Advice & Counsel

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Is Sulfuric Acid Carcinogenic?

Dear Advice & Counsel,
I don't know why I have not looked more closely at the MSDS sheets we receive from our chemical suppliers. A review of a recently obtained MSDS for sulfuric acid relayed the information that sulfuric acid is carcinogenic. How can this be? I've handled this acid for decades, and I'm still here (and cancer-free as far as I can tell). Is this MSDS correct or should I straighten them out?

Signed,
Ollie Vitriol

Dear Mr. Vitriol,
The MSDS requires the manufacturer to include any information on the carcinogenicity of its product that is publicly available. A quick check of two organizations that publish carcinogenicity data on chemicals indicated the following:

1. American Conference
Of Governmental Industrial Hygienists
This organization[1] publishes a list of chemicals, along with recommended maximum exposure levels and health hazards. For sulfuric acid, this list indicates a TWA (time weighted average) maximum of 1 mg/m^3. It also indicates that strong inorganic acid mist from sulfuric acid has been tied to cancer of the larynx.

2. International Agency
For Research on Cancer (IARC)
This agency[2] provides the following information on sulfuric acid:

Exposure to Inorganic Acids

Sulfuric acid is the most widely used of the strong inorganic acids. Average exposures to sulfuric acid mists in pickling, electroplating and other acid treatment of metals are frequently above 0.5 mg/m^3, while lower levels are usually found in the manufacture of lead-acid batteries, and in phosphate fertilizer production. Exposure to sulfuric acid also occurs during its manufacture and during the production of isopropanol, synthetic ethanol and detergents. Hydrochloric acid is used in industries that involve acid treatment of metals, where occupational exposure levels to hydrochloric acid mists and gas are frequently above 1 mg/m^3. Exposures to hydrochloric acid may also occur during its synthesis and use in various industrial processes. Pickling and other acid treatments of metal may entail occupational exposures to nitric and phosphoric acids, but these occur less frequently than exposures to sulfuric and hydrochloric acids. Exposure to nitric acid also occurs during its manufacture and exposure to phosphoric acid in phosphate fertilizer production.

Human Carcinogenicity Data

An early study of isopropanol manufacture in the U.S. using the strong-acid process demonstrated an excess of nasal sinus cancer. Studies of one U.S. cohort of workers in pickling operations within the steel industry showed excesses of laryngeal and lung cancer, after control for smoking and other potential confounding variables had been made. A Swedish study of a cohort of workers in steel pickling also showed an excess risk for laryngeal cancer. A nested case-control study of workers in a U.S. petrochemical plant showed an elevated risk for laryngeal cancer among workers exposed to sulfuric acid. Of two population-based case-control studies in Canada, one of laryngeal cancer showed an increased risk for exposure to sulfuric acid, and one of lung cancer suggested an excess risk; the latter also suggested a risk associated with exposure to mixed inorganic acids. In all these studies, sulfuric acid mists were the most common exposure, and positive exposure-response relationships were seen in two of the studies.

Additional supporting evidence was provided by one cohort study in the soap manufacturing industry in Italy, which showed an increased risk for laryngeal cancer. Studies of three U.S. cohorts and one Swedish cohort in the phosphate fertilizer manufacturing industry showed excess lung cancer, but there was potential confounding from exposure to radon decay products in some cohorts.

Animal Carcinogenicity Data

No data were available to the Working Group.

Other Relevant Data

Acid mists containing particles with a diameter of up to a few micrometers will be deposited in both the upper and lower airways. They are irritating to mucous epithelia, cause dental erosion, and produce acute effects in the lungs (symptoms and changes in pulmonary function). Asthmatics appear to be at particular risk for pulmonary effects.

Significant increases in the incidences of sister chromatid exchange, micronucleus formation and chromosomal aberrations in peripheral lymphocytes were observed in a single study of workers engaged in the manufacture of sulfuric acid.

The studies reviewed examined the effects of pH values < 7, specifically. In cultured mammalian cells at pH 6.7 or below, cell transformation, gene mutation and chromosomal aberrations were induced. Mitotic abnormalities were induced in sea urchins and clastogenic effects in plants. Gene conversion was induced in yeast cells. No point mutation

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- Constant voltage/amperage—This type of control does not allow setting either voltage or amperage to a desired level and maintaining that level as conditions within the bath change. This is a necessity for some operations.
- Mechanical wear—Because the tapswitch is mechanical, it will eventually wear out, depending on how often it is turned. A related issue is the need to keep tapswitches from seizing up by turning them all the way up and down periodically.
- Remote control—A tapswitch rectifier cannot be easily adjusted anywhere but at the rectifier. Motorized tapswitches are available, but add cost and reduce reliability. Adjustment via PLC is generally not possible either.
- Size restrictions—Because of the need for larger and larger tapswitches as the amperage of the rectifier increases, the use of a tapswitch rectifier for large amperage draw is restricted. The increased size of the switch makes them difficult to turn and maintain, and minimizes their use in such applications.

Like any other selection of "the right tool for the right job," the tapswitch rectifier has and will continue to have a place in the plating shop. As plating becomes more sophisticated and programmable controllers make greater inroads, however, the size of that place may become less significant. ***P&SF***

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was observed in fungi, yeast or bacteria. Acid pH caused depurination of isolated DNA.

Evaluation

There is sufficient evidence that occupational exposure to strong-inorganic-acid mists containing sulfuric acid is carcinogenic.

Overall Evaluation

Occupational exposure to strong-inorganic-acid mists containing sulfuric acid is carcinogenic to humans (Group 1).

The above confirms that the MSDS is conveying the proper health hazard information to you, Mr. Vitriol. Be sure to train all of the employees with a potential of exposure in accordance with the OSHA Hazard Communication Guidelines. If your plant is in California, refer to Proposition 65 for guidance and additional requirements. You may want to investigate a change to hydrochloric acid. ***P&SF***

References

1. IARC information was obtained from IPCS INCHEM's home page on the Internet (www.inchem.org).
2. ACGIH, 1330 Kemper Meadow Dr., Cincinnati, OH 45240-1634; www.acgih.org.

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