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أثر المواد الضارة المستخدمة في عمليات صباغة وطباعة و تجهيز المنسوجات على صحة وسلامة العاملين مع تقييم المخاطر الأخرى

Effects of Textile Dyeing, printing & Finishing Harmful substances on Human Health & risk assessment of other hazards

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Abstract

Textile industries in order to give finished fabrics it undergoes several process in dyeing process. The dyeing process is the most hazards process among all the textile industry processes. The hazards are caused due to the chemicals used in dyeing processes. Chemicals used in dyeing process rather than dyes are the most hazardous materials in this process, some hazards lead to severe effects on workers when they exposed continuously to their effects, as well as these chemicals may lead to fire if they not stored properly. Dyes are further classified in to several other classes of dyes, each dye have its own hazards based on the different chemicals used in the dyeing processes. Some of these are very hazards chemicals include potassium dichromate, alkyl amine, etc..., Thus its very important to know the various hazards of these chemicals that we are exposed to due to dyeing process as well hazards that is caused due to usage of substrate that are dyed using highly toxic materials.

key words

OHS, Dyeing process, Textile industry, Hazards, disperse dyes, MSDS , levelling agents

Boundaries: the research conducted during March -April 2022, on one of Dyeing, finishing & printing facilities in Egypt.

Introduction

The appearance of global clothes trademarks was a result of some companies' studies to the customer requirements, and applications of scientific bases that facilitate producing special products have the functional and aesthetic advantages,(23), Polyester

fibers, PET (polyethylene terephthalate), are widely used in the field of the fabrics industry and have very good mechanical

performances, good resiliency, chemical properties and inertness, and heat resistance.

Several typical polyester fibers, such as micro and non-circular cross-section

(NCCS) are ones that have attracted more focus in research during the past couples of decades due to their special handle feeling, visual aesthetical appearances and highly soft touch ⁽¹⁾

Polyester fibres show outstanding resistance to damage by most common chemicals under ordinary conditions of exposure and a wide range of substances have little or no effect on their strength.

Their resistance to oxidizing and reducing agents is excellent and, as a consequence, bleaching treatments using sodium chlorite, sodium hypochlorite or hydrogen peroxide may be employed. ⁽⁵⁾

Textile finishing which deals with providing of better fibers for usage includes three processes they are preparation; dyeing and after finishing. Among these processes in this paper we will deal with hazards associated with dyeing process. Dyeing is the homogeneous coloration of textile substrates using dyes in order to improve the substantivity of the fibers and improve wetting, dispersion, leveling and other properties of dyes by adding surfactants^[2].

dyeing is the process of adding color to the polyester materials in order to improve the substantivity of the fibers, then we print the polyester fabrics with some other printing materials, to give the printed fabrics

attractive shape to the final consumer, the fabrics are treated with some other finishing materials in order to improve fabrics characteristics such as the abrasion resistance, resistance to insects, shrink

proofing, to develop wrinkle resistance, etc., ^[3,4].

Disperse dyes are traditionally non-ionic chemicals with sparing solubility in water which, consequently, are able to retain comparatively better substantivity for hydrophobic fibres, such as polyester, nylon and acetate. For the sake of efficient diffusion into textiles, the particles of disperse dye should be as fine as possible comprising low molecular weight molecules in the range of 400 – 600. It is essential for disperse dyes to be able to withstand various dyeing conditions, pH and temperature, resulting in negligible changes in shade and fastness ⁽⁵⁾

Polyester fibres are very hydrophobic, therefore, they absorb only a very small amount of water and there is no significant change in their tensile properties when they are wetted.

The moisture regain of polyester fibre is approximately 0.4% at 65% relative humidity and 20C, Polyester materials dry quickly because of their very low water absorption. ⁽⁵⁾

The Hazards and risk involved in the textile industry is high compared with other industries and least importance are given to textile industries. Most of accident do not come to the legal formalities. The People are not aware of Health & safety is due to the workers are uneducated and management not given importance due to promote OHS in Textile industry becomes a barriers in implementing OHS. The major hazards happen are physical, chemical, ergonomically & physiologically hazards along with these some of things

which can create hazards are more working hours, improper ventilation. The RPN(Risk priority number) has been find out for all the hazards in the textile industry and FEA(fault tree analysis) is done for the hazard with highest RPN no⁽¹⁶⁾.

