

CHEMICAL MANAGEMENT AT HCMUT

Promotion for Sustainability in the Textile and Garment Industry in Asia-FABRIC

CHEMICAL MANAGEMENT AT HCMUT 8:30-9:15



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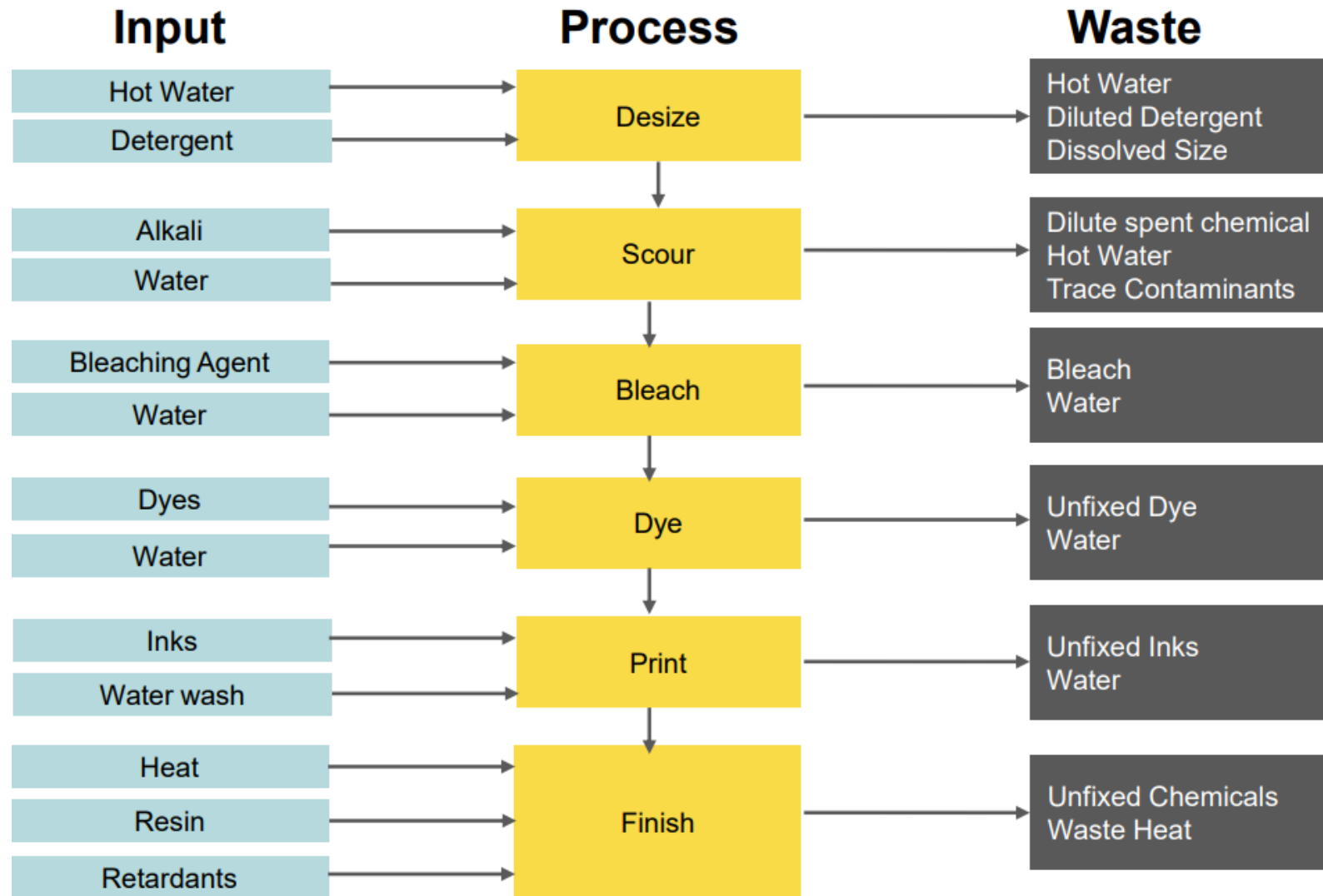
- i. The concern subjects and Subject's learning outcomes in Textile Engineering (TE) and Garment Technology (GT) Program**
- ii. Training content about ZDHC and MRSL in Textile Engineering and Garment Technology Program**
- iii. Several particular thesis related to sustainable chemical development**

