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Evaluating Disinfectant Health Hazards and Risks

Tech Talk

Human health risks from chemicals like disinfectants depend on both the hazards of the chemical and the amount of exposure a person has. Chemical hazard information can be found in many places but the Safety Data Sheet (SDS) and product label are common sources. Some chemicals will have worker (occupational) exposure limits developed for them, usually because they are volatile enough to get into the air and/or have significant health hazards. It is important to understand that those limits are only appropriate for healthy adult working populations and not the typically more vulnerable general public.

Once risk is characterized, by looking both at the chemical hazards and the amount of exposure, we can determine how to manage it using controls like ventilation, work practices, and personal protective equipment (PPE). The following gives more detail on the process of evaluating disinfectant health hazards and risks, along with some general hazard and exposure limit information on commonly used disinfectant chemistries.

Evaluation Steps

1. Hazard Identification – Using Toxicology Studies, Epidemiology Studies and human experience, to identify hazards which are then communicated on Safety Data Sheets and labels.

Disinfectant type	Health hazards		Occupational exposure limits (air concentrations)
	Concentrate	RTU	
Organic acids; silver	Not applicable	Mild irritation	Acetic Acid = 10 ppm Silver = 0.01 mg/m3 OSHA PEL-TWA
Phenolics	Burns	Mild irritation	Not applicable
Peroxyacetic acid	Burns; harmful if inhaled, swallowed or absorbed through skin	Harmful if swallowed	0.4 ppm ACGIH TLV-STEL
Hydrogen peroxide	Irritation; harmful if swallowed	Low health hazard	1 ppm OSHA PEL-TWA
Bleach	Burns	Depends on dilution	1 ppm (as chlorine) ACGIH TLV-STEL
Quats	Burns; harmful if swallowed or absorbed through skin	Low health hazard	Not applicable
Alcohols	Not applicable	Irritation; may cause drowsiness or dizziness	Isopropanol = 200 ppm ACGIH TLV-TWA

There are some references in the published literature to quats causing allergic respiratory reaction, but you may notice that is not included as a hazard on the table. This is because available data doesn't meet the criteria for classifying quats as a respiratory allergen on an SDS or EPA label. Quats are widely used and there are very few cases of respiratory allergy associated with them. The reports of respiratory allergy related to quats are based on a limited number of case studies. Human case studies are often unreliable in linking chemical exposure to respiratory allergy because of other factors that may be present that may also contribute to similar respiratory effects (eg. presence of other respiratory diseases or allergies, smoking habits, etc.). Scientists often use other tests (eg. animal studies, in vitro tests etc.) to better understand the connection between chemical exposure and a specific health hazard. These types of studies allow the scientists to control factors such as genetic differences and other environmental factors that may also cause a similar health effect. Currently there are no test data, besides a few human case studies, that indicate quats can cause respiratory allergy.

2. Exposure Assessment – Measuring airborne chemicals and comparing to exposure limits.
   The next step in evaluating health risk once hazards have been identified is to determine the extent of exposure. Inhalation and skin exposure are typically of more concern since ingestion of disinfectants is less likely. Gloves are often used to limit skin contact but inhalation can occur if disinfectants become airborne as gases, vapors or aerosol particulates. Air concentrations should be kept below limits, where they are applicable, and sometimes testing of the air may be needed to verify exposure limits are not exceeded. The likelihood of exposure over limits depends on many things such as how volatile the chemical is and how much is used. In the past when mostly quats were used, exposure concerns were low as they were considered low hazard and low volatility. But with the low exposure limits of some of the newer disinfectant chemicals and the large amounts of surface area they may be applied to, chemical exposure assessment may be needed when these new disinfectants are used – even if they are not sprayed, as wiping large amounts of surface area could result in enough chemical evaporation to go over their low exposure limits.

3. Risk Characterization and Management – Making changes when needed to reduce risk.
   If the evaluation indicates there is too much health risk, exposure reduction may be needed. Approaches could include using a different disinfectant, reducing the amount of exposure, increasing PPE or ventilation, and changing work practices. In general, implementing controls other than expecting PPE or behavior changes are usually more successful. Using a stronger disinfectant chemistry only when it is needed may help reduce health risk more effectively than trying to change behavior during application.

References

American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) 2014.

Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PEL).

Plog, Barbara. Fundamentals of Industrial Hygiene, 6th Edition, 2012, National Safety Council.

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