Hydroquinone

123-31-9

Hazard Summary

Hydroquinone is used as a developing agent in photography and as an antioxidant in rubber and food. Tinnitus (ringing in the ears), dizziness, headache, nausea, vomiting, dyspnea, erosion of the gastric mucosa, edema of internal organs, cyanosis, convulsions, delirium, and collapse may result from the ingestion of a large amount of hydroquinone in humans. Hydroquinone is also a skin irritant in humans. Chronic (long-term) occupational exposure to hydroquinone dust can result in eye irritation, corneal effects, and impaired vision. No information is available on the reproductive, developmental, or carcinogenic effects of hydroquinone in humans. There was some evidence of carcinogenic activity in orally-exposed rodents. Increased skin tumor incidence has been reported in mice treated dermally. EPA has not classified hydroquinone for carcinogenicity.

Please Note: The main source of information for this fact sheet is EPA's Health and Environmental Effects Document for p-Hydroquinone. (2) Other secondary sources include the Hazardous Substances Data Bank (HSDB) (1), a database of summaries of peer-reviewed literature, and the Registry of Toxic Effects of Chemical Substances (RTECS), a database of toxic effects that are not peer reviewed. (4)

Uses

- Hydroquinone is used as a developing agent in black-and-white photography, lithography, and x-ray films. It is also used as an intermediate to produce antioxidants for rubber and food. It is added to a number of industrial monomers to inhibit polymerization during shipping, storage, and processing. (2,7)

Sources and Potential Exposure

- Occupational exposure to hydroquinone may occur by inhalation or dermal contact. (1)
- Hydroquinone is released to the atmosphere from its production and use, such as during methyl methacrylate manufacture and in the production of coal-tar chemicals. (1,2)
- It may be released in the effluent of photographic processes and from coal gasification condensate water. (1,2)
- Individuals who develop black-and-white film may be exposed to hydroquinone, as it is a common component of developing solutions. (1)
- Hydroquinone has been detected in cigarette smoke and in diesel engine exhaust. (2)

Assessing Personal Exposure

- No information was located regarding the measurement of personal exposure to hydroquinone.

Health Hazard Information

Acute Effects:

- Tinnitus (ringing in ears), dizziness, headache, nausea, vomiting, dyspnea (labored breathing), erosion of the gastric mucosa, edema of internal organs, cyanosis (bluish coloration of the skin due to lack of oxygen in the blood), convulsions, delirium, and collapse may result from the ingestion of a large amount of hydroquinone in humans. (1-3)

- Hydroquinone is also a skin irritant in humans. (2)
- Acute (short-term) animal tests in rats, mice, and rabbits have demonstrated hydroquinone to have high acute toxicity from oral exposure. (4)

Chronic Effects (Noncancer):

- Chronic occupational exposure to hydroquinone dust has resulted in eye injuries, which varied from mild irritation and staining of conjunctivae and cornea to changes in the thickness and curvature of the cornea, loss of corneal luster, and impaired vision; prolonged exposure is required for the development of severe ocular effects. (2)
- Nausea, vomiting, abdominal cramps, and diarrhea occurred in humans who chronically consumed water contaminated with hydroquinone. However, in one study, no effects on the blood or urine parameters tested were observed in people who voluntarily ate low doses of hydroquinone for less than 6 months. (2)
- Rats chronically exposed via gavage (experimentally placing the chemical in the stomach) suffered from tremors and convulsions and death at the highest levels, as well as effects on the kidneys and stomach, and forestomach lesions were reported in mice. Rats exposed to hydroquinone in their diet ate less, lost weight, and developed aplastic anemia. Rats that consumed the chemical in their water gained weight more slowly; developed slight blood effects and dystrophic changes in the small intestines, liver, kidneys, and myocardium; and had increased liver and kidney weights. In several animal studies, no significant health effects were noted. (2,7)
- EPA has not established a Reference Concentration (RfC) for hydroquinone. (5)
- EPA has calculated a provisional Reference Dose (RfD) of 0.04 milligrams per kilogram body weight per day (mg/kg/d) for hydroquinone based on hematological effects in humans. The provisional RfD is a value that has had some form of Agency review but is not on the Integrated Risk Information System (IRIS). The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfD, the potential for adverse health effects increases. Lifetime exposure above the RfD does not imply that an adverse health effect would necessarily occur. (6)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of hydroquinone in humans.
- A slight reduction in maternal body weight gain, decreased fetal weight, increased resorption rate, and reduced fertility in males have been observed in rats orally exposed to hydroquinone via gavage or in the diet. (2)
- Exposure of rabbits to hydroquinone via gavage produced negligible developmental alterations. (1)

Cancer Risk:

- No information is available on the carcinogenic effects of hydroquinone in humans.
- Increased skin tumor incidence has been reported in mice treated dermally. (2)
- In a National Toxicology Program (NTP) study of rats and mice dosed by gavage, there was some evidence of carcinogenic activity for male rats, as shown by increases in tubular cell adenomas of the kidney; there was some evidence of carcinogenic activity for female rats, as shown by increases in mononuclear cell leukemia; there was no evidence of carcinogenic activity for male mice; there was some evidence of carcinogenic activity for female mice, as shown by increases in hepatocellular neoplasms. (1,7,8)
- EPA has not classified hydroquinone for carcinogenicity. (5)