i. The subjects and the learning outcomes

SUBJECTS	THE LEARNING OUTCOMES
1. Quality accreditation and evaluation for textiles (in TE and GT program)	<ul style="list-style-type: none">•Comprehending for the basic knowledge for Quality accreditation and evaluation for textile and garment (L.O.1)•Be able to design and analyze quality accreditation and evaluation process for textile and garment (L.O.2)•Be able to identify technical specification related with requirements, constraints and technical standards for quality accreditation and evaluation in textile and garment design process (L.O.3)

i. The subjects and the learning outcomes

SUBJECTS	THE LEARNING OUTCOMES
2. Textile Finishing (in TE program)	<ul style="list-style-type: none">• Being able to select materials with an understanding of how such choices will affect the manufacturing process, product behavior and environmental impact during the life of the product (L.O.5)
3. Dye chemistry (in TE program)	<ul style="list-style-type: none">• Explain properties, application range of dyes (L.O.4)• Analyze, investigate, solve the problems in dyes (L.O.5)
4. Analytical Chemistry in textiles (in TE program)	<ul style="list-style-type: none">• Understand basic chemicals properties and how to use them



Normal Chemical Classes	Typical Uses in Textile Industry	Process where Utilise
Alkylphenol Ethoxylates/Alkylphenols (APEOs/APEs)	cleaners, detergents, sizing agents	desizing, scouring, washing, dyeing, softening
Halogenated Flame Retardants	flame retardants	functional finishing
Chlorinated Solvents	spot cleaners, dry cleaning, scouring	Sizing, dry cleaning, scouring
Chlorinated	benzenes solvents, fiber swelling	agents dyeing
Chlorophenols	textile preservatives	pesticides, sizing, dyeing
Heavy Metals	dyes, pigments catalysts	fiber polymerising, dyeing, printing, tanning
Per- and poly-fluorinated chemicals	durable water repellents and their by-products	functional finishing (water/oil repellent)
Ortho-phthalates	plasticisers	dyeing, printing, coating, softening
Short-Chained Chlorinated Paraffins	leather	conditioners tannin
Azo dyes that may release carcinogenic amines as defined in Annex XVII of REACH	by-products of banned dyes	agents dyeing
Organotin Compounds (e.g., TBT)	antimicrobial, preservatives, catalysts	dyeing, leathering coating, polyurethane synthesizing

ii. Training content (ZDHC)

ZDHC Chemical Management System Technical Industry Guide

Introduction:

A Chemical Management System (CMS) is one of the cornerstones for ensuring continuous improvement towards our goal of **zero discharge of hazardous chemicals**. A sound chemical management system is paramount to worker safety and reduction in impacts on the community and the broader environment.

The ZDHC CMS Framework provides a high-level overview of minimum requirements for adoption of a CMS by the leadership of Suppliers and Brands for safe management of chemicals.

ii. Training content (ZDHC)

ZDHC Chemical Management System Technical Industry Guide

Content:

This is demonstrated by the following:

1. Policy
2. Strategy
3. Assessment
4. Health and safety
5. Chemical inventory
6. Storage and handling
7. Output management
8. Process control
9. Continuous improvement

We have based on these contents to design topics of subjects outlines such as Quality accreditation and evaluation for textiles, Textile Finishing, Dye chemistry, Analytical chemistry in textiles

ii. Training content (ZDHC)

ZDHC Chemical Management System Technical Industry Guide

3. Chemical Hazard and Risk Assessment

***Hazards are of 3 types (as per GHS):**

+Physical: Chemical substances that may be explosive, self- reactive, corrosive to metals, oxidising liquids, etc.

+Health: Chemical substances that may be toxic or cause cancer, germ cell mutagenicity, skin/ eye allergies, damage organs, affect fertility & reproduction or may be an endocrine disruptor.

+Environmental: Chemical substances that are toxic to aquatic or terrestrial life, persistent, bio accumulative or impact the ozone layer.

