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Review Article

Hazards of Xylene

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ABSTRACT

Xylene is an aromatic hydrocarbon. It is widely used for tissue processing, staining and for application of cover slips to slides in the histopathology laboratory. It is a flammable liquid and utmost care is required during its usage. The risks of xylene are very much recorded, making it a probable occupational hazard for the histopathological professionals. On exposure to xylene its vapors are quickly absorbed through the lungs and the gradually through the skin. Over the time more exposure to xylene prompts noteworthy amount of solvent aggregation in the fat and muscle tissue. This article reviews the intense and unending health effects of xylene through different routes of exposure.

Key words: Hazards; health; histopathological professional; xylene.

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INTRODUCTION

Xylene is an aromatic hydrocarbon created from coal tar.[1]It is used as a solvent in industry and medical technology on a wider scale. It occurs naturally in petroleum, coal and wood tar so named in light of the fact that it is found in crude wood spirit (Gr. xy`lon- wood). It is a colorless, sweet smelling liquid or gas.[2] Xylene is used as a solvent in the printing, rubber, paint and leather industries and is also found in little sums in airplane fuel, gasoline and cigarette smoke. In dentistry, xylene is utilized in histological laboratories for processing of tissues, staining and application of cover slips and as gutta percha solvent in endodontic retreatment. Its increased solvency factor permits maximum displacement of alcohol and makes the tissue transparent, upgrading paraffin penetration. In staining techniques, its exceptional dewaxing and clearing abilities add to intensely stained slides.[3]

Histopathological experts who regularlycome in contact with xylene-contaminated solvents in the place of work are the people who aremainly exposed to increased levels of xylene. The current Occupational Safety and Health Administration permissible exposure limit for xylene is 100 ppm as an 8-h time-weighted average (TWA) concentration.[4] The National Institute for Occupational Safety and Health recommended exposure limits for xylene at 100 ppm as a TWA for up to a 10-h work shift and a 40-h work week and 200 ppm for 10 min as a short-term limit.[5]In addition to occupational exposure, the main pathway of human contact is by means of soil contamination from leaking underground storage tanks having petroleum products.[3]

Hazardous Effects of Xylene on Various Organs

Nervous system

Xylene causes depression of central nervous system. Symptoms of xylene toxicity includes Nausea, headache, Feeling high, dizziness, weakness, irritability, vomiting, slowed reaction time, Giddiness, confusion, clumsiness, slurred speech, loss of balance, ringing in the ears, Sleepiness, loss of consciousness and eventually death.[2,5]

Ocular

Accidental splash in the eye can damage the surface of the eye and leads to irritation, which will take few days to heal.[2,6]

Respiratory system

Exposure to more than 200ppm can lead to Nose & throat irritation, death, severe lung congestion with focal interalveolar hemorrhage, pulmonary edema, labored breathing, impaired pulmonary function.[1]

Liver and kidney

At increased levels of exposure, xylene can harm the liver as well as kidneys, yet this is exceptionally unlikely to happen without perceptible effects on the nervous system. Normally, such damage is reversible.[3] Low-level industrial exposure does not affect the liver and the kidneys.[6]

Gastrointestinal tract

Symptoms of nausea, vomiting and gastric discomfort were seen in workers exposed to xylene vapors (unspecified concentration), which were reversible.[7]

Musculoskeletal system

Researchers exposed to xylenes (TWA 14 ppm) showed less grasping power and low muscle power in the extremities on comparison with unexposed controls. This was because of neurological effect rather than a direct effect on the muscles.[6]

Skin

Xylene, as other natural solvents, can disintegrate the skin's normal defensive oils. Recurrent or delayed skin contact can cause irritation and dermatitis, dryness, chipping and breaking of the skin. Damaged skin may permit more prominent absorption of chemicals.[8,9] Xylene effectively infiltrates clothes and can wind up in normal gloves and boots. Xylene caught in the clothing can cause burns and blistering.[2]

Reproductive system

The existing animal data is inadequate to associate xylene with any reproductive effects.[10,11] Xylene has created fetotoxic impacts like deferred ossification and behaviora leffects in animals, without maternal toxicity. Xylene inhaled by a lady can reach a developing fetus and can contaminate her breast milk. It is prescribed that pregnant and nursing ladies limit their introduction to xylene, just as they ought to limit their introduction to liquor, tobacco also, other drugs.[3]