In every industry, they are mainly concentrating on health and safety and health measures. The worker must be thought of the occupational hazard in the industry. At the same time, it is compulsory to protect the worker from a hazardous situation by management and give suitable precaution for takes the necessary steps to protect workers from a potentially hazardous situation. ⁽¹⁷⁾, As a result of the variety of designs and products that meet the human needs, these products have a negative effect on the environment due to its accumulation in large quantities after the end of the hypothetical life as wastes which pollute the environment. So, the designers try to find solutions of this problem by putting ideas to determine how they can benefit from these wastes and use it in designing new products reduce the environmental wastes. ⁽²²⁾

Historically, developments in the field of occupational safety and health (OH&S) have been mainly based on efforts to prevent accidents arising from the use of technical equipment in the work process. In general, it is possible to outline the periods in the development and understanding of safety and its scope.

Thus, the current period in particular has seen an intensive increase in requirements for the application of risk management

theory in such a way that management at different levels and in different activities is effective and takes into account the visions of possible so called catastrophic scenarios. Their probability is rated very low, but the consequences can have socially serious effects. These are, for example, activities related to spatial planning (risk assessment in planning the production or use of hazardous substances), construction of new facilities (determining the type and extent of zones in terms of explosion hazard), transport of hazardous substances (setting safety programs), etc. ⁽¹⁸⁾

Occupational Health and Safety ISO 45001:2018 in the Context of Occupational Accidents in the Conditions of Egypt

Occupational health and safety is a key concern and responsibility of the state. The role of the state is to support the protection of employees at work; social justice; strengthen the functioning of the labor market; eliminate losses from accidents at work, occupational diseases, and industrial accidents; promote suitable working conditions; increase laborefficiency and productivity; and encourage market competitiveness with an impact on business prosperity and overall development of the country.

Occupational accidents and diseases have a detrimental effect on workers and equipment and on the quantity and quality of production ⁽¹⁸⁾

METHODOLOGY

A descriptive research design was planned using a survey method. To gain a holistic

insight into the functioning and existing status of the selected textile facility unit, purposive random sampling technique was adopted for the present investigation in order to select the respondents.

Risk assessment is carry out step by step. I used to discover the risk level and zone

1. Identifying chemical risk and its level.
2. Evaluating and organizing risk.
3. Deciding on preventive measure.
4. Taking action.
5. Monitoring and inspecting.

COMMON HAZARDS DUE TO DYEING PROCESS

fire hazards

Fire hazard is one of the common hazards that prevails in the dyeing industries. The use of flammable liquids without any prior precautions such as improper storage facilities; not properly designed storerooms, not constructed of fire resistance materials with a raised and ramped sill in the doorway thus letting all the liquid to flow to the ignition region and causing a massive fire. The presence of oxidizing agents such as hydrogen peroxide may lead to increase the intensity of the fire by fuelling with oxygen. The presence of large quantities of dry fabrics and paper may also lead to huge fires. Insulation damages in electrical wiring may also cause fire. ⁽⁶⁾

Chemical Hazards:

A chemical incident is the uncontrolled release of a toxic substance, potentially resulting in harm to public health and the environment. Chemical incidents can occur as a result of natural events, or as a result of accidental or intentional

events. These incidents can be sudden and acute or have a slow onset when there is a ‘silent’ release of a chemical. They can also range from small releases to full-scale major emergencies.

The term “chemical incident” might refer to anthropogenic or technological events, including:

- an explosion at a factory that stores or uses chemicals
- contamination of the food or water supply with a chemical
- an oil spill
- a leak from a storage unit during transportation
- deliberate release of chemicals in conflict or terrorism
- an outbreak of disease that is associated with a chemical exposure.

Chemical incidents arising from natural sources include volcanos, earthquakes and forest fires. An estimated 65 000 people died due to technological events between 2009-2018.

