

# Dye classification

## & Dyeing processes

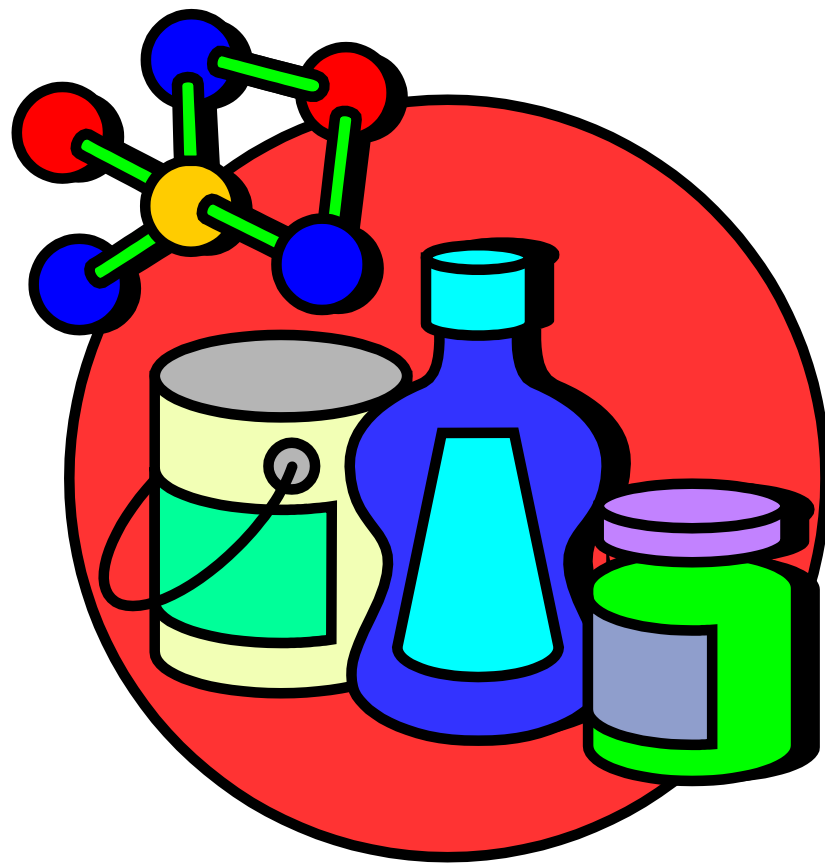


- No single class of dye can dye all fibres.
- A specific class of dye can only be applied to a given type of textile fibres.

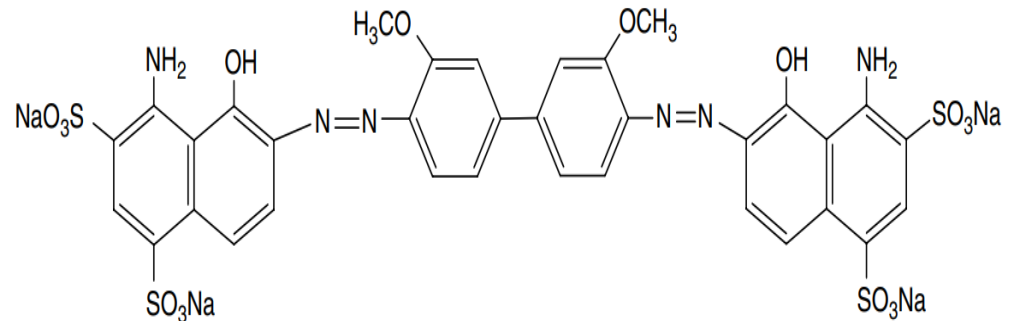
# *Classification of dyes*

## **Dye for Cellulose Fibres:**

- **Direct Dyes**
- **Reactive Dyes**
- **Vat Dyes**
- **Sulphur dyes**



# DIRECT DYES



(C.I. Direct Blue 1)

- 
- Easy to dye - require only common salt & hot to boiling water.
- Dyes have a good light fastness but only moderate wash fastness.
- It is possible to improve on wash fastness by after-treatment of dyed article with dye-fixing agent.
- These dyes are principally used for “not so expensive” products or product with fewer washes such as T-shirts, curtains & theatre productions.

