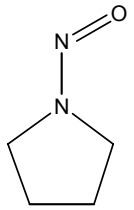
N-NITROSOPYRROLIDINE
CAS No. 930-55-2
First Listed in the *Second Annual Report on Carcinogens*



CARCINOGENICITY

N-Nitrosopyrrolidine is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC 1978, 1982, 1987). When administered in the drinking water, *N*-nitrosopyrrolidine induced lung adenomas in mice of both sexes, hepatocellular carcinomas, leukemia, cholangiocarcinomas, and olfactory carcinomas in rats of both sexes, and papillary mesotheliomas of the tunica vaginalis, interstitial cell tumors, and a cavernous hemangioma of the testis in male rats (IARC 1978).

No adequate human studies of the relationship between exposure to *N*-nitrosopyrrolidine and human cancer have been reported (IARC 1978).

PROPERTIES

N-Nitrosopyrrolidine is a yellow liquid. It is miscible with water and is soluble in organic solvents. It decomposes when exposed to light and is especially sensitive to ultraviolet light. When heated to decomposition, it emits toxic fumes of nitrogen oxides. It is oxidized by strong oxidants to corresponding nitroamine and can be reduced to the corresponding hydrazine and/or amine. It is relatively resistant to hydrolysis, but can be reduced by hydrogen bromide in acetic acid (IARC 1978, HSDB 2001).

USE

N-Nitrosopyrrolidine is used primarily as a research chemical and is not produced commercially (IARC 1978, HSDB 2001).

PRODUCTION

N-Nitrosopyrrolidine was first prepared in 1888 by the reaction of pyrrolidine with potassium nitrate in a weak hydrochloric acid solution. Chem Sources (2001) identified nine U.S. suppliers for *N*-nitrosopyrrolidine. The 1979 TSCA Inventory identified one company producing 500 lb of *N*-nitrosopyrrolidine in 1977 (TSCA 1979). No other production, import, or export data were found.

EXPOSURE

N-Nitrosopyrrolidine is produced when nitrite-preserved or -contaminated foods, especially fatty foods, are heat-prepared. Exposure occurs through inhalation of vapors released during cooking or ingestion of food. In recent years, lower concentrations of sodium nitrite in food have resulted in lower concentrations of *N*-nitrosopyrrolidine in food. For example, the *N*-nitrosopyrrolidine content of bacon decreased from approximately 67 μg/kg in 1971 through 1974 to only 17 μg/kg in 1975 and 1976; when bacon is fried, an average of 50% of the *N*-nitrosopyrrolidine normally present in that meat is detected in the vapor. Dry premixed cures containing spices and sodium nitrite originally contained *N*-nitrosopyrrolidine at concentrations of 40 μg/kg; these levels increased to 520 μg/kg after six months of storage. Investigators have also found *N*-nitrosopyrrolidine in tobacco smoke at concentrations up to 0.113 μg/cigarette, and in pipe bowl scrapings at concentrations up to 1.6 mg of *N*-nitrosopyrrolidine/kg of residue (IARC 1978).

Wastewater from chemical factories was reported to contain *N*-nitrosopyrrolidine at concentrations of 0.09 to 0.20 μg/L (IARC 1978). *N*-Nitrosamines are produced frequently during rubber processing and may be present as contaminants in the final rubber products. Significant levels of *N*-nitroso compounds have been identified in a number of materials including pesticides, cosmetics, cutting fluids, and fire resistant hydraulic fluids. The *N*-nitroso compounds found in these products were apparently formed *in situ* during storage or handling as the result of a reaction between amines present in the mixture and inorganic nitrite, which may have been added as a corrosion inhibitor (CHIP 1978).

REGULATIONS

EPA regulates *N*-nitrosopyrrolidine under the Clean Water Act (CWA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and Resource Conservation and Recovery Act (RCRA). EPA published water quality criteria under CWA. EPA has established a reportable quantity (RQ) of 1 lb under CERCLA. *N*-Nitrosopyrrolidine is subject to reporting and record-keeping requirements under RCRA.

FDA regulates *N*-nitrosopyrrolidine under the Food, Drug, and Cosmetic Act (FD&CA), requiring separate packaging of spices and sodium nitrite in dry, premixed cures. This action resulted in a dramatic decrease in the *N*-nitrosopyrrolidine content of dry mixes.

OSHA regulates *N*-nitrosopyrrolidine under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 137.

REFERENCES

Chem Sources. Chemical Sources International, Inc. http://www.chemsources.com, 2001.

CHIP. Chemical Hazard Information Profile. *N*-Nitroso Compounds. Office of Pesticide Programs and Toxic Substances, U.S. EPA, Washington, DC, 1978.

HSDB. Hazardous Substances Data Bank. Online database produced by the National Library of Medicine. *N*-Nitrosopyrrolidine. Profile last updated August 9, 2001. Last review date, January 31, 1998.

IARC. International Agency for Research on Cancer. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Some *N*-Nitroso Compounds. Vol. 17. 365 pp. Lyon, France: IARC, 1978.

IARC. International Agency for Research on Cancer. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Chemicals, Industrial Processes and Industries Associated with Cancer in Humans. Supplement 4. 292 pp. Lyon, France: IARC, 1982.

IARC. International Agency for Research on Cancer. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Overall Evaluations of Carcinogenicity. Supplement 7. 440 pp. Lyon, France: IARC, 1987.

TSCA. Toxic Substances Control Act, Chemical Substance Inventory, 1979: public record.