As the production and use of chemicals continues to increase worldwide the health sector must expand its traditional roles and responsibilities to be able to address the public health and medical issues associated with the use of chemicals and their health effects. ⁽²¹⁾ The use of chemicals such as hypochlorite used as bleaching solution possess gaseous substance chlorine.

When the workers come in contact with dangerous level of chlorine they develop skin irritation, mucous membrane gets affected and thus leading to pulmonary tissue damage thus causing lung edema. The acid and alkalis used in dying process for treatment of cloth with boiling liquor expose the workers are risk to the burns and scalds. The chips flying from metals like chromium becomes hazardous when it strikes the person. Aromatic amines used in dying industries has the capability of DNA mutation. Most of the dye stuff used in the industries are skin irritants. ⁽⁷⁾

In most of the printing unit, the usage of toxic level in chemical is very high because of that workers are getting ill in the working area. Since, a major time of a worker is spent in his workplace, the need for the concern towards health problems and factors responsible for the same becomes a decisive point of the study. ⁽¹⁷⁾

Specialists in the textile industry are additionally presented to various synthetic substances, particularly those occupied with the exercises of coloring, printing and wrapping up. Over the long haul, introduction to formaldehyde could prompt respiratory trouble and dermatitis.

Inhalation and skin contact of chemicals are can create serious health problems.

Additionally, a high level of colorectal disease, thyroid tumor, testicular growth and nasal malignancy was seen among material specialists. Also presence of non-Hodgkin's lymphoma.

Hazardous substances include:

Substances used directly in work activities (e.g. adhesives, solvents, cleaning agents)

Substances generated during work activities (e.g. fumes from welding)

Normally happening substances (e.g. dust)

Biological agents such as bacteria and other micro-organisms

Cases of the impacts of dangerous substances incorporate:

Skin irritation or dermatitis as a result of skin contact:

Asthma because of building up a hypersensitivity to substances utilized at work.

Losing consciousness as a result of being overcome by toxic fumes.

Disease, which may seem long after the presentation to the concoction that caused it.

Disease from bacteria and other microorganisms (biological agents). ⁽¹⁵⁾

Risk & Hazards

Occupational Hazards are basically the risks, unpleasant experiences or accidents that take place in a workplace as a result of physical, biological, chemical, psychosocial conditions.

Each Occupational disease and injury has a major effect on economy due to loss of productive hour, man-power losses, compensation to the victim's. Due to this reason, for reduction of all occupational diseases, injuries/fatalities, corrective and preventive measures should be done.

Safety is one of the biggest issue and it is the responsibility of the owners to make sure that the worker is working in a safe environment. In the dyeing units, workers' attitudinal approach towards the

safe working condition is negative. They have no knowledge regarding the remedial action towards the problem. So, it is very necessary to observe the working conditions in order to spread awareness about the health problems and also to study their healthcare and safety facilities provided to them in the units. ^[19]

formaldehyde resins and allergic contact dermatitis

Allergic contact dermatitis due to clothing is one of the most unfortunate dermatologic conditions. The affected individuals are often almost erythrodermic and experience a persistent intractable pruritus, which can be debilitating. Since 1926, formaldehyde-containing resins have been used in the clothing industry to make wrinkle resistant fabrics. These resins employ methylol reactive groups to crosslink cellulose fibers in cotton, linen, and rayon (cellulose-based natural polymer) garments.

Formaldehyde-related contact allergy to clothing is still a concern today, despite efforts made in the textile industry in the US to switch to the resins imparting fabrics with lower amounts of free formaldehyde ^[8].

The industry now claims that the average level of free formaldehyde, contained in the textiles for US, is approximately 100–200 ppm ^[9].

Allergic contact dermatitis due to formaldehyde present in textiles was commonly reported in the literature in the 1950s and 1960s. In recent years, the textile industry has attempted to lower the amount of free formaldehyde in wearing apparel and bedding fabrics, and the

reports of contact allergy to textiles, caused by formaldehyde have become less common ^[13].