# *Direct dyes*

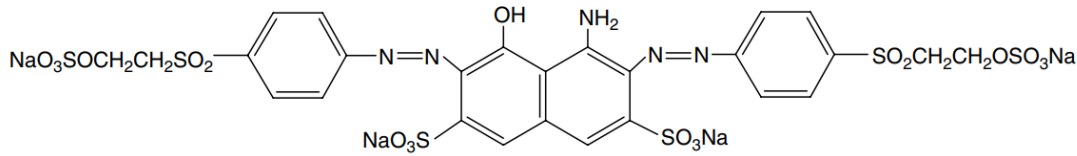
<b>General description</b>	<b>Main application</b>
<p><b>Simple application;</b> <b>Cheap;</b> <b>Complete color range;</b></p> <p><b>Use common salt in application for exhaustion</b></p>	<p><b>Mainly used for cellulosic fibres; can be applied on Rayon, Silk &amp; wool.</b></p>

# DIRECT DYES

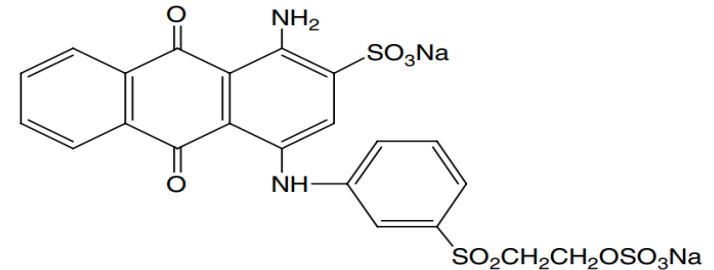
<b>Yellow</b>	<b>Pink</b>	<b>Brown</b>	<b>Turquoise</b>
<b>Orange</b>	<b>Red</b>	<b>Violet</b>	<b>Black</b>
<b>Fushia</b>	<b>Grey</b>	<b>Green</b>	<b>Forrest Green</b>
<b>Scarlet</b>	<b>Blue</b>	<b>Wine</b>	<b>China Blue</b>

# REACTIVE DYES

homo-bifunctional reactive dye



Mono-functional



- This is an entirely class of dye introduced to the market in 1956.
- The fibre reactive cluster is connected to the group through a bridging group that is typically a  $-NH-$  group.
- Reactive dyes used to color several house hold textile things like towel, ribbons and dress textile that need high wash fastness properties for frequent washings.
- Some specimen reactive dyes are shown in above figures.
- They react chemically with the fibre being dyed and cannot be removed by washing or boiling.
- The main feature of the dyestuff is its low affinity to cellulose; therefore large amounts of salt are required to force its deposition on he fabric.

# REACTIVE DYES

- Reactive dyes are used where bright dyeing with high light & wash fastness is required.
- Although some reactive dyestuffs have been specially modified to dye wool. However, their main usage is in dyeing cotton linen & viscose rayon.
- .but cold dyeing is used extensively in batik work.
- Cannot be used on synthetics or fabric that has been coated with resin.

Yellow 2GL	
Golden Yellow 2RL	
Orange 2R	
Scarlet	
Red BG (primary)	
Red 4B (bluish red)	
Red 8B (magenta)	
Rubinole 5B	
Brilliant Blue 2R	
Brilliant Blue BL	
Violet 2R	
Turquoise 2G	
Navy GRL	
Brown 2R	
Brilliant Green BL	
Black B (blue base)	
Black 2B (green base)	

Dye Class	General description	Main application
<b>Reactive</b>	Easy application; moderate price; complete colour range; good fastness due to direct reaction with fibres.	Commonly used for all cellulosic goods especially in knitted fabric batch dyeing; Selective dyes can also be applied on wool, silk & rayon; increasingly used in printing due to good fastness.