Preventive measures

Substitution

In the field of medicinal innovation histopathology professionals are occupationally presented to xylene as it frames a necessary piece of pathological research facility as a clearing agent of tissue samples.[8] After the risky impacts of xylene ended up undeniable during the 1970s, numerous potential substitutes became accessible, some with the same number of if not more dangers. In general, these substitutes fall into four classes and are promoted under different trade names. The compound parts are one of the following:[12]

- Limonene reagents
- Aromatic hydrocarbon mixtures
- Aliphatic hydrocarbon mixtures
- Aromatic hydrocarbon mixtures
- Mineral oil mixtures

Routine methods to decrease assimilation of xylene following its intense introduction have been featured in literature. The initial step is to promptly expel the individual from the wellspring of presentation. Dermal and visual exposure can be managed by sterilizing the zone by completely washing with lukewarm water or ordinary saline and mild soap.[13,14] Ellenhorn and Barceloux have recommended the utilization of activated charcoal so as to confine the assimilation of the substance in the digestive organs.[13,15]Sevcik et al., has performed haemodialysis and haem perfusion so as to rush the expulsion of xylene from the body.[13,16]

Local Exhaust Ventilation

The place of work can be customized to reduce the inhalational hazards by installation of local exhaust ventilation with anappropriatecover.[17] Local exhaust ventilation is extremely efficient in controlling the hazards as it removes the contaminant inspite of diluting it. It ought to be in a fixed position, situated close to the resource of the hazard. It has five key components:

- A fan or blower which provides negative air pressure to draw in contaminated air.
- A hood allowing effective capture of contaminant.
- A system of ducts that transport the contaminated air away from the workplace.
- An air-cleaning device that removes the contaminants from the air
- A source of make-up air that replaces the air removed from the workplace.

A well-designed covering takes advantage of the natural movement of the contaminant. As the air moves throughout the duct, it creates friction beside the duct walls. Friction is more by the side of the corners, bends and obstructions of the duct. In general duct length should be kept as short as possible with as few bends as possible. Various types of air-cleaning devices can be used, like fabric filters, charcoal filters, cyclones, electrostatic precipitators and scrubbers.[17]

Proper protective equipment

Personal hygiene practices and protective equipment reduce the amount of a substance that is absorbed by the worker’s body after he or she has been exposed to it and also prevent hazardous toxic chemicals from being carried home. They include[2]:

Thoroughly washing hands and removing outer protective clothing before entering clean areas.

- Usage of impervious clothing such as Buna–N-rubber or Viton gloves and impervious aprons.
- A face mask or full-face organic respirator to reduce the inhalational hazards • safety goggles/face shields for eye protection.
- Periodic medical examinations and biological monitoring of the worker’s body fluids to detect if the exposure to xylene is within limits.

In spite of the fact that exposure of people cannot be completely avoided it can be kept negligible by strict adherence to the occupational and safety health guidelines proposed by Agency for Toxins Substance and Disease Registry (ATSDR). The establishment of an approved exhaust in the laboratory and a face mask or a full face organic respirator by the laboratory personnel can help limit the inhalational exposure.[18] Staff utilizing xylene ought to have an extensive knowledge of its handling characteristics. Emergency eye wash or quick drench facility should be made available to the personnel.[13]

The biological exposure index of xylene according to ACGIH is 1.5 grams of methyl hippuric acid per gram creatinine in the urine of the exposed workers.[19]As the level of urinary methyl hippuric acid correlates to that of xylene exposure, steps should be taken to detect their levels in the urine of workers periodically. Increase in the levels of the urinary metabolite warrants the necessary steps to reduce their exposure.[13,19]

CONCLUSION

Researchers in specific groups are at a more serious danger of exposure to high concentrations of xylene. Literature proposes that xylene exposure causes harmful effects on different parts of body. Researchers coming in contact with xylene ought to have a comprehension of the different lethal impacts of xylene. Appropriate handling of xylene, protective measures by people and proper disposal as per the state prerequisites can help limit the harmful impacts of xylene.

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