alloy for chemical resistance is “316S”. “316” is almost as good, followed by “308”, “304” and “18-8” . You will sometimes see these numbers on the packaging or literature for higher quality stainless ware. High chloride ion concentration, particularly at high temperature, can corrode even the best stainless steel. This is unlikely to cause concern for home dyers. Because there is a possibility that stainless steel pots can become pitted from use in dyeing, and the pits may make it hard to completely remove contaminants, such pots should not be used for food purposes. Beware of *aluminum* rivets that are sometimes used to fasten handles to inexpensive stainless steel pots. {Rev 3.0.0r}

starch - a *polysaccharide* with a much higher molecular weight than that of a sugar, but typically lower than that of cellulose; *amylose* and *amylopectin* are the major plant starches

The starches used in the textile industry are derived from plants. In North America, most starch comes from corn (maize), but starch from rice or tapioca is also common. Starch is extensively used as a *size* for warp yarns in commercial weaving. It must be removed before dyeing, because it can interfere with the uptake of dye by the fibre. It isn’t appropriate for thickening *reactive dye* solutions for printing or direct application because much of the dye will react with the starch instead of the fibre. It can be used to as a thickener for some other types of dye. Starches are also chemically processed to produce *dextrin*, starch ethers (see *Monagum*) and starch esters. Unmodified starch has very low solubility in water. {Rev 3.0.0r}

starch indicator - a solution that is used to detect starch by a color reaction

Starch indicator is usually a solution of iodine and potassium iodide in water (typically about 2.3% potassium iodide and 0.33% iodine in distilled water). It will react with starch to produce a violet to blue-black color, depending on the specific type of starch. This can be useful for detecting starch *size* in fabrics. *Mercerized* cotton

will also give a blue-black color with this test, though the color seems to appear slowly, whereas with starch it appears almost instantly.

stripping - removal of dye from fabric

Stripping is usually done with a *reducing agent* such as *thiox*, *formosul* or *sodium hydrosulfite* and often requires hot to boiling conditions. Some dyes are difficult to strip, and the result often is not white.

stock solution - a solution of known strength, made up with the intent of dilution or mixing before final use

Stock solutions are a convenient way of avoiding the need to weigh chemicals each time you need to use some. For example, if you need 0.27 grams of Smurf extract in a blue dye formula, and you have a stock solution of 10% extract, you would measure 2.7 milliliters of stock solution to get that amount. Some chemical solutions have limited *shelf life*.

sublimation - the conversion of a solid directly to a gas, without passing through a liquid phase

Some *disperse dyes* will sublime. This can make dyed fabric subject to fading due to heating, as from ironing at high temperature. Sublimation printing of synthetic fibres, mostly polyester, is used commercially. Typically, the pattern is printed on paper, then the dried pattern is heat transferred to the fabric. The dye gas penetrates the hot fibre, where it becomes physically trapped as it cools back to solid form. Washfastness is very high. There are now a number of special sublimation inks available for computer printers and others for screen printing, both for making transfers. One t-shirt maker also makes shirts that have a polyester outer layer and a cotton inner layer, also specifically for "digital" transfer printing. {Rev 3.0.0r}

substantive(ity) - tendency of a dye to move from a solution onto fibres in the solution

A dye that is substantive will leave the dye bath and be concentrated on the fibre in the bath. Without substantivity, most of the dye would simply remain in solution or dispersion in the bath. Dye substantivity is generally associated with the molecular structure of the dye, and often big molecules have high substantivity, while small molecules have low substantivity. Dye bath conditions, including temperature and additives such as salt influence substantivity. Substantivity is often produced in ways that differ from the final bond of the dye to the fibre. Also see *affinity*. {Rev 3.0.0r}

subtractive - with reference to color, removal of colors from light reflected from a surface