Fiber additives and allergic contact dermatitis

Fiber additives are chemicals incorporated into fibers to provide special properties, such as flame retardants, delustrants (a substance that reduces the lustre (sheen) of synthetic fibres, antioxidants, optical brighteners and ultraviolet light absorbers. The chemicals are added to the polymer solution or melt, so they become embedded and locked between the polymer fibers, as the solution coagulates or solidifies. One case of fiber additive dermatitis from 1985 was found in the literature to the present. The allergen was an ultraviolet light absorber, 2-(2-hydroxy-5-methylphenyl)benzotriazole, which had been added to spandex fibers. believe that another compound in the spandex was causing the sensitization ^[8].

Epoxy resins and allergic contact dermatitis

Epoxy resins are commonly used at workplaces because of their physical strength, strong adhesive properties, ability to resist other chemicals, low shrinkage, and ease of curing. Epoxy resin is most commonly found in adhesives and glues for both, industrial and personal use.

It may also be found in surface coatings such as paints and primers, electrical insulation, and in polyvinyl chloride products. It is thus important to recognize the role of occupational exposure to epoxy. Epoxy resins were implicated in a number of cases of allergic contact dermatitis and have subsequently become well-recognized irritant and sensitizing agents. Epoxy resin compounds can

provoke sensitization after a single exposure in about 50% of people.

Epoxy resins are well-known sensitizers and represent an occupational hazard for personnel who use or manufacture plastics, glues, paints, varnishes, composites and electrical equipment [11]. Most epoxy resins are based on the monomer diglycidyl ether of bisphenol A (DGEBA), which is also the most potent sensitizing molecule [12].

Metallic fibers and allergic contact dermatitis

Metallic fibers are rarely used in fabrics, particularly the fabrics that are worn, because such fabric tends to be abrasive during wear [13].

Mutogenic and carcinogenic potential of textiles

The mutogenicity of azo dyes and their potential to cause some types of cancer have been reported.

It has been observed that painters had developed bladder cancer after long-time exposure to azo dyes.

These compounds are mainly metabolized at the intestinal wall and in the liver, producing free aromatic amines that are potentially carcinogenic and mutagenic [14].

Hazards based on classes AZARDS BASED ON CLASSES OF DYES

Disperse dye is used for all synthetic fibers, Acid or base dyes used for wool, silk or cotton. Disperse dyes used in polyester & other, Direct dyes are very fast and used in wool and rayon. The sulphur dyes are used on cellulosic materials. Next is azo type dye this is created by dissolving naphthol in aqueous

caustic soda. The Vat dyes are made into leuco compounds with sodium hydroxide and sodium hydrosulphite.

While the mineral dyes are inorganic pigments which are salts of iron and chromium. Reactive dyes are used in hot or cold bath of soda ash and common salt for cotton. Each class of dyes has its own hazards associated with them based on the chemicals used.⁽¹⁷⁾

SULFUR DYE:

Sulfur dyes (fig.1) are synthetic organic substantive

materials dyes for cellulosic.

Sulphur dyes are water insoluble dyes hence it's made soluble by addition of alkaline compounds such as sodium sulphide or sodium hydrosulphide which acts as a reducing agent. It also uses oxidizing agents such as sodium dichromate and hydrogen peroxide.

The oxidizing agents used are mostly bleaching agents, the chemical reaction of peroxide bleaching must be controlled by

adding the agents constantly rather than at a single flow which may lead to oxygen evolution due to decomposition of

hydrogen peroxide. When the oxygen level increases than that of the relief device can withstand it leads to severe

vessel failure. Thus, the reducing agents generate more heat leading to explosion. Formaldehyde is also one of the

reducing agents, the exposure of formaldehyde will lead to cancer on nose, lung and brain. It also causes respiratory

difficulties and eczema (patches on skin with bleeding).

AZO DYES:

These dyes are the most commonly used colorants in the textile industries. The main constitute of azo dyes are aromatic amines. The azo dyes are formed by diazotization in which the aromatic amines are converted to diazonium salts further which undergoes a coupling reaction .The azo dyes contain $-N=N-$.These $-N=$ Undergoes the bond breakage in order to form $-NH_2$ which is called as amine, Amines are carcinogenic in nature thus causing cancer.

There are 24 banned amines which is considered as very hazardous when a person comes in contact with these kind of amines.