=> Both health and environmental hazards are considered in the ZDHC MRSL

ii. Training content (ZDHC)

ZDHC Chemical Management System Technical Industry Guide

3. Chemical Hazard and Risk Assessment

Hazards in chemical products can be identified in the following ways:

1. Through Safety Data Sheets (SDS)
2. Through labels on the chemical container
3. Information on ingredients through CAS numbers

ii. Training content (ZDHC)

ZDHC Chemical Management System Technical Industry Guide

3. Chemical Hazard and Risk Assessment

Safety Data Sheet (SDS) is a document that is provided by a Chemical Formulator and contains information on the hazards of a substance or preparation, potential effects on exposure to the chemical product and safe procedures for storage, handling and disposal. A GHS/CLP based SDS contains 16 sections.

1	Product and Producer identification	9	Physical and Chemical Properties
2	Hazards Identification	10	Stability and Reactivity
3	Information on ingredients	11	Toxicological Information
4	First Aid Measures	12	Ecological information
5	Firefighting Measures	13	Disposal considerations
6	Accidental Release Measures	14	Transport Information
7	Handling and Storage	15	Regulatory information
8	Exposure Controls/PPE	16	Other information

ii. Training content (ZDHC)

ZDHC Chemical Management System Technical Industry Guide

3. Chemical Hazard and Risk Assessment

Safety Data Sheet (SDS)

Safety Data Sheet	
according to Regulation [EC] no. 1907/2006 version 5.2 Revision date 03.01.2015 Print date 10.12.2015	
GENERIC EU SDS - NO COUNTRY SPECIFIC DATA - NO SPECIFIC DATA	
SECTION 2: Hazard Identification	
Label Elements	
Signal Word	Danger
Hazard Statements	H-315 Causes skin irritation H-336 May cause allergy or asthma or breathing difficulties if inhaled
Pictograms	
Precautionary Statements	P-101 Read label before use P-201 Avoid breathing dust / gas / mist / vapors P-280 Wear protective gloves/eye protection/face protection
GHS Classification	Skin Corrosion/Irritation Category 2 Respiratory sensitization Category 1

Figure 06: Example of a hazard identification from a section 2 of a Safety Data Sheet (SDS)

ii. Training content (ZDHC)

ZDHC Chemical Management System Technical Industry Guide

5. Chemical inventory

An SDS is the fundamental source of hazard information that can be used to control the health & safety impacts from chemicals stored, used and disposed of. It is a document that provides information on:

- Hazards of a chemical substance or preparation
- Potential health effects on exposure to a chemical
- Safe handling and storage of chemicals

ii. Training content (ZDHC)

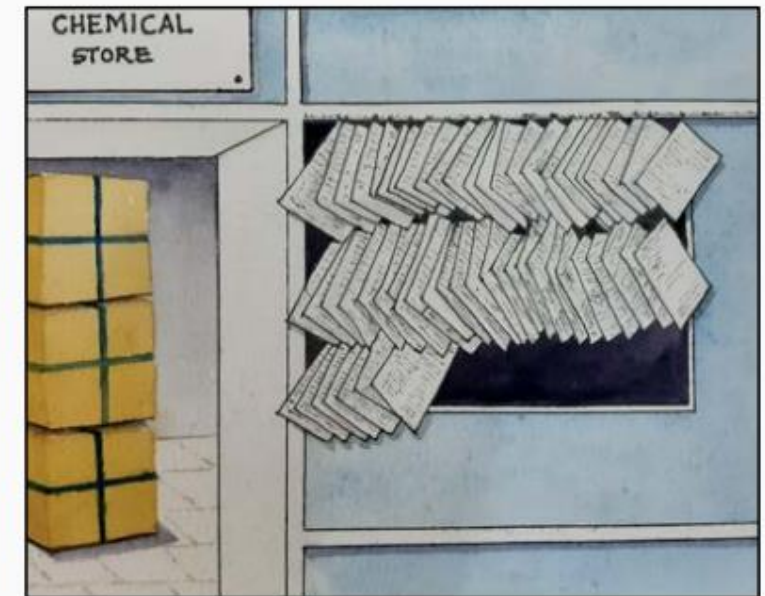
ZDHC Chemical Management System Technical Industry Guide