A surface that is illuminated by white light and that reflects all visible colors will appear white. The surface can be made to appear some other color than white by altering it with materials that absorb or subtract colors present in the white light. The subtractive primary colors are designated *cyan*, *magenta* and yellow. If a white material is colored with something that absorbs magenta, for example, then cyan and yellow will be reflected, making the material look what is normally called green. If another material is added that absorbs the cyan component - "subtracts" cyan, then only the yellow is reflected, and the material looks yellow. If all colors are subtracted or absorbed, then the material appears black. Dyes used on fabric work according to subtractive principals. In theory, if truly pure cyan, yellow and magenta dyes were available, any other color could be mixed from them. In practice, there are limitations. Color theory and practice are complex topics.

sulfamic acid - NH_2SO_3H

Sulfamic acid, applied to wool typically by printing, followed by baking then steaming, fixes to the wool much like an acid dye. It is colorless and prevents the treated wool from taking up other acid dye, so it is an effective *resist*. {Rev 3.0.0a}

sulfur dye - a class of dyes made by reacting sulfur with organic compounds; most are of unknown chemical structure

Sulfur dyes are insoluble in water, and must be converted to a soluble form for application. The process is a quite similar to that used for *vat dyes*. Sulfur dyes are typically inexpensive, but dull in color. They generally have good washfastness, but are sensitive to bleaches. Sulfur dyes on fabric, particularly some blacks, may decompose under warm, humid conditions, forming an acid. This can cause *tendering* of cellulose fibres, but can generally be prevented by making the finished fabric slightly alkaline. Sulfur dye is often used commercially to produce a good black at low cost on cellulosic fabrics. {Rev 2.0.0r}

sulfuric acid - H_2SO_4; a very potent inorganic ("mineral") acid; a *strong acid*

Sulfuric acid is used in some preparation and dyeing process, most often with wool. Concentrated acid will absorb water very rapidly, releasing heat in the process. Skin burns are caused by both this heating and by corrosive action, and can happen within seconds. EXTREME CARE IS ESSENTIAL! See comments under *acid* regarding mixing. *Sodium bisulfate* (not bisulfite) can sometimes be used as an alternative.

supermilling - a class of acid dye

Supermilling acid dyes offer moderate brightness and good to very good washfastness, but have poor to fair *leveling* tendency. Their leveling characteristics mean that extra care is required in the process to produce level results. There is no clear distinction between milling and supermilling acid dyes. These dyes are used for wool and work well on polyamide (nylon).

surfactant - surface active agent

When used in association with dyeing, this term almost invariably refers to a synthetic detergent. Detergents operate at the surface between a solvent (water) and some material that is to be removed from where it is, and made to enter solution or suspension in the solvent. One end of the surfactant molecule is hydrophilic ("likes" water, and the other is hydrophobic ("fears" or water; sometimes lipophilic - oil loving). Surfactants can be synthesized to have specific properties by varying the structure of the hydrophilic and hydrophobic ends. Surfactants are used to *scour* fibres or fabric, act as wetting agents in dyeing, as *retarders* in dyeing, and to help remove unfixed dye after dyeing. They may be classified as *anionic*, non-ionic or *cationic*. There are even types that can behave as anionic or cationic, depending on conditions. Some fabric softeners are surfactants. There is a vast array of surfactants on the market. {Rev 3.0.0r}

syntan - synthetic tanning agent

There are many syntans, and many are proprietary mixtures of chemicals. They are sometimes used as post-dyeing treatments for wool or nylon to increase *washfastness*. {Rev 3.0.0a}

tannic acid - a mixture of compounds derived from oak bark, nutgall and other natural sources; no well-defined chemical composition

Tannic acid treatment, followed by treatment with *tartar emetic*, has been used to improve the *washfastness* of dyed wool or nylon. *Syntans* and now used for this purpose. {Rev 3.0.0a}

tartar emetic - antimony potassium (or sodium) tartrate

This was once commonly used with *tannic acid* to improve the washfastness of dyed wool or nylon. {Rev 3.0.0a}

technical grade - a term applied to chemicals sold for general industrial purposes

Technical grade chemicals are usually somewhat less pure than "reagent grade" or "analytical grade" chemicals, and are much cheaper. Technical grade is now rather rare in small packages from laboratory chemical suppliers. Package sizes from industrial chemical vendors often range from about 25kg or 50 pounds up to rail car lots. "Tech" grade chemicals are very suitable for textile dyeing. Also see *grades of chemicals*. {Rev 3.0.0a}

