

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Vol. 7, Issue 2, February 2018

Impact of Textile Dyes on Workers

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ABSTRACT: The textile industry is one of the important industries that generates a large amount of industrial effluents. Color is the main attraction of any fabric. Manufacture and use of synthetic dyes for fabric dyeing has therefore become a massive industry. Synthetic dyes have provided a wide range of colorfast, bright hues. However, their toxic nature has become a cause of grave concern to environmentalists. Use of synthetic dyes has an adverse effect on all forms of life. Presence of sulphur, naphthol, vat dyes, nitrates, acetic acid, soaps, enzymes chromium compounds, and heavy metals like copper, arsenic, lead, cadmium, mercury, nickel, and cobalt and certain auxiliary chemicals all collectively make the textile effluent highly toxic. These organic materials react with many disinfectants, especially chlorine, and form byproducts (DBPs) that are often carcinogenic to workers and therefore undesirable.

KEYWORDS: textile dyes, synthetic, workers, environment, water pollution, effluent, heavy metals, fabric, chemicals

I.INTRODUCTION

Dyes used in textile finishing have many different, complex chemical structures and there are many products in commercial use.[1] Uncontrolled exposure to some hazardous dyestuffs is clearly recognised as potentially harmful to health; but there are a very large number of dyes that have not been associated with any adverse health effects. It is possible that, for a small number of these, adverse effects on health can occur but have not yet been detected; however, it is unlikely we will ever have complete knowledge of all the hazards of dyes. So it is prudent to minimise exposure to dyes of all types, even if no adverse health effects are known. Some reactive dyes are recognised respiratory sensitisers.[2] Breathing in respiratory sensitisers can cause occupational asthma and, once a person is sensitised, re-exposure to even very small amounts of the same dye may result in allergic symptoms such as a runny or stuffy nose, watery or prickly eyes, wheezing, chest tightness and breathlessness. Some dyes can cause allergic skin reactions. Certain reactive, vat and disperse dyes are recognised skin sensitisers.[3]

A small number of dyes, based on the chemical benzidine, are thought to cause cancer – there are substitutes for these dyes in textile use.

Other dyes may also present hazards to health. It is essential to read the safety data sheet supplied with each hazardous product.[4]

Adding sodium hydrosulphite, also known as sodium dithionite or 'hydros' to process vessels can cause serious injuries. This generally happens when the substance has been added too quickly and has solidified into a plug. The reaction is often so violent it causes the contents to erupt over the side of the vessel. [5] To avoid this, take these precautions:

- Ensure a safe system of work for adding hydros, particularly for cleaning dye vessels
- Do not add hydros to an item of plant that has previously contained an oxidising agent such as hydrogen peroxide unless it has been rinsed thoroughly first
- Always dispense hydros into clean, dry containers
- Ensure adequate ventilation to remove sulphur dioxide fumes that are likely to be created when hydros is cooled.
- Always make sure hydros is adequately diluted and that any lumps are broken up
- Consider fixing a mechanical mixer to any vessel that regularly has hydros introduced to it[5,6]

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Consider if there are less hazardous forms of the dyestuffs available. Choosing low-dusting dyes such as those in granular, dust-suppressed or liquid form can be a very important factor in reducing exposure. Remember that even liquid dyes can cause dust problems if spills are allowed to dry out[7,8]

Monitor batches of powdered dyestuffs closely and consider returning any unduly dusty product to the supplier. Restrict access to the colour store to essential trained personnel. In some dyehouses, each dyer weighs their own dye and this tends to increase the chances of spillage and reduce the standards of housekeeping. It is better to have only one or two people do all the weighing, with proper training and precautions. RPE should always be considered as a last resort:

a number of factors can seriously affect its performance, so the protection afforded to the employee decreases dramatically, eg if a respirator is badly maintained, contaminated with dyestuff, not properly adjusted to the wearer or removed for even short periods while dust is airborne[9,10]

RPE does not protect against skin irritation wearing

RPE all day may cause undue stress and discomfort to the wearer.

II.DISCUSSION

The dyeing process involves a chemical mixture of colours and cloth fibres. Dyeing is the process of applying dyes or pigments to textile materials such as fibres, yarns, and fabrics in order to get a desired colour and colour fastness. Temperature and time are critical determining elements in how dye molecules are fixed to the fibre through absorption, diffusion, or bonding. Hazards in dyeing process Fire hazards: The majority of the dye job is done with easily combustible solvents. As a result, careful storage is required. Fire hazards are workplace dangers that entail the presence of a flame, increase the likelihood of an uncontrolled fire, or increase the intensity of a fire if one does develop. [11]

Fire hazards include: Flames, Sparks, Hot objects, Flammable chemicals, Chemicals accelerants, which can increase a fire's rate of spread.

Chemical hazards: Bleaching is done with chloride solution, and the bleaching agent is atmospheric chlorine, which produces chlorine and can cause skin irritation, eye irritation, and lung inflammation. Burns and scalds are caused by the use of alkalis and acids, and many dyestuffs are skin irritants that can lead to dermatitis. Printing unit-The dye or pigments are thickened with starch or turned into an emulsion. The printing of the material in engraved cylinders absorbs this emulsion or paste. [12]

Printing hazard

Fire hazard: Up to 50% of the thickening system is made up of highly hazardous components. Fire hazards are workplace dangers that entail the presence of a flame, increase the likelihood of an uncontrolled fire, or increase the intensity of a fire if one does develop.