5. Chemical inventory

SDS:

- + Should be collected from every Chemical Formulator and kept at a central location and also at the point of storage
- + Can be displayed at the point of storage for a quick reference point
- + Should preferably follow the Globally Harmonized System (GHS)
- + Should be in the local and/or official language(s) of the Supplier's location
- + SDS soft copies can also be uploaded on a company server and access given to the Chemical Management Team

ii. Training content (ZDHC)



Left – SDS file kept on a stand near the Store; Middle – SDS displayed on a notice board; Right – SDS documents kept in plastic sheets on hooks outside the chemical store

ii. Training content (ZDHC)

ZDHC Chemical Management System Technical Industry Guide

6. Storage and handling

The **Globally Harmonized System** of classification and labelling of chemicals (GHS) was created by the United Nations in 1992 as a common language for hazard classification and labelling. It harmonises different national labelling standards with consistent norms applicable on a global basis. GHS has been adopted by

- the European Union as ‘Classification, Labelling and Packaging (CLP) regulation’ in 2008,
- the USA in June 2015,
- China in Dec 2011 and
- Vietnam in March 2016

ii. Training content (ZDHC)

ZDHC Chemical Management System Technical Industry Guide

6. Storage and handling

GHS has defined guidelines for labels on chemical containers, which must include 5 label elements:

- a. Product Identifier
- b. Signal Word
- c. Hazard Pictogram
- d. Hazard Statement(S)
- e. Precautionary Statement(s)

ii. Training content (ZDHC)

ZDHC Chemical Management System Technical Industry Guide

6. Storage and handling

a. Product Identifier

This is the name of the chemical product that is the same as mentioned in the SDS. This is also the name that is used by the supplier in their Purchase Contracts with the Chemical Formulator.



b. Signal Word

A signal word is used to “signal” the relative level of severity of hazard to the reader of the label. The signal words used in the GHS are “Danger” and “Warning”. • Danger is mostly used for the more severe hazard categories • Warning is mostly used for the less severe hazard categories

c. Hazard Pictogram

These are images that convey the hazard pictorially. GHS has harmonised hazards into 9 pictograms. Each pictogram is an image inside a red diamond on a white background. The pictogram is related to the hazard class and category of classification as per the GHS, which is conveyed through the Hazard or H-Statement(s).

ii. Training content (ZDHC)

GHS Code	Hazard Pictogram	Symbol description	Represents/Conveys
GHS 01		EXPLODING BOMB	Explosive, Self-Reactive, Organic Peroxides
GHS 02		FLAME	Flammable, Self-reactive, pyrophoric, Self-heating, emits flammable gas, organic peroxides


GHS 03		FLAME OVER CIRCLE	Oxidizers
GHS 04		GAS CYLINDER	Gases under pressure
GHS 05		CORROSION	Corrosive to skin and metal parts
GHS 06		SKULL AND CROSSBONES	Acute Toxicity
GHS 07		EXCLAMATION MARK	Irritant, Dermal Sensitizer, Acute Toxicity (harmful), Narcotic effects, respiratory tract irritation
GHS 08		HEALTH HAZARD	Carcinogen, Respiratory Sensitizer, Reproductive toxic, Target Organ Toxic, Mutagenicity, Aspiration toxicity
GHS 08		ENVIRONMENT	Environmental hazard

Figure 25: GHS Pictograms for chemical labelling

ii. Training content (ZDHC)

STUDENTS NEED:

- How to read a label.
- How to verify the correctness of the information

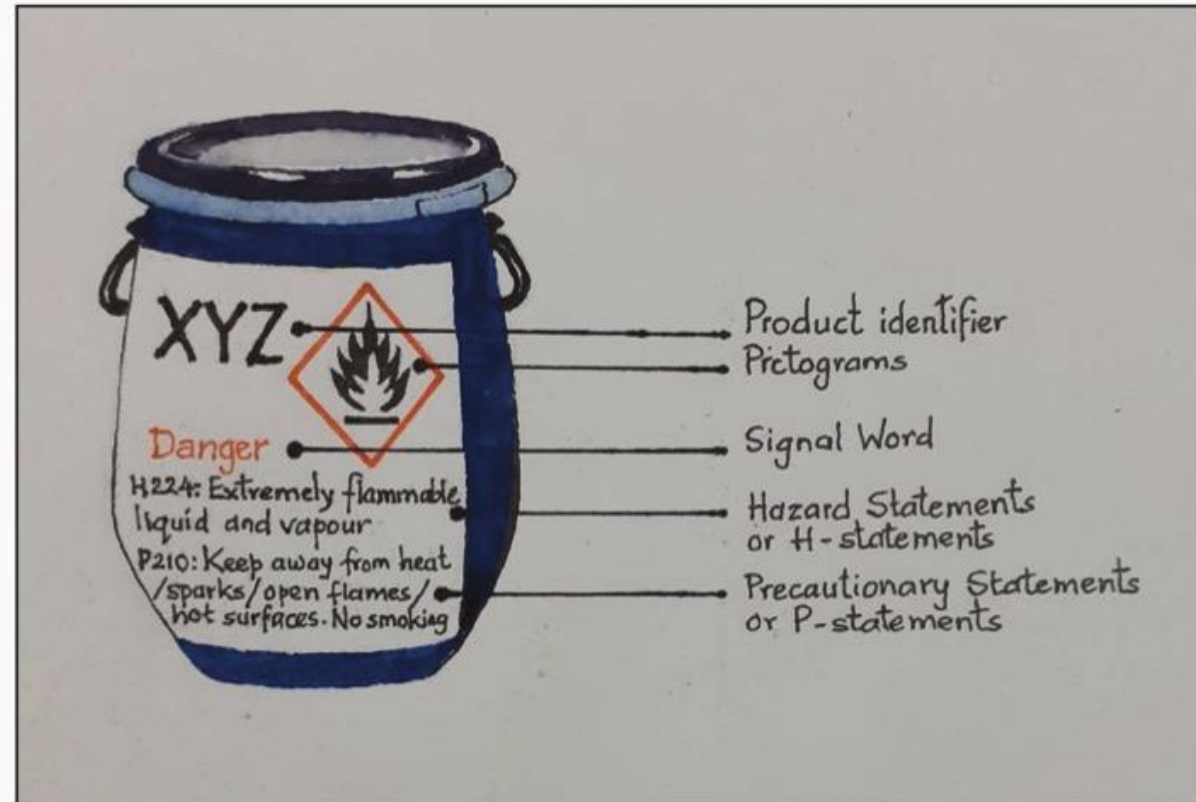


Figure 26: GHS label elements on a chemical container

ii. Training content (ZDHC)

- Well-defined chemical handling practices help to prevent spillages, personal injury due to chemical splashes or inhalation and loss of material and money.
- **Student need to have a basic understanding of what you should and should not do when handling chemical products in Lab.**



Read label before use



Wash hands thoroughly after chemical usage



Do not smoke near chemical containers



Do not mix chemicals without knowing the contents



Do not do welding activity near flammable chemicals



Do not roll or push drums

Figure 27: DOs and DON'Ts for chemical handling

ii. Training content (ZDHC)

MRSL for Textiles Processing

This section applies to chemical formulations and substances used during the creation and wet processing of textile fibres.

RSL Groups

- Group A: Raw Material and Finished Product Supplier Guidance
- Group A substances are banned from intentional use in facilities that process raw materials and manufacture finished products.
- Group B: Chemical Supplier Formulation Limit
- Group B substances are restricted to concentration limits in chemical formulations commercially available from chemical suppliers. These limits ban intentional use while allowing for reasonable expected manufacturing impurities that should be consistently achievable by responsible chemical manufacturers.