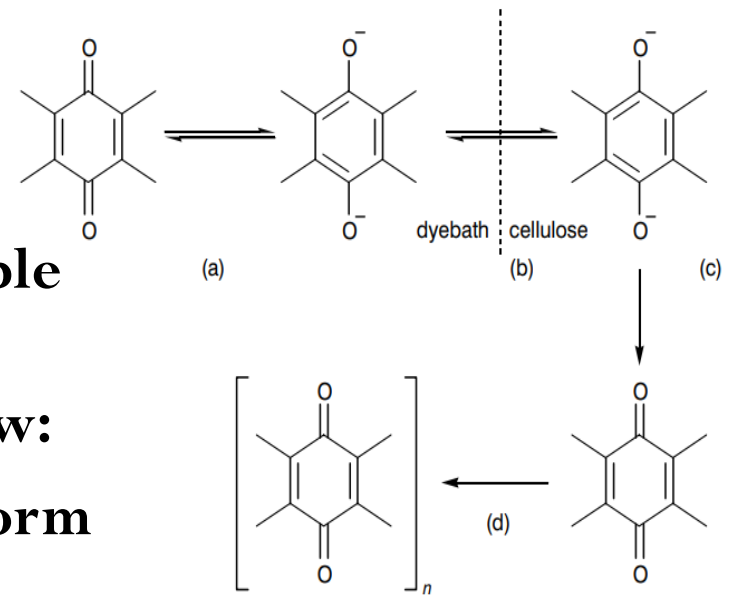


# VAT DYES

- **INDIGO**, probably the oldest dye known to man, is one of the most important members of this group.
- Natural indigo extracted from the plant was used by the Egyptians in 200 BC.
- The first synthetic indigo was introduced to the textile trade in 1897 & had the effect of completely replacing the natural product.
- Because of the time consuming & costly procedure in reducing vat dye into a water-soluble complex, dye manufacturers have produced a **stabilized water-soluble vat dye**.

# VAT DYES

- A vat color is colorant that isn't soluble in water, the appliance of vat dyes take in four steps as shown below:
  1. Reduction and dissolution (leuco form has substantively for fibres .
    - A. Sodium dithionite
    - B. Sulphur-free hydroxyacetone and
    - C. Thiourea dioxide
  2. Absorption by cellulose,
  3. Reoxidation and
  4. Association of the vat dye molecules within the fibre



# VAT DYES

YELLOW	GREEN
ORANGE	OLIVE B
RED	BROWN
BLUE	NAVY
VIOLET	BLACK

- Vat dyes are used in cotton dyeing where high wash & boil fastness required.
- When the ultimate in wash & boil fastness is required.
- Also used to dye over fibre reactive dyes for multi-layered dyeing.
- Because of the high alkali concentration in the dye bath, pure vat dyes cannot be used on animal fibres, (wool, natural silk, & various hairs).
- Solubilized vat dyes, not requiring the presence of alkali, can be used for dyeing on animal fibres.
- **Bright red** is absent in vat dye range.
- Because they are dyed at low temperatures, they are used in batik dyeing for **green** shades.

# Vat dyes

General description	Main application
<ol style="list-style-type: none"> <li>1. Difficult to apply (<b>become water soluble when reduced in the presence of an alkali. After dyeing, the fabric is oxidized &amp; the dye again becomes water insoluble.</b>)</li> <li>2. Most expensive; and incomplete colour range (strong in blue &amp; green but weak in brilliant red);</li> <li>3. Good all round fastness except indigo &amp; sulphurised vat species;</li> </ol>	<p>Commonly used for high quality cotton goods, e.g. towel &amp; Napkins</p> <p>Moreover specially used in the dyeing of denim fabric.</p>

