

# Poison Facts:

## High Chemicals: Formaldehyde

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### **Properties of the Chemical**

Formaldehyde is a colorless gas at ordinary temperatures. It has a pungent, suffocating odor. The chemical is very reactive and combines readily with many substances. It is miscible with water, acetone, benzene, diethyl ether, chloroform and ethanol.

Formalin is a solution of about 37 percent formaldehyde by weight in water, usually with 10 to 15 percent methanol added to prevent polymerization. This solution is full-strength and also known as Formalin 100 percent or Formalin 40, which signifies that it contains 40 grams of formaldehyde within 100 ml of the solution.

### **Uses of the Chemical**

Formaldehyde is used in fertilizers, insecticides, germicides, fungicides, herbicides, sewage treatment, paper-making preservatives, embalming fluids, disinfectants, ureaformaldehyde resins, foam insulation, industrial and soil Stalinit, urea and melamine resins, polyacetal and phenolic resins, artificial silk and cellulose esters, dye fasteners, explosives, latex-backed fabrics, particle board, plywood, air fresheners, cosmetics, wet fingernail hardeners and polishes, antimicrobial hair shampoos and conditioners, water-based paints, chemicals for tanning and preserving hides, and as a chemical intermediate.

### **Absorption, Distribution, Metabolism and Excretion (ADME)**

Formaldehyde is rapidly absorbed by ingestion and inhalation. Delayed absorption of methanol might occur following ingestion of formalin if the formaldehyde causes fixation of the stomach. Based on studies, very little formaldehyde is absorbed through the dermal route. In all cases, absorption appears to be limited to cell layers immediately adjacent to the point of contact.

Formaldehyde is rapidly metabolized to formic acid, largely in the liver by the catalytic action of alcohol dehydrogenase and to a lesser extent in erythrocytes in the brain, kidney and muscles. Formic acid is then metabolized to carbon dioxide and water through a folate-dependent enzymatic pathway. The conversion from formaldehyde to formic acid has an estimated half-life of 1.5 minutes. Formaldehyde is normally converted and excreted as carbon dioxide in the air and as formic acid in the urine. Little to no formaldehyde is excreted unchanged.

### **Clinical Effects of Acute Exposure**

- **Ocular exposures:** Formaldehyde vapors are immediately irritating to the eyes. Formaldehyde solutions of 4 to 26 percent have produced immediate discomfort and reversible corneal, iris and eyelid injury. Direct exposure can cause burns and severe corneal opacification and loss of vision. The degree of injury depends upon the dosage.

- **Dermal exposures:** Allergic dermatitis has developed with both the vapor and solution forms of formaldehyde. Reactions include simple drying, erythema, urticaria, eczematous lesions, desquamation, hyperesthesias and angioneurotic edema.
- **Inhalation exposures:** Inhalation of formaldehyde vapors at elevated concentrations may result in upper respiratory tract irritation and coughing. Severe exposure may result in serious lower respiratory effects, such as bronchitis, pulmonary edema and pneumonia. Reactive airways may develop in susceptible individuals. Respiratory distress and Acute Respiratory Distress Syndrome (ARDS) have been reported following ingestion of formaldehyde.
- **Ingestion exposure:s** Shock may develop in severe exposures. Tachypnea secondary to metabolic acidosis following ingestion is common. Hypotension and cardiovascular collapse may occur. Lethargy and coma may occur following large ingestions or marked inhalation exposures. Nausea, vomiting and severe abdominal pain may occur following ingestion. Corrosive gastritis, hematemesis, and edema and ulceration of the esophagus may occur. Strictures and perforation are possible delayed complications. Hepatotoxicity has been reported after both ingestion of formalin and inhalation of formaldehyde. Nephritis, acute renal failure and lactic acidosis may occur.

### **In-Field Treatment Prior to Arrival at a Health Care Facility**

- **Ocular exposures:** Irrigate eyes with copious amounts of water for 15 to 20 minutes.
- **Dermal exposures:** Irrigate with copious amounts of water. Remove exposed clothing and shoes.
- **Inhalation exposures:** Move victim to fresh air and away from toxic environment.
- **Ingestion exposures:** Immediately give patient small amounts of water or milk. Do not exceed 8 ounces (120-240 ml) in an adult or 4 ounces (120 ml) in a child. Emesis is contraindicated.

### **Special notes to first responders:**

- Wear a positive-pressure Self-Contained Breathing Apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.

### **Treatment of Exposures in a Health Care Facility**

- **Ocular exposures:** Initiate or continue eye irrigation using room-temperature 0.9 percent saline solution until the superior and inferior cul-de-sacs have returned to neutrality. After splash exposure to significant concentrations (25 percent), severe eye injury may develop in a delayed fashion. It may take 48 to 72 hours after the burn to assess correctly the degree of ocular damage. All patients should receive a follow-up ophthalmic exam.

- **Dermal exposures:** Remove contaminated clothing, and wash exposed areas extremely thoroughly with soap and water.
- **Inhalation exposures:** Administer 100 percent humidified oxygen. Provide assisted ventilation if needed. Administer inhaled beta-adrenergic agonist as needed for bronchospasm.
- **Ingestion exposures:** Dilute with small quantities of water – no more than 8 ounces (240 ml) for adults or 4 ounces (120 ml) for children. Lavage with a soft, small-bore NG tube soon after ingestion may be beneficial. Caution should be employed in the patient with obvious oral and esophageal injuries. Consider upper GI endoscopy or laryngoscopy to evaluate for laryngeal/tracheal, gastric or esophageal injury. Endoscopy should be performed within the first 24 hours of exposure.

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**For more poison prevention and first aid information, call the**

Poison Control Center

Serving the Residents of Kansas

Toll-free Hotline

1-800-222-1222

THE UNIVERSITY OF KANSAS HOSPITAL

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