CAS No.	Substance	Group A: Raw Material and Finished Product Supplier Guidance	Group B: Chemical Supplier Commercial Formulation Limit
Alkylphenol (AP) and Alkylphenol Ethoxylates (APEOs): including all isomers			
104-40-5 11066-49-2 25154-52-3 84852-15-3	Nonylphenol (NP), mixed isomers	No intentional use	250 ppm
140-66-9 1806-26-4 27193-28-8	Octylphenol (OP), mixed isomers		250 ppm
9002-93-1 9036-19-5 68987-90-6	Octylphenol ethoxylates (OPEO)		500 ppm
9016-45-9 26027-38-3 37205-87-1 68412-54-4 127087-87-0	Nonylphenol ethoxylates (NPEO)		500 ppm
Chlorobenzenes and Chlorotoluenes			
95-50-1	1,2-dichlorobenzene	No intentional use	1000 ppm
Other isomers of mono-, di-, tri-, tetra-, penta- and hexa-chlorobenzene and mono-, di-, tri-, tetra- and penta- chlorotoluene			Sum = 200 ppm

CAS No.	Substance	Group A: Raw Material and Finished Product Supplier Guidance	Group B: Chemical Supplier Commercial Formulation Limit
Chlorophenols			
25167-83-3	Tetrachlorophenol (TeCP)	No intentional use	Sum = 20 ppm
87-86-5	Pentachlorophenol (PCP)		
4901-51-3	2,3,4,5-tetrachlorophenol		Sum = 50 ppm
58-90-2	2,3,4,6-tetrachlorophenol		
935-95-5	2,3,5,6-tetrachlorophenol		
95-57-8	2-chlorophenol		
120-83-2	2,4-dichlorophenol		
583-78-8	2,5-dichlorophenol		
87-65-0	2,6-dichlorophenol		
95-95-4	2,4,5-trichlorophenol		
88-06-2	2,4,6-trichlorophenol		
591-35-5	3,5-dichlorophenol		
576-24-9	2,3-dichlorophenol		
95-77-2	3,4-dichlorophenol		
108-43-0	3-chlorophenol		
106-48-9	4-chlorophenol		
15950-66-0	2,3,4-trichlorophenol		
933-78-8	2,3,5-trichlorophenol		
609-19-8	3,4,5-trichlorophenol		

Alternative chemicals for Textile Finishing

Anti-wrinkle chemicals:

- + Ureformaldehyde => release formaldehyde => Restricted use
- + Melamine formaldehyde => release formaldehyde => Restricted use
- + Dimethylol -4,5 – DihydroxyEthylene Urea (DMDHEU)
- + N,N'-Dimethyl- 4,5-dihydroxyethylene urea (DMeDHEU)
- + 1,2,3,4-Butanetetracarboxylic acid (BTCA)

Alternative chemicals for Textile Finishing

Water repellent chemicals:

- + Paraffin repellents
- + Stearic acid–melamine repellents
- + Silicone water repellents
- + Fluorocarbon-based repellent
- + Nano particles



ii. Training content (ZDHC)