TENCEL® - Acordis Fibres (Holdings) Ltd. trademark for their *lyocell* regenerated cellulose fibres

There are two types of TENCEL®. "Conventional" TENCEL®, is subject to *fibrillation*, which is exploited to produce a "peach skin" finish. TENCEL® A100 is treated to cause cross-linking of cellulose fibres, which prevents fibrillation. TENCEL® has much higher wet strength than other regenerated cellulose fibres such as viscose rayon. It can be dyed much like cotton. {Rev 3.0.0r}

tendering - weakening of a fibre, normally meaning as a result of chemical degradation

Cellulose fibres can be tendered by acids or by excessive action of *oxidative bleaches.*

thiodiglycol - also called thiodiethylene glycol or 2,2'-thiodiethanol

Thiodiglycol is sometime used to increase solubility of acid dyes, particularly for making printing pastes. It is very hazardous if mixed with hydrochloric acid. It is difficult to obtain, and there may be restrictions on its sale in some countries. {Rev 3.0.0a}

thiourea dioxide - thiox; a *reducing agent* used in *discharge*, *stripping* and *vat dyeing*; also called formamidine sulfinic acid or thiox; sometimes abbreviated TUDO; Colour Index Reducing Agent 11

Thiourea dioxide is popular discharge agent. It can also be used for bleaching wool, since will not damage the fibre like chlorine bleach will. Thiourea dioxide is considered to be safe, from a health risk point of view. Thiourea itself, which may exist in very minute proportions in thiox, is known to be a carcinogen. Extra care in handling is warranted. Thiox powder is flammable. *Carboxymethyl starch* (Monagum) is suitable as a thickener if required. {Rev 3.0.0r}

tin chloride (tin (II) chloride, read tin two chloride) $SnCl_2$; also called stannous chloride

Formerly, tin (II) chloride was often used as a *reducing agent* for *discharge* printing. In most cases *sodium formaldehyde sulfoxylate* or *zinc formaldehyde sulfoxylate* has replaced it in modern processes. It still finds some application for discharge on *acrylic* fabrics. It is also used as a *mordant* with some natural dyes. {Rev 3.0.0a}

triple-beam balance - a weighing device

This term refers a laboratory-type balance scale. “Triple-beam” simply refers to the fact that there are three bars on which weights slide to counterbalance the item on the pan. Typically, one bar has a weight for tenths or hundredths of a gram, one has a weight for grams, and one has a weight for tens of grams. Often additional weights can be hung from pins to increase the total capacity. Triple-beam balances are moderately priced and quite useful in dyeing. A type with a single pan where the mechanism is below the pan (as opposed to a hanging pan type) with a resolution of a tenth of a gram is a good choice for general dyeing use. There are now many electronic scales available that are very easy to use, but typically a good deal more expensive for comparable capacity and resolution.

T.S.P. (or TSP) - Na_3PO_4, trisodium phosphate; also called “sodium phosphate, tribasic”

TSP is sometimes used to produce pH in the range of about 12 for dyeing processes. It may be used in *scouring*. Strong solutions can be very irritating to skin, so handle it with care. {Rev 3.0.0r}

TUDO - *thiourea dioxide*

Tyvek® - a somewhat paper-like material made from polyethylene fibres; manufactured by DuPont.

Tyvek is a very strong non-woven material that is often used for high-strength mailing envelopes. It is good for labels for items to be dyed, because of its toughness and resistance to dyeing. Use a permanent-ink felt-tipped marker to write on it. Be careful ironing items with Tyvek labels - it melts easily. {Rev 2.0.0a}

ultraviolet - light that is just beyond the visible portion of the light spectrum at the blue end.