# SULPHUR DYES

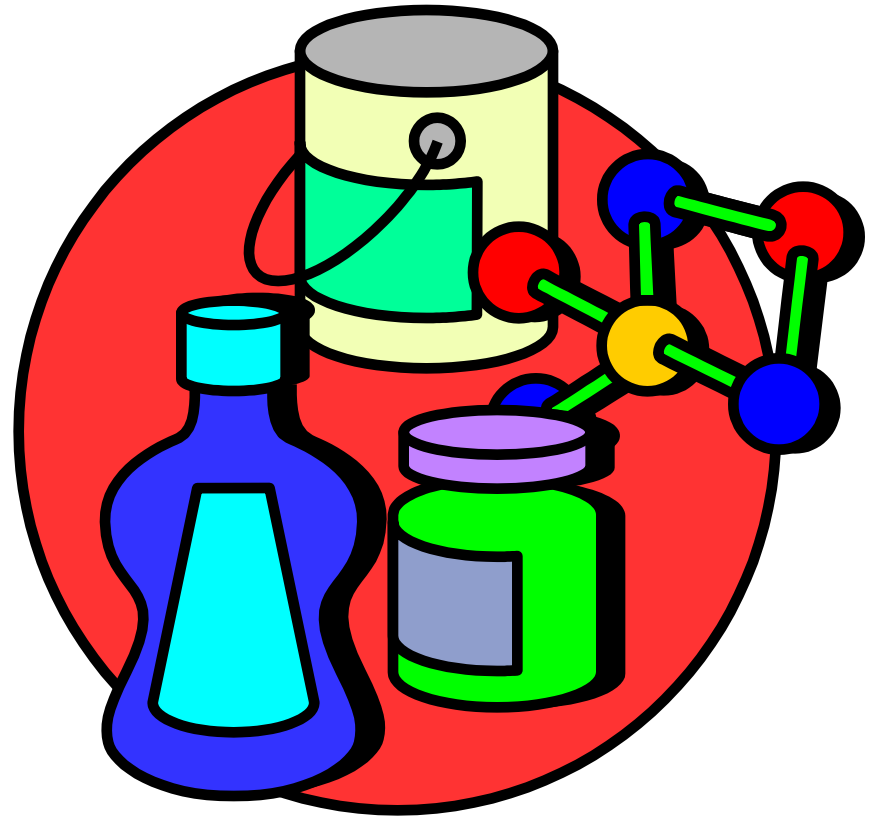
- Its outstanding fastness to light, washing but not boil-fastness. An outstanding member of this family is Sulphur black and cheap in price.
- It dyes all cellulose fibres, but particularly linen & jute, to a lustrous & deep black with excellent wash & light fastness.
- The general disadvantage of the Sulphur dyes that they & lack a **red and** produce dull shades of **brown**, **Khaki** & **Navy**.
- Sulphur dyes are dyed from a dye bath containing Sodium Sulphide & common or Glaubers Salt, & are oxidized by airing or with some oxidizing agents (Sodium Bichromate or Hydrogen Peroxide) in a fresh bath.

# *Sulphur dyes*

General description	Main application
<ol style="list-style-type: none"><li data-bbox="83 468 1251 604">1. Difficult to apply (application similar to vat dyes);</li><li data-bbox="83 639 1251 925">2. Cheap particularly for dark shade; incomplete black, navy, khaki &amp; colour range (strong in brown but no bright shade);</li><li data-bbox="83 961 1251 1246">3. Poor washing &amp; rubbing fastness &amp; sensitive to chlorine; may cause fabric rendering of cellulose upon storage (aging).</li></ol>	<p data-bbox="1290 468 1812 753">Mostly used for heavy cellulosic goods in dark shades.</p>

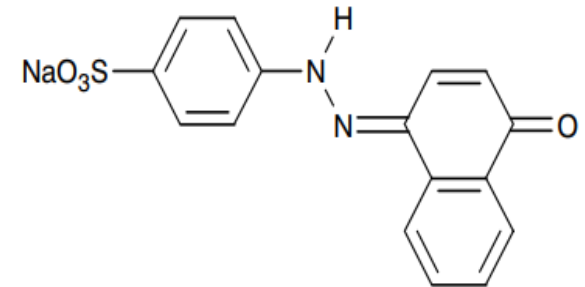
# Dye for Protein Fibres:

- Acid Dyes
- Metal-complex Dyes
- Chrome Dyes



# ACID DYES

- Acid dyes comprise a large number of dyes used for the dyeing of wool, silk & nylon.
- Acid dyes are anionic in nature
- They vary considerably in their basic chemical structure and applied in acid dye bath.
- Besides to coloration of nylon, wool and silk, several acid dyes allowed to be used in food items.



CI Acid Orange 20



Dye Class	General description	Main application
<b>Acid</b>	Easy application;  Complete colour range with very good bright shades;  Fastness properties may vary among individual dyes.	Commonly used for wool, silk & nylon.