Human get exposed to banned amines either by direct or exposure of skin to these garments. Ingestion occurs due to sweating which leads the amines to migrate in the body. These thus causes mutagenic changes in the human body⁽⁶⁾

DISPERSE DYE:

Disperse dyes are only insoluble dyes they are used in polyester. It's basically based on azobenzene. These dyes are possible to create some reactions when it comes in contact with human bodies. This allergic towards disperse dyes was noticed in 1868.In 1940 nylon stockings were introduced in America which on continuous survey lead to many allergic contact dermatitis problem due to use of disperse dyes like disperse blue 124.Due to improper effluent treatment this lead to many aquatic problem by increasing the toxic levels of water stream making aquatic life a pathetic situation. ⁽⁶⁾

VAT DYES

Dyes like indigo are applied after alkaline reduction which are classified as vat dyes. The effluent from this process

contains residuals like dyestuff, reducing agents and oxidizing agents. These dyestuff creates skin irritation.

The reducing agent like sodium hydrosulphite used when contaminated with water generates heat and which might

lead to ignition. Among all the classes of dyes vat dyes are less toxic to the environment^[20].

action taken by the facility to control risk

specialized safety clothing

A variety of specialized safety clothing and equipment is available for use as protection when handling or working with dyes and chemicals. Ideally all personnel in small-scale textile production should be familiar with this equipment.

Aprons are provided for protection from splashes. Face shields are used when there is a potential for splashing, spattering or spraying of chemicals or solutions to the face. Skin contact is a potential source of exposure to toxic materials and biohazard so it is important to wear the right glove for proper protection. Safety glasses and goggles are used for eye protection and should be worn when making solutions and distributing solutions from one container to another. Overall or overcoat is worn to prevent contact with dirt and minor chemical splashes. Nose masks should be worn when making solutions in an enclosed area. According to the study,

50% percent of the population studied sometimes use protective or safety equipment while 26% do not use them at all. Twenty four percent of the respondents indicated that they use protective and safety equipment

chemical handling

use appropriate safety equipment when using chemicals. Safety education must be organised periodically by managers of small-scale textile enterprises. This must also include first aid procedures such as the immediate steps to take when

there is an accident. All textile workers must acquaint themselves with the material safety data and danger symbols and their corresponding safety gears. This material safety information must be displayed at vantage locations at their enterprises to serve as a constant reminder of safe practices.

In the long term, there should be a liaison between the Environmental Protection Agency of Ghana and the small-scale textile producers as to the appropriate ways of disposing chemicals after usage. This is an area that would require

much attention in terms of consultation and capacity building.

Material Safety Data Sheets

Material Safety Data Sheets are an important tool in achieving good health and safety standards. They provide information on names of chemicals, their properties, safe storage, handling and disposal.

Material safety data information consulted and followed for all chemicals received by the set-ups and workers should be made aware of the contents of

such information. If a supplier does not provide MSDS automatically the facility request.

To maintain high standards of health and safety, the managers should regularly review and revise their health and safety tips to keep workers safe and prevent avoidable accidents.

It is envisaged that, just as small holder textile producers form guilds to meet huge demands just before the industrial revolution in Europe, small-scale textile producers in Ghana could put in place measures that would be more sustainable

and drive them into large scale production. Hence, appropriate use of chemicals and other hazardous substances must be encouraged for a safe and more efficient work environment.

Chemicals warehouse precautions (arrangements, ventilation, location,)

Dyes, chemicals and other auxiliaries stored in a separate work area and access to this area should be limited to trained personnel. The storage area should be kept relatively cool and dry, and all items must be recorded in log books and clearly labelled in the language used by the handlers. It is important to know what chemicals one has and their compatibility because when mixed, certain chemicals may react in a hazardous way; they may react violently, generate much heat or evolve toxic gases. Textile chemicals must, therefore, be carefully stored to avoid such reactions. Some substances, such as sodium hydrosulphite, may react violently if contaminated with a small quantity of water, so should be kept covered and off the floor. Small-scale textile dyeing is an essential contributor to

the growth of the Egyptian textile industry. Its diverse operations can also have significant impacts on the local environment and resent health and safety risks to its workforce. It is, therefore, very imperative on the part of managers and proprietors of small-scale textile establishments to consider the potential safety hazards and environmental impacts in the planning

risk assessment

the facility determined risk assessment in production areas as below:

- Printing
- Non woven
- Dyeing
- Finishing
- Steaming
- Silk screen & nickel screen
- Polishing
- Color kitchen
- Wastewater treatment
- Boiler & water treatment

chemical hazards & accidents

- The Company's has identified the risk and opportunities and determining which covers impact have the potential significant of risk in each service.
- The methodology applied is mainly based on SWOTHSE analysis.
- Following are the risks identified:

- Resources
- Technological issues.
- Financial issues

- Verified the actions in progress to address the identified risks and opportunities.

- The actions are implemented through development of smart objectives and management programs.

- Actions implemented to address opportunities and risk include: Optimizing the performance to increase efficiencies

- Aspects identification and evaluation procedure was established, implemented and maintained, aspects identification and evaluation

- register was last update on the 01st of July. 2022, the following aspects were included:

- chemical hazards
- Liquid waste.
- Heat stress.
- Fire
- Solid waste.
- Hazards waste

Resources

- Appropriate resources are being identified for the task within the Company
- Top Management is involved in resource requirement
- Highly qualified staffs were provided (Admin. and technical).
- Preventive maintenance plan every year established and effectively implemented.
- Work instruction of maintenance for every machine are established by manufacture and implemented.
- Repair of machines is implemented.

- Statistical techniques are related to monitoring and measure services, check for operation and natural resources consumption,
- Daily and monthly services and activities report is implemented, checked for HSE , Production, Maintenance, Purchasing, QC. and QA activities,
- Maintenance plan for infrastructure was in place. Work environment needed to achieve conformity to services requirements was identified and managed.
- the Company has developed knowledge based learning through share point for each process and also customer related department keep on posting the related to repeated compliant issues, learning lessons, from customer etc.
- Recruitment process is implemented as per HR & Training procedure that was established and effectively implemented, appraisal for persons were carried out as per the same procedures.
- Evaluation data analysis is defined and make predictive action.
- Key persons which affecting services quality and competence were qualified and trained as HSE Manager.
- HSE training plan established & implemented every year.
- Awareness of “Chemical hazards” & HSE objective were provided for new workers evaluation of training program for all training programs effectively implemented & evaluation of trainees after programs recorded.

training

- The company established training procedure for effectively implementation of all related HSE issues
- All workers are highly qualified in the job they are doing
- Jobs profiles were established for positions defining the roles and responsibilities in form of job description, examples such as HSE Manager, HSE Specialist, Spare parts Warehouse Keeper, Mechanical Maintenance Section Head, Training Specialist.
- Organization chart was established depicting the interaction between department, functions and other activities.
- handling staff recruitment, discipline and Each departmental manager communicated the relevant OHS objectives to its staff.
- General HSE awareness to all employees and also posted in the noticed board, internal email was sent to all Employees
- The records of different awareness sessions were checked and founded completed.

Eliminating hazards and reducing OH&S risks (hierarchy of controls

- The company established, implemented and maintained Hazard Identification, Risk Assessment and Control Procedure, The procedure was identifying the hazards and to assess the

risks, Analysis of activities recorded, so identification and evaluation hazards found in place, Hazards for all activities, processes, equipment and tasks -it covers the normal, abnormal and potential situations - were identified and associated risks were determined and assessed using the defined criteria that are based on the probability of occurrence and the severity (consequences).

- Adequate and appropriate records were found to be maintained Risk assessments matrix that updated manually as well for evaluation of compliance with legalizations, accident records for the major & minor accidents registration during the period.

Emergency preparedness and response

- Emergency preparedness and response: Procedure has been in place and implemented.
- Emergency plan was established for the cases of emergencies:
 - Firefighting.
 - Oil / fuel leakage
 - Evacuation
 - Emergency equipment include the following items:
 - Fire extinguishers
 - Emergency lighting, and
 - Fire water reel
 - Training on emergency plans was provided for all employees.
 - Emergency drill to test evacuation was carried out as planned on yearly basis
 - Checked drills conducted on fire and evacuation & chemical spillage periodically.