It is primarily ultraviolet light that is responsible for fading of colors, and that makes fluorescent compounds glow. Longwave ultraviolet, “blacklight”, with a wavelength of around 365 nanometers, is the preferred source for exposing many photosensitive materials, such as silkscreen emulsions. It is also useful for inspecting fabrics to detect *optical brighteners*. Longwave UV sources can be found in the form or fluorescent tubes. Tubes that appear white when off also emit considerable visible light and are best as exposure sources. Tubes that appear very dark purple don’t produce much visible light and are best for inspection sources. The dark purple type can often be purchased at novelty shops. “Germicidal” lamps are shortwave UV emitters. This wavelength, typically about 254 nanometers, can cause eye damage.

In one classification system, the ultraviolet spectrum is referred to by three wavelength classes: UB-A (315-400 nm), UV-B (280-315 nm) and UV-R (280-400 nm)

Ordinary glass is fairly transparent to longwave UV, but nearly completely opaque to shortwave UV. {Rev 2.0.0r}

union dye - a dye that is a mixture of two or more different classes of dye, used typically to dye blends of fibres

“Household” dyes, of the sort sold in grocery stores, are usually union dyes containing a *direct dye* which will work on cellulose fibres, and an *acid dye* which will work on wool or nylon. Industrially, union dyes may be other combinations, such as reactive and disperse dyes for dyeing cotton-polyester blends (often with two distinctly different sub-processes).

urea - an *organic* nitrogen compound; NH_2CONH_2

Urea is used in dyeing for a number of purposes. Urea helps increase the limit of solubility of some dyes, such as MX, in water. This can be useful when strong solutions are to be made for tie-dyeing, for example. From 5% to

20% *w/v* can be used. Urea is used as an *humectant*. In tie-dyeing or similar processes it helps prevent fabric from drying out during the long periods when it is left in the open for the dye to fix. Urea increases the swelling of fibres and can break hydrogen bonds, aiding penetration and mobility of dye. Large amounts of urea, up to 30% *w/v*, are used in some cold pad-batch dyeing processes for wool. Most urea sold is synthesized from natural gas. (Urea is sold as an "organic nitrogen" fertilizer. Pure urea will be designated 46-0-0 when sold as such.) {Rev 3.0.0r}

van der Waals forces - intermolecular forces as a result of localization of electrical charge within molecules

A molecule considered as a whole is electrically neutral. Because of the way in which electrons are held, there may be local areas that appear to have positive or negative electric charge, either permanently or temporarily. These charges lead to attraction between molecules. Van der Waals forces are weak and easily broken, but they can be important in dyeing. They can be important in *affinity*, and hold dye molecules on the fibre near to where a much stronger bond may ultimately be formed. {Rev 3.0.0a}

vat dye - a classification of dyes that are converted from a water-insoluble *pigment* form to a soluble *leuco* form (using a *reducing agent*), applied by immersion to fabric, then converted back to the insoluble form (by oxidation)

The name comes from "vatting" which once meant using natural fermentation processes in a vat to produce the reducing conditions to make the dye soluble. Indigo, the blue of blue jeans, is a common vat dye. Vat dyes, with the notable exception of indigo, are generally very *lightfast* and *washfast*. Many have very good resistance to chlorine bleach. Multiple applications of dye may be required to build strong shades because of limited *substantivity*. *Sulfur dyes* use processes similar to vat dyes, but are distinguished by their sulfur content. Some modern vat dyes are supplied in already-reduced soluble form. Occasionally art dyes will say something is vat dyed when they mean it has been dyed with any dye type in a large volume of solution, as opposed to by direct application of dye or other techniques. This use should be avoided. {Rev 3.0.0r}

vinegar - dilute *acetic acid*, typically around 5%

Vinegar is a convenient acid for many dyeing processes, although a lot may be required because it is so dilute. Much of the white vinegar sold is made by diluting concentrated acetic acid produced by synthesis from natural gas. Vinegar diluted with 10 parts of water will give a pH of around 4.2.

vinyl sulfone - (or sulphone) a of *reactive dyes*, generally used for cellulosic fibres but with some use for wool