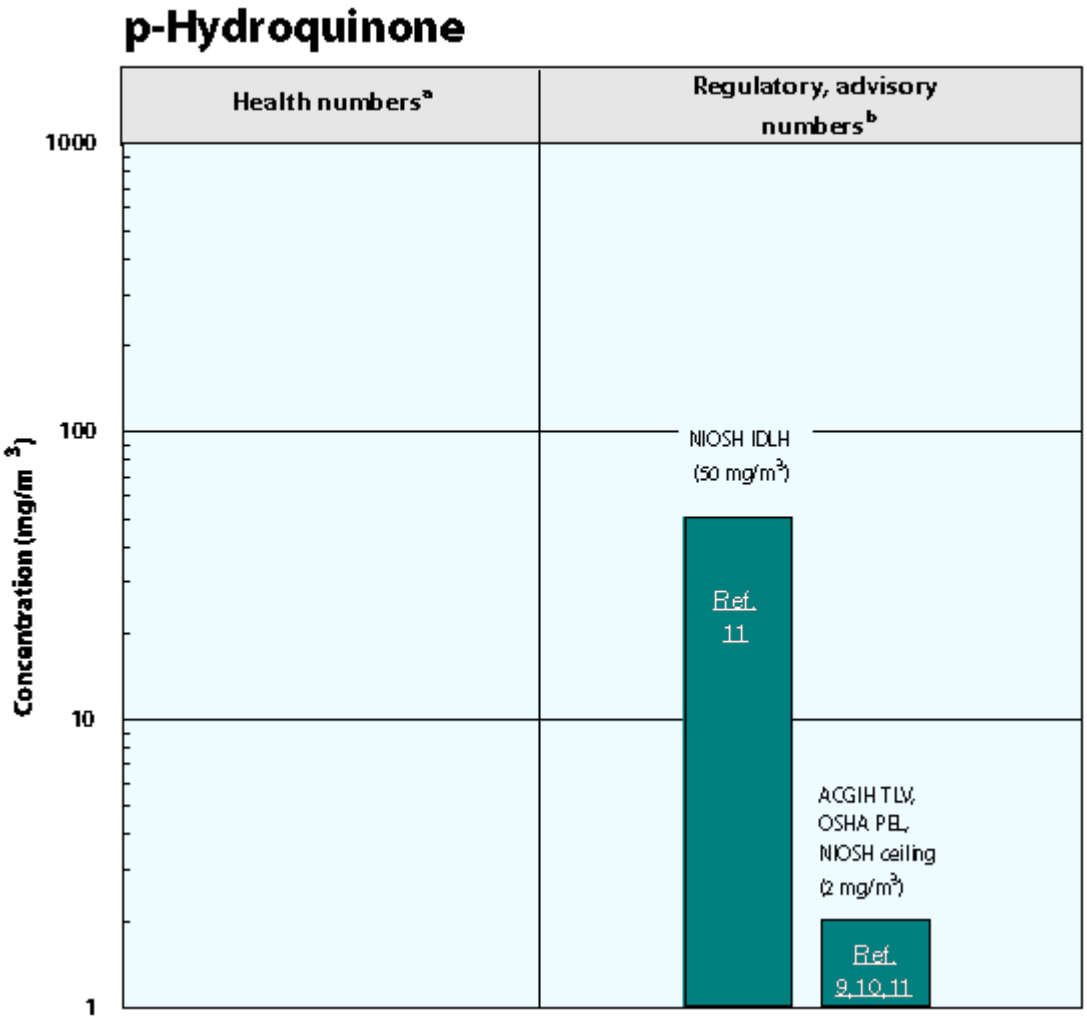
Physical Properties

- The chemical formula for hydroquinone is $C_6H_6O_2$, and its molecular weight is 110.06 g/mol. (2)
- Hydroquinone is a white crystalline solid that is soluble in water. (2)

- The odor threshold for hydroquinone has not been established.
- The vapor pressure for hydroquinone is 0.000019 mm Hg at 25 °C, and its log octanol/water partition coefficient (log K_{ow}) is 0.59. (2)

Conversion Factors:
To convert concentrations in air (at 25 °C) from ppm to mg/m^3: mg/m^3 = (ppm) × (molecular weight of the compound)/(24.45). For hydroquinone: 1 ppm = 4.5 mg/m^3.

Health Data from Inhalation Exposure



ACGIH TLV--American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.
NIOSH REL ceiling--National Institute of Occupational Safety and Health's recommended exposure limit ceiling; the concentration that should not be exceeded at any time.
NIOSH IDLH -- NIOSH's immediately dangerous to life or health concentration; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.
OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a time-

weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.

[a] Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

[b] Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH and ACGIH numbers are advisory.

Summary created in April 1992, updated January 2000

References

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