https://methanolfuels.org/about-methanol/environment

Methanol Fuel in the Environment

Ten or more years ago, a typical methanol manufacturing plant would emit about 0.9—1.0 metric tons of carbon dioxide for every ton of methanol produced. In addition to the environmental concerns, large CO2 emissions represent operational inefficiencies in a methanol plant, since the carbon emitted as CO2 is not available for making methanol molecules. In fact, excess CO2 from other industrial facilities can also be captured and consumed to increase methanol production. Through the implementation of efficiency improvements and through replacing of older facilities with newer plants that use more efficient technologies, over the last decade methanol plants have been able to significantly reduce CO2 emissions by up to 40%. Some facilities report emissions as low as 0.54 tons of CO2 / ton of methanol produced. This is equivalent to emitting 3.8 lbs. of CO2 per gallon of methanol.

Iceland Carbon Recycling Geothermal Meoh

A key benefit of renewable methanol is its potential to significantly reduce greenhouse gas (GHG) emissions from the transportation sector. Methanol has the highest hydrogen to carbon ratio of any liquid fuel. Relative to conventional fuels on a well-to-tank (WTT) basis, producers estimate that renewable methanol offers carbon reduction benefits ranging from 65 percent to 95 percent. These GHG benefits are among the highest for alternative fuels that can displace gasoline and diesel. For the tank-to-wheels (TTW) portion of the full fuel cycle, methanol as a transportation fuel can offer two types of advantages over conventional fuels: lower tailpipe emissions in combustion and higher efficiency vehicle technologies. When used to fuel a combustion engine, methanol has been shown to emit 15 to 20 percent less carbon than gasoline. Further, renewable methanol by incorporation "short-cycle carbon" that is part of the natural cycle that moves carbon from the atmosphere to plant and back to the atmosphere would not include CO2 in the TTW calculation of the renewable methanol's carbon footprint. Together, the WTT and TTW GHG emissions of renewable methanol represent compelling benefits that can enable the transportation sector to meet ambitious carbon reduction goals.

When burned as fuel, methanol cuts emissions of nitrogen oxides and volatile organic compounds that form ground-level ozone or "smog." Methanol is much less reactive than gasoline in the atmosphere, with the only toxic component of the emissions being

formaldehyde, compared to dozens of carcinogenic components of gasoline emissions, which also contains formaldehyde. The use of heated catalytic converters has shown that methanol-fueled auto emissions meet and exceed California's stringent Ultra Low Emission Vehicle (ULEV) emission targets for formaldehyde. Methanol fuel also does not contain the toxic BTEX additives found in gasoline—benzene, toluene, ethylbenzene, and xylenes. These compounds are highly carcinogenic, do not readily biodegrade in the environment, and are capable of contaminating groundwater supplies.

Methanol is readily biodegradable in both aerobic and anaerobic environments, with a half-life in surface and groundwater of just one to seven days compared to a half-life for benzene in groundwater of 10-730 days. A report prepared for the Methanol Institute by the environmental consulting firm Malcolm Pirnie concluded that relative to conventional gasoline and diesel fuel, methanol is a safer and more environmentally benign fuel the United States, more than 200 municipal wastewater treatment plants inject methanol into the treatment system to reduce nitrogen levels in plant effluent that can harm sensitive aquifers.