Vinyl sulfone reactive dyes are intermediate in reactivity, so they are applied above room temperature, but well below the boiling point of water. They are quite non-reactive until exposed to alkaline pH, so they can be stored as solutions for much longer periods than highly reactive dyes like MX. Washfastness may be somewhat inferior to some other reactive dyes. Vinyl sulfone dyes can be a good choice for dyeing the background color for *discharge*, since they are quite easy to discharge with *reducing agents*. There are also simple chemical *resists* , that work well with these dyes, preventing fixation to the fibre, so they find application in printing processes. *Remazol*® is a popular brand name. {Rev 3.0.0r}

washfastness - a measure of the resistance of a dye to washing out of the fibre

There are a number of industry-standard tests for washfastness, usually based on the equivalent to the home laundry process appropriate for the fibre. Washfastness tests are concerned not only with loss of dye from the colored fabric, but also transfer of dye from the wash liquor to other items. Washfastness depends to a great extent on the nature of the dye, but also on the fibre, the application process and the post-dyeing treatment. There is not necessarily any relationship between washfastness and *lightfastness*. {Rev 3.0.0r}

washfast acid dyes - a vague term for a group of *acid dyes* that have good *washfastness* properties

This term is sometimes used by dye sellers for a group dyes selected for good washfastness properties. Often the dyes come from the *premetallized*, *milling* or *reactive* classes. {Rev 3.0.0r}

washing soda - *sodium carbonate*

Washing soda, if "pure", is usually sodium carbonate decahydrate ($Na_2CO_3 \bullet 10H_20$). Retail washing soda may contain additives such as detergents, salt and *optical brighteners*, and is therefore not a good substitute for soda ash for dyeing {Rev 3.0.0r}

weak acid/weak base - see *acid, weak* or *base, weak*

wetting agent - a chemical that helps water penetrate a material or form a film over its surface; usually a *surfactant*

Wetting agents are often used in dyeing to help the dye solution penetrate to the individual fibres (they don't usually help the dye penetrate from the surface of the fibre to the interior of the fibre). They can help in some fibre arts dyeing processes, but too much in a dye solution used for direct application may make the dye spread more than is wanted.

w/v - abbreviation for weight/volume

Solutions are sometimes specified as being made as some percentage weight/volume. This means that the substance dissolved is measured by weight, and the final solution is measured by volume. For example, 5% sodium chloride w/v would mean that 5 grams of salt would be dissolved in enough water to make a total solution volume of 100 millilitres (or, say, 150g to make 3 litres, etc), and would be labeled "Sodium chloride 5% w/v". Solutions are most commonly made this way, and it can be assumed to be this way unless otherwise specified. Also see *w/v*. {Rev 2.0.0r}

w/w - abbreviation for weight/weight

Solutions are sometimes specified as being made as some percentage weight/weight. Both the substance dissolved and the final solution are measured by weight. For example, a 10% solution of urea w/w would be made by dissolving one pound of urea in 9 pounds of water, and would be labeled "Urea 10% w/w". This method is sometimes preferred in industry since automatic mixing equipment is often designed to handle everything by weight rather than volume. Also see *w/v*. {Rev 2.0.0r}

zinc formaldehyde sulfoxylate - *Colour Index* Reducing Agent 6, used for *discharge*

This discharge agent works best in mildly acid conditions, so it is preferred, over *sodium formaldehyde sulfoxylate*, for work on wool. It is also often used in discharge screen printing of garments. {Rev 2.0.0a}

NOTE TO USERS OF THIS GLOSSARY

Found an error? Can't find a term you think should be here?
Please let me know.

Trying to keep this thing formatted to avoid inappropriate splitting of items across page breaks has proven rather daunting. I haven't given up, but I've become less fussy.

Doug
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Revision History

Starting with Revision 2, items that have been revised or added are marked at the end with the revision number. The letter at the end of the revision number marks the type of revision (a for added, g for grammatical or spelling change, r for content change).

Rev 3.0.0 - about 50 additions and 95 revisions

Rev 2.0.0 - several additions and revisions

Rev 1.0.1 - minor formatting & spelling fixes
2000-11-15

Rev 1.0.0 - change to preface
2000-11-14

Rev 0.0.0
2000-11-13