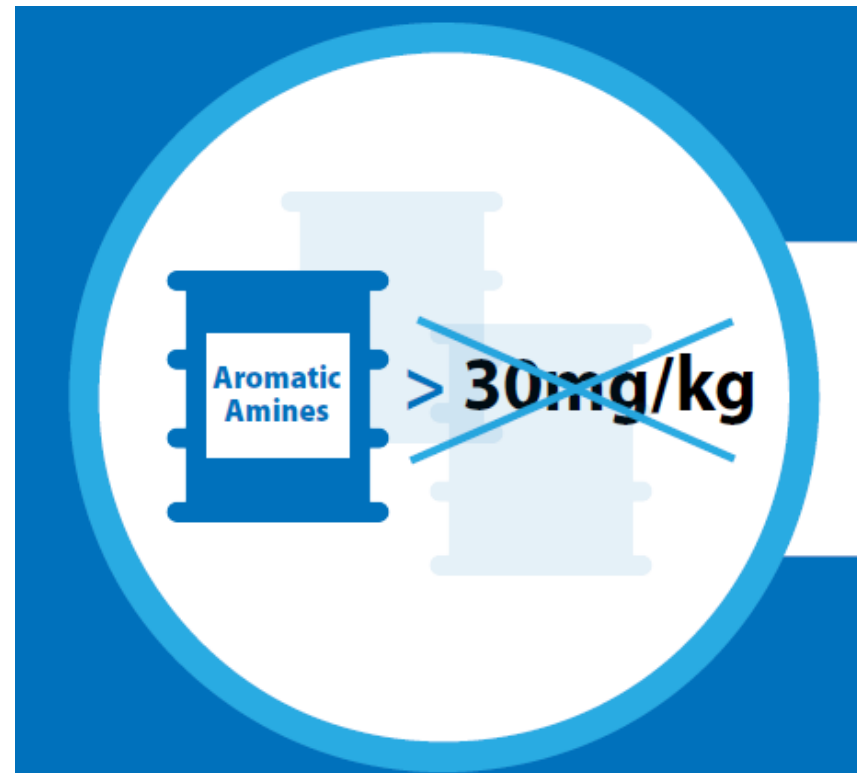
Dyestuff

Azo dyes give off many carcinogenic aromatic amino radicals



CAS No.	Substance	Group A: Raw Material and Finished Product Supplier Guidance	Group B: Chemical Supplier Commercial Formulation Limit
Dyes – Azo (Forming Restricted Amines)			
101-14-4	4,4'-methylene-bis-(2-chloro-aniline)	No intentional use	150 ppm
101-77-9	4,4'-methylenedianiline		150 ppm
101-80-4	4,4'-oxydianiline		150 ppm
106-47-8	4-chloroaniline		150 ppm
119-90-4	3,3'-dimethoxybenzidine		150 ppm
119-93-7	3,3'-dimethylbenzidine		150 ppm
120-71-8	6-methoxy-m-toluidine		150 ppm
137-17-7	2,4,5-trimethylaniline		150 ppm
139-65-1	4,4'-thiodianiline		150 ppm
60-09-3	4-aminoazobenzene		150 ppm
615-05-4	4-methoxy-m-phenylenediamine		150 ppm
838-88-0	4,4'-methylenedi-o-toluidine		150 ppm
87-62-7	2,6-xylydine		150 ppm
90-04-0	o-anisidine		150 ppm
91-59-8	2-naphthylamine		150 ppm
91-94-1	3,3'-dichlorobenzidine		150 ppm
92-67-1	4-aminodiphenyl		150 ppm
92-87-5	Benzidine		150 ppm
95-53-4	o-toluidine		150 ppm
95-68-1	2,4-xylydine		150 ppm
95-69-2	4-chloro-o-toluidine		150 ppm
95-80-7	4-methyl-m-phenylenediamine		150 ppm
97-56-3	o-aminoazotoluene		150 ppm
99-55-8	5-nitro-o-toluidine	150 ppm	
Dyes – Navy Blue Colourant			
118685-33-9	Component 1: C ₃₉ H ₂₃ ClCrN ₇ O ₁₂ S ₂ Na	No intentional use	250 ppm
Not Allocated	Component 2: C ₄₆ H ₃₀ CrN ₁₀ O ₂₀ S ₂ ·3Na		

Aromatic amine's restricted concentration



iii. Several particular thesis related to sustainable chemical development

Graduation thesis on the application of natural compounds to dyeing and finishing fabrics :

❖ **Aim: Create natural compounds to apply textile products but only just stop in laboratory scale. At present, They have not implemented in pilot.**

- Investigation of dyeing silk fabric and viscose fabric from mangrove bark peel extract
- Investigation of antibacterial ability on cotton and CVC fabrics treated with tannin-containing extracts from Betel leaves
- Investigation of dyeing silk fabric from King orange peel extract
- Investigation of dyeing Terylene/Cotton (TC) from Curcuma Longa L
- Investigate the process of dyeing 100% Merino wool fibers with food coloring
- Investigation of dyeing silk fabric from perilla leaf extract
- Research on antibacterial activity of cotton fabric dyed with spent coffee extract
- Completed antibacterial research on cotton fabric from water lily extract
- Investigation the dyeing process of Diospyros mollis extract on silk fabrics
- Investigate the dyeing process of 100% Cotton and 100% wool fabrics from extracts of Camellia leaves containing Anthocyanin compounds
- Investigate the natural dyeing process for cotton fabric by indigo extracted from indigo with fructose reducing agent

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