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Title: Phase III: The Removal of Fuel Oxygenates from Water – Saving the Future from Yesterday, 427 words

Tap water is delivered to homes, schools, and businesses and is the most readily available source of water for human consumption; consequently, our groundwater system provides the greatest opportunity for the harmful spread of pollutants, including methyl tertiary butyl ether (MTBE), diisopropyl ether (DIPE), ethyl tertiary butyl ether (ETBE), and tertiary amyl methyl ether (TAME). These fuel oxygenates, added to gasoline as a response to the Clean Air Act Amendments of 1990 for the cleaner burning of gasoline, were manufactured at the rate of over 200,000 barrels produced per day in 1999, without consideration of the effects of seepage into the groundwater system (US EPA). Acute neurotoxic effects, along with cancer and tumors at multiple organ sites were found in almost every rat and mouse exposed to these fuel oxygenates (Bond et al.). As a result, the use of these fuel oxygenates was banned in 2004.

The 2004 ban was not a sufficient remedy. In September 2006, Hartford County Maryland reported levels of MTBE at 101 ppb in the elementary school drinking water supplies (Aqua). The maximum contamination level of MTBE is 13 ppb, and children, who are exposed to seven times more water compared to their body size than adults, were exposed to dangerously high levels of MTBE two years after the use of MTBE was banned. The number of U.S. drinking water systems reporting MTBE contamination increased six-fold between 1996 and 2002. In 2002, California was reported to have the most severe contamination, with systems serving more than 30 million people reporting MTBE contamination (California). To protect ourselves and our children, I have researched an inexpensive and effective method for the removal of MTBE, DIPE, ETBE, and TAME.

After researching the removal of nitrate and ethylene dibromide/dibromochloropropane using adsorbents, I developed an experiment to determine a method to remove fuel oxygenates from contaminated waters. Water samples representing three different matrices of water – groundwater, tap water, and surface water – were spiked with 10 ppb of the MTBE, DIPE, ETBE, and TAME stock solution to simulate acute contamination of water sources. The samples were then filtered using five different adsorbents with distinctively varying physical characteristics. It was determined that divinylbenzene polymer, a synthetic adsorbent, and coconut carbon, a natural carbon, were able to remove all of the fuel oxygenates consistently, regardless of the varying background of organic content. This experiment uncovered a potable, cost-effective, efficient method that can help save our future from yesterday. For me, personally, it was the discovery of a life-long passion for research because of the life-saving potential of such discoveries.

Works Cited and Consulted

Belpoggi, Fiorella, et al. Results of Long-Term Carcinogenicity Bioassays on Tert-Amyl-Methyl-Ether (TAME) and Di-Isopropyl-Ether (DIPE) in Rats. 2002. 29 February 2008 <http://www.annalsnyas.org/cgi/content/abstract/982/1/70?ck=nck>.


Cheng, Robert, Ph.D., P.E. Personal Interview Margaret Yoo. November 2005.