- Procedure for emergency preparedness established & implemented.
- Emergency plan is set to address the potential emergency situations such as potential of fire, major accidents, epidemic, Emergency plan have been developed for potential of fire; it includes:
 - Layout of the site showing distribution of the firefighting facilities.
 - Organization of emergency teams and their responsibilities.
 - Emergency contact list and information
 - Information relating to local civil defense.
 - Emergency preparedness and response scenarios for all identified emergency cases at all sectors.
 - Emergency plan is well prepared.
 - Water firefighting system:
 - Firefighting water is supplied from city water (2 UG tanks 300m3 each), 2 electrical pumps, 2diesel pumps, 2 jockey
 - Hydrant system: 28 internal hose reel (1.5'') and 38 out-door hose reel (2.5'')
 - Water spray system: It has been installed at carpet.
 - Fire extinguisher system:
 - 50 CO2 (7x2kg+26x6kg+10x10kg) extinguishers located at different locations in the plant.
 - 2x400L foam tanks located at different diesel oil tanks.
 - Powder extinguishers (178x6kg+10x50kg) located at different location in the plant.

- Inspection and Maintenance of firefighting facilities:
- Checked weekly inspection of extinguishers records periodically.
- Checked weekly inspection fire hydrant records periodically.
- Training on emergency plan > checked records of training periodically.

Exercises (drills) were performed on (evacuation – firefighting) conducted periodically.

Monitoring, measurement, analysis and performance evaluation & Hazard identification and assessment

The facility apply very strict monitoring programme to control hazards & risk suah as

- Monthly inspection record for electrical panels checked periodically.
- OH&S performance monitoring include statistics for:

- Number of Near misses.
- Incident Frequency Rate.
- Incident Severity Rate.
- Lost Time Accident.
- Number of fatalities
- Accident Cost.
- Lost Time Illness.
- Aspects identification and evaluation procedure was established, implemented and maintained, aspects identification and evaluation
- register including the following aspects were included:
 - chemical hazards
 - Liquid waste.
 - Heat stress.
 - Fire
 - Solid waste.
 - Hazards waste

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Summary of material safety information conducted by the facility

Table 1. Summary of material safety information.

HAZARD SYMBOLS	EXPLANATION
	E Explosive Chemical that explodes
	O Oxidizing Chemicals that react exothermically with other chemicals.
	F+ Extremely Flammable Chemical that has an extremely low flash point and boiling point, and gases that catch fire in contact with air.
	F Highly Flammable Chemicals that may catch fire in contact with air, only need brief contact with an ignition source, have a very low flash point or evolve highly flammable gases in contact
	T+ Very toxic Chemicals that at very low levels cause damage to health.
	T Toxic Chemicals that at low levels cause damage to health.
	Carc Cat 1 Category 1 carcinogens Chemicals that may cause cancer or increase incidence.
	Carc Cat 2 Category 2 carcinogens
	Carc Cat 3 Category 3 carcinogens Carcinogens
	Muta Cat 1 Category 1 mutagens Chemicals that induce heritable genetic defects or increase their incidence.
	Muta Cat 2 Category 2 mutagens Chemicals that induce heritable genetic defects or increase their incidence.



Image # 1
Chemical signage



Image # 2
Chemical secondary containers



Image # 3
Signs of using the correct PPEs



Image # 4
Chemical storage well organization



Image # 5
Chemical storage well organization



Image # 6
Eye wash in Chemical kitchen



Image # 7
Chemical hazard waste



Image # 8
Correct PPEs



Image # 9
Chemical labelling & hazards



Image # 10
HSE instructions

DANGEROUS GOODS AND COMBUSTIBLE LIQUIDS SEGREGATION CHART

Class or Subsidiary Risk	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9
Flammable Gas	1	2	3	4	5	6	7	8	9
Non-Toxic Non-Flammable Gas	2	1	3	4	5	6	7	8	9
Toxic	3	2	1	4	5	6	7	8	9
Choking Gas	3	2	1	4	5	6	7	8	9
Flammable Liquid	3	2	1	4	5	6	7	8	9
Flammable Solid	3	2	1	4	5	6	7	8	9
Environmentally Combustible	3	2	1	4	5	6	7	8	9
Dangerous When Wet	3	2	1	4	5	6	7	8	9
Outgassing Agent	3	2	1	4	5	6	7	8	9
Organic Peroxide	3	2	1	4	5	6	7	8	9
Toxic Substance	3	2	1	4	5	6	7	8	9
Corrosive	3	2	1	4	5	6	7	8	9