# *Acid dyes*

Dye Class	General description	Main application
Metal-complex	Relatively difficult to apply; expensive; complete colour range but duller shade than acid dyes; good fastness due to high molecular size & metal complex structure.	Mainly used for wool & Nylon.

# *Acid dyes*

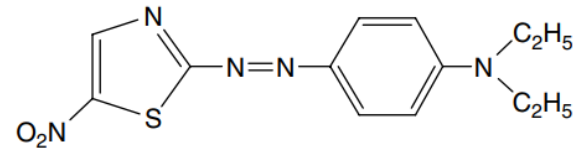
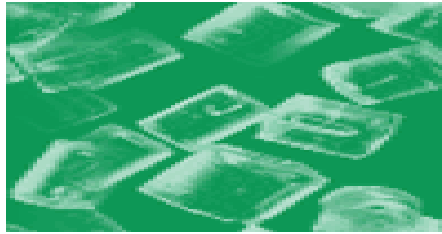
Dye Class	General description	Main application
Chrome Mordant	Complicated application; expensive; complete colour range but very dull shade; good all round fastness.	Mainly used for wool products especially for the end use of carpet.

# Dye for Man-made Fibres:

- Disperse Dyes
- Basic (Cationic Dyes)



# DISPERSE DYES



- These dyes are unremarkably used for the coloring of polyester Basically developed for dyeing of acetate and nylon fibres and acrylic (Orlon & mode-acrylic) fibres.
- These dyes aren't soluble in cold water and are used as dispersions with the addition of 'carriers' or swelling agents these dyes are also used in dyeing of Polyester (Terylene, Dacron, etc.)
- These dyes are applied at warm temperature and pressure wherever they'll enter into the structure of artificial fibres.
- As these dyes are applied in dispersion type so that they are said as disperse dyes. they need particles size in vary of zero.5–1.0µm.
- The key distinction between these dyes and different water- soluble dyes is that the absence of water solubilizing group like -SO<sub>3</sub>Na or -COONa in disperse dyes. Disperse dyes might have some polar group like -NH<sub>2</sub>, -NO<sub>2</sub>, -CN or -OH thus these dyes are nonionic and even at warm temperature are terribly less soluble in water.

# *Disperse Dyes*

General description	Main application
<p>Require skill in application (either by carrier or under high temperature); moderate price; complete colour range; limited solubility in water (normally dispersed in water for application); good fastness after reduction clearing treatment; sublimation property.</p>	<p>Mostly used for polyester &amp; acetate; can also be applied on nylon &amp; Acrylic.</p>

# CATIONIC & BASIC DYES - USE:

- With the introduction of acrylic fibre a new range of 'modified' basic dyes – “cationic dyes” were perfected for dyeing of this material.
- Cationic dyes for dyeing acrylic (Mode-acrylic, Orlon) paper, wood & dried flowers.  
Also used for dyeing silk & silk flowers in very brilliant colors.

YELLOW	BLUE
ORANGE	TURQUOISE
RED	VIOLET
PINK	GREEN
RHODAMINE	BLACK

# *BASIC (Cationic dyes)*

General description	Main application
Complete colour range with very good brilliant shades.	Mainly used for acrylic.



## *DYE CLASSES' COLOUR FASTNESS PROPERTIES*

Dye Class	Colour fastness to				
	Washing	Light	Dry cleaning	Perspiration	Rubbing
Direct	Moderate (can be improved after proper after-treatment)	Moderate (can be improved after proper after-treatment)	Good	Good	Good
Azoic	Good	Good	Moderate	Good	Moderate
Vat (except indigo)	Excellent	Excellent	Good	Excellent	Good
Sulphur	Moderate (sensitive to chlorine)	Good	Good	Good	Moderate (poor on dark shades)
Reactive	Good	Good	Excellent	Excellent	Good
Acid	Moderate to poor	Good	Good	Moderate	Good
Metal-complex	Good	Excellent	Good	Good	Good
Chrome Mordant	Excellent	Excellent	Good	Good	Good
Disperse	Good	Good	Good	Good	Good
Basic (Cationic)	Good	Moderate to poor	Good	Good	Good

# Dye Companies

