METHANOL HEALTH EFFECTS

Methanol is a colorless liquid with a mild alcohol odor. It is widely used as a chemical feedstock to produce a variety of consumer products, including windshield washer fluid. Methanol also is an excellent hydrogen carrier for a range of fuel cell technology applications. While consumer exposure to methanol should be avoided and will continue to be minimized with the use of well-engineered fuel containers meeting stringent requirements, it is useful to review the health effects of exposure to methanol.

Methanol is toxic to humans, and is readily absorbed by ingestion and inhalation, and more slowly by skin exposure. However, methanol is already present within the human body in small quantities from eating fruits and vegetables, and drinking diet soda containing artificial sweeteners. According to the FDA, as much as 500 milligrams per day of methanol is safe in an adult's diet. In the body, methanol is metabolized in the liver, converted first to formaldehyde, and then to formate. As a building block for many biological molecules, formate is essential for survival. However, high levels of formate buildup after excessive methanol intake can cause severe toxicity and even death. Refueling a fuel cell car with methanol will only give low-dose exposures (23-38 ppm for a few minutes), with a small intake of 3 milligrams of methanol. This is less than drinking a single can of diet soda containing 200 milligrams of aspartame which would produce 20 milligrams of methanol in the body.

The initial symptoms of methanol poisoning (drinking one to four ounces) may be delayed for as long as 12 to 18 hours as the body metabolizes methanol to formate, and can consist of weakness, dizziness, headache, nausea and vomiting, and blurred vision. In severe cases of accidental or reckless ingestion, methanol poisoning may lead to permanent blindness or death, although complete recovery is the rule in patients admitted early to a hospital. There are several treatments available to combat methanol poisoning, including early treatment with sodium bicarbonate to help prevent visual impairment. In a hospital setting, hemodialysis is effective in removing both methanol and formate from the blood, and co-exposure to ethanol has been shown to reduce formate levels. h case of skin exposure to methanol, washing immediately with soap and plenty of water can prevent further skin absorption.

Methanol exposure should be avoided and can be managed safely through the proper design of fuel containers and fueling systems. A spill-free nozzle has been developed by Identic of Sweden that features a dry-connection to the fuel cell car that makes it virtually impossible for the consumer to contact methanol from the pump or the vehicle. Similarly stringent standards are now being developed for methanol fuel cartridges that will be used in a broad range of micro-fuel cell devices for consumer electronics.

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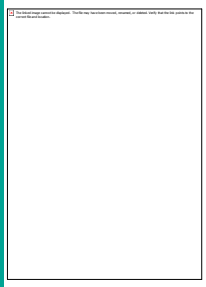
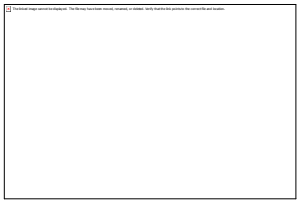
- Methanol
- Health, Safety, and the Environment
- Fuel Cells
- Biodiesel
- Reformulated Gasolines
- Alternative Fuel
- DME
- EU
- Reach **New**
- Calendar
- Who We Are
- Methanol Foundation
- Search
- FAQs
- "Members Only"



The Methanol Institute (MI) and its research arm, the Methanol Foundation, represent the global methanol industry. Our mission is to expand markets for the use of methanol as a chemical commodity building block, a hydrogen carrier for fuel cell applications, and an alternative fuel. MI was formed in 1989, during the height of the Clean Air Act debate, and worked to help create the highly successful reformulated gasoline program.

Today, methanol is one of the world's most widely distributed chemical commodities. As a basic building block for hundreds of chemical products, methanol is being used safely and effectively in everything from plastics and paints, to construction materials and windshield washer fluid.

The emergence of fuel cell technologies has the potential to create vast new markets for methanol as the hydrogen carrier of choice. Methanol fuel cell technologies can be used to power zero and near-zero emissions cars, buses and trucks. In the growing market for distributed power, stationary fuel cell systems for residential and commercial applications can also be fueled with methanol, particularly in rural locations that do not have access to natural gas lines. The earliest consumer markets for methanol fuel cell technology will power everything from laptop computers and cellular phones, to lawnmowers and portable power generators.



MI is encouraging the development of several emerging markets for methanol. Wastewater treatment plants are using methanol to reduce nitrates that can

literally kill small and large water bodies. Methanol is also considered a "superior" fuel for electric power turbines, providing an alternative to natural gas and distillate fuels that significantly reduces nitrogen oxide emissions.

Promoting the development of innovative technologies to produce methanol from renewable resources is a central focus of MI. Landfill methanol gas is being purified into a synthesis gas for the production of methanol at pilot plants in New Jersey and New York, and full commercial demonstrations in Ohio and elsewhere.

MI directs international efforts relating to methanol product stewardship and regulatory affairs. For example, MI formed a testing team to respond to the U.S. EPA's High Production Volume Chemical Testing Challenge Program, completing a rigorous analysis of the health and environmental research available on methanol. This work will form the basis for a review of methanol by the international community.

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