Sludge problems:- Because formaldehyde is a sensitive and irritant, it irritates the eyes and skin and makes breathing difficult. Because a range of dyes and chemicals are employed in different wet processing processes, textile sludge is made up of a cluster of organic and inorganic complexes with high concentrations of heavy metals as Fe, Cu, Cd, Zn, Cr, and others. Textile effluent treatment uses a variety of wastewater treatment processes.

Finishing unit-Before production, the final manufacturing procedure is finishing. In the mechanical finishing procedure, no chemicals are used to modify the structure of the cloth.

Health hazards: - Noise, temperature, and the nip points' moving parts . When formaldehyde is used to polish fabrics, it can cause blood cancer, brain cancer, and respiratory problems.[13]

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Dyeing and printing: Dyeing is the chemical reaction that occurs between the dye and the cloth fibre. In this processes, flammable solvents are employed, posing a fire risk. On a daily basis, workers are exposed to harmful levels of chlorine, which can induce lung edema. The use of organic solvents causes dermatitis (skin disease)

Hazard: Noise- (Noise induced hearing loss - NIHL). It will Result in tinnitus.

Control measures: - Proper equipment maintenance (lubrication) to limit noise, increasing the distance between source and receiver, enclosures – isolating the worker, staff rotation to reduce exposure time, and modifying job schedules are all options.

Hazard: Fire -There is a loss of life and equipment damage as a result of this. The fire is caused by a welding operation and an electrical short circuit.

Control measures: Proper housekeeping is required, as is the employment of only authorised personnel and the provision of circuit breakers.

Workers are uninformed about health and safety due to a lack of education and insufficient training. As a result, encouraging workers to be aware of occupational health and safety, implement safety measures, and only then achieve a healthy and safe workplace environment is essential. Removal, replacement, engineering controls, administrative controls, and personal protective equipments are used to develop health and safety standards in the textile industry through a hierarchy of controls.[13,14]

III.RESULTS

The textile industry is spread globally, generating around 1 trillion dollars, contributes with 7% of the total world exports and employs around 35 million workers around the world . Despite its undeniable importance, this industrial sector is one of the biggest global polluters and it consumes high amounts of fuels and chemicals [11]. The special emphasis is placed on the enormous use of drinking water in various operations of its production chain, such as washing, bleaching, dyeing, among others .The acute toxicity to textile dyes is caused by oral ingestion and inhalation, especially by exposure to dust , triggering irritations to the skin and eyes . The workers who produce or handle reactive dyes may have contact dermatitis, allergic conjunctivitis, rhinitis, occupational asthma or other allergic reactions . The latter are the result of the formation of a conjugate between human serum albumin and the reactive dye, which acts as an antigen , producing immunoglobulin E (IgE) antibodies, which combine with histamine . The Disperse Red 1 dye is also used by the textile industry and exhibits mutagenic potential . When used in vitro in human lymphocyte and human hepatoma (HepG2) cells, hepatocyte imitative cells in vivo,[12] it is capable of increasing the frequency of micronuclei which are indicative of mutagenic activity at the chromosome level .The carcinogenesis comprises multiple stages favored initially by mutagenic factors . The textile dyes may offer carcinogenicity, especially those of the azo and nitro type, and its effects manifest themselves over time .The Crystal Violet dye, a member of the cationic triphenylmethane group, shows a very intense color , and is responsible for mitotic poisoning, which is associated with abnormal accumulation of metaphases ,as well as the in vitro clastogenic effects observed in Chinese hamster ovules ,which induce chromosomal damage [13]. This powerful carcinogenic agent promotes fish tumors , as well as hepatocarcinoma, reticular cell sarcoma in various organs, such as the vagina, uterus, ovary and bladder hardened gland adenoma and ovarian atrophy in rats. In humans, it is capable of generating chemical cystitis, irritation of the skin and digestive tract, respiratory and renal failure, among others .

IV.CONCLUSIONS

Thousands of workers are engaged in textile industry worldwide. Textile industry involves the use of different kinds of dyes which are known to possess carcinogenic properties. Solvents used in these industries are also associated with different health related hazards including cancer. In previous studies on textile and iron industries, the authors have reported genotoxicity among them and observed occurrence of cancer deaths among textile industry workers. Thus, an attempt has been made to compile the studies on the prevalence of different types of cancers among textile industry

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workers. Textile industry workers are exposed to a number of chemicals which are known to have carcinogenic properties. Reviewing the data of 54 research papers on textile industry workers revealed the occurrence of different types of cancers among them. Exposure to different sets of chemicals and physical factors in textile industry may induce occupational cancer as a long term effect among textile industry workers. Formulation and use of alternate non-toxic textile chemicals for different processes should be encouraged. Conclusively, proper protection equipments and other precautionary measures should be used by the workers while dealing with toxic chemicals in these industries.[14]

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