Image # 11
Posting chemical compatibility chart

Image # 12
Firefighting emergency

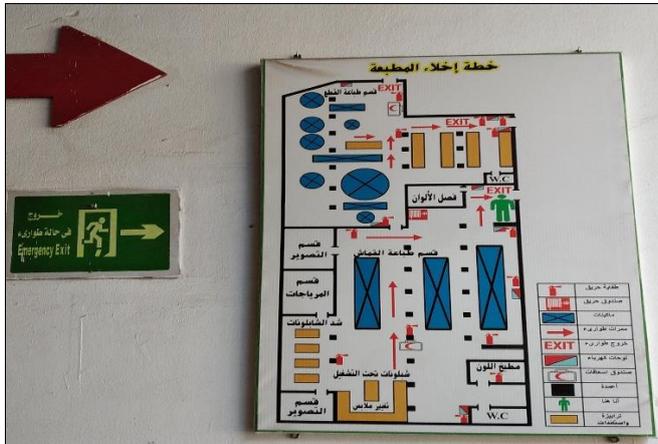


Image # 13
Emergency plan

Image # 14
Emergency Exits routes



Image # 15
Chemicals usage area authorized team ONLY

Image # 16
MSDS in chemical kitchen

الملخص:

- يتناول البحث المواد الكيميائية المختلفة المستخدمة فى عمليات الصباغة والطباعة و التجهيز و أضرار كل منها مع ذكر الإحتياطات اللازمة للوقاية من هذه الأخطار و الإجراءات الفعلية المتخذة من قبل المنشأة لتجنب الأخطار و الحوادث الكيميائية و تتضمن:
- ملابس ومعدات السلامة المتخصصة للاستخدام كحماية عند التعامل مع الأصباغ والمواد الكيميائية أو التعامل معها.
 - ملابس للحماية من البقع
 - يتم استخدام واقبات الوجه عندما يكون هناك احتمال لتناثر أو تناثر أو رش مواد كيميائية أو محاليل على الوجه.
 - ارتداء القفاز المناسب للحماية المناسبة عند ملامسة الجلد مصدرًا محتملاً للتعرض للمواد السامة والأخطار البيولوجية
 - التعامل الآمن مع المواد الكيميائية والتدريب المستمر
 - التدريب على معرفة مخاطر المواد الكيميائية MSDS
 - إشتراطات تخزين الكيماويات فى أماكن منفصلة عن مناطق العمل ويجب أن يقتصر الوصول إلى هذه المنطقة على الأفراد المدربين مع الإبقاء على منطقة التخزين باردة وجافة نسبيًا ،
 - حصر و تسجيل جميع العناصر والمواد الكيميائية و المواد المساعدة فى دفاتر
 - وضع علامات عليها بوضوح باللغة المستخدمة من قبل المتعاملين. من المهم معرفة المواد الكيميائية الموجودة ومدى توافقها لأنه عند مزجها ، قد تتفاعل بعض المواد الكيميائية بطريقة خطيرة وبعنف ، وتولد الكثير من الحرارة أو تنتج غازات سامة. لذلك ، يجب تخزين المواد الكيميائية بعناية لتجنب مثل هذه التفاعلات
 - تجنب تخزين المواد المتفاعلة مع بعضها البعض لتجنب تفاعل هذه المواد ، مثل هيدرو كبريتيت الصوديوم ، بعنف إذا كانت ملوثة بكمية صغيرة من الماء ، لذلك يجب أن تظل مغطاة وبعيدة عن الأرض