

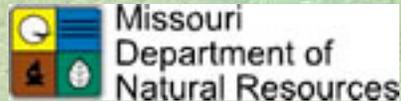
MTBE AND ETHANOL HISTORY AND ENVIRONMENTAL IMPACT

By

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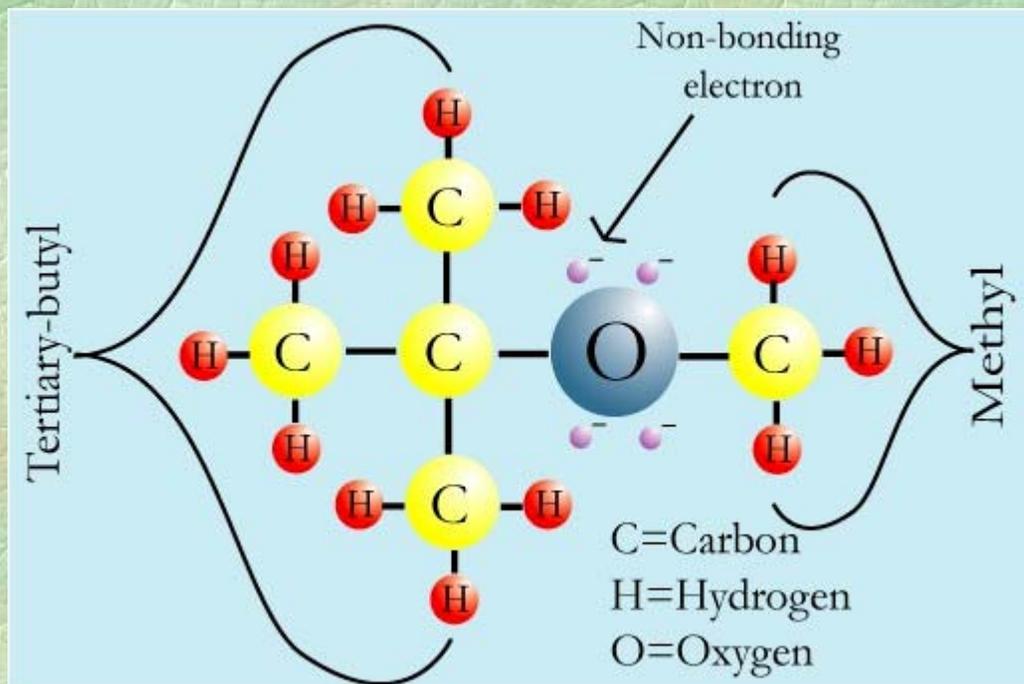


WHAT IS MTBE

- MTBE is a member of a group of chemicals commonly known as fuel oxygenates. When added to fuel, it increases its dissolved oxygen content to enhance fuel combustion.
- MTBE was also used in gasoline to reduce carbon monoxide and ozone levels in non-attainment areas caused by auto emissions.



Methyl Tertiary Butyl Ether



The oxygen atom is connected to a methyl and to a tertiary butyl by single bonds

HISTORY OF MTBE

- MTBE was first added to gasoline in the U.S. in the mid-1970s to boost octane and as an extender.
- In 1979, MTBE began to be added to gasoline in Missouri to replace lead and prevent engine knocking at amounts ranging from 1% to 8% by volume.
- MTBE was also added to gasoline to improve engine performance and make gasoline burn more completely, thereby enhancing air quality.

HISTORY OF MTBE

- In 1990, the US Clean Air Act (CAA) Amendments required the use of oxygenates in reformulated gasoline (RFG), the specific choice of oxygenates was left up to the gasoline refiners.
- In 1992, the winter oxygenate fuel program, which required 2.7% oxygen by weight in gasoline equivalent to 15% MTBE or 7.3% ethanol by volume in 40 U.S. metropolitan areas.

HISTORY OF MTBE

- In 1995, the U.S. implemented RFG Phase I, requiring 2.0% oxygen by weight in gasoline year-around equivalent to 11% MTBE or 5.4% ethanol by volume.
- RFG usage accounts for approximately 32% of the total U.S. gasoline market or approximately 100 million gallons per day.

Fuel Oxygenates Are Either Ether or Alcohol

MTBE

TBA

TBF

ETBE

DIPE

TAME

ETHANOL

METHANOL

PHYSICAL & CHEMICAL PROPERTIES OF OXYGENATES

Table 2-1. Representative Values of Chemical and Physical Properties of Various Fuel Components and Degradation Products (at 25°C unless Otherwise Specified)

Compound	CAS Number	Molecular Weight (gram/mole)	Boiling Temp. (°e)	Specific Gravity (dimensionless)	Water Solubility (mg/l)	Vapor Pressure (mm Hg)	Log Kow	Log Koc	Henry's Law	
									Constant (atm-m ³ /gram-mole)	Henry's Law Constant (dimensionless)
Methyl tert butyl ether	1634-04-4	88.15	54	0.74	50,000	251	1.2	1.1	1.5E -3	5.5E-2
Tert butyl alcohol	75-65-0	74.12	83	0.79	Infinite	41	0.35	1.6**	1.2E-5	4.9E-4
Tert butyl formate	762-75-4	102.13	82	0.89	-40,000	81*		1.1	2.7E-4	1.1E-2
Ethyl tert butyl ether	637-92-3	102.18	67	0.73	-26,000	152	1.7	1.6	2.7E-3	1.1E-1
Diisopropyl ether	108-20-3	102.18	91	0.74	-9,000*	150*	1.5	1.6	6.9E-3	2.8E-1
Tert amyl methyl ether	994-05-8	102.18	86	0.77	-20,000	68		1.7	1.3E-3	5.2E-2
Ethanol	64-17-5	46.07	79	0.79	Infinite	53	-0.24	0.71	5.9E-6	2.4E-4
Methanol	67-56-1	32.04	65	0.80	Infinite	122	-0.75	0.68	4.4E-6	1.1E-4
Benzene	71-43-2	78.11	80	0.88	1,780	86	2.0	1.9	5.4E-3	2.2E-1
Toluene	108-88-3	92.13	111	0.87	535	28	2.6	1.9	5.9E-3	2.4E-1
Ethylbenzene	100-41-4	106.16	136	0.87	161	10	3.2	2.7	8.4E - 3	3.5E-1
m-Xylene	108-38-3	106.16	139	0.88	146	8.3	3.2	2.3	7.7E-3	3.1E-1
o-Xylene	95-47-6	106.16	144	0.88	175	6.6	3.0	1.8	5.1 E - 3	2.1 E-1
p-Xylene	106-42-3	106.17	138	0.86	156	8.7	3.2	2.4	7.7E-3	3.1E-1
2,2,4-Trimethylpentane	540-84-1	114.23	99	0.69	2.4	49	4.1	4.6	3.3E+2	1.3E+4

N,.,,t'c' *, ,,+)n or

MTBE Fate And Transport Depends on its Physical and Chemical Properties

- MTBE will volatilize readily from product to air to a greater extent because it has a high vapor pressure when compared to other gasoline components.
- MTBE vapors will sink in low areas, in building basements, and crawl spaces because of its vapor density greater than air 29 gr/mole.

FATE AND TRANSPORT

- Once the released gasoline containing MTBE drains through the soil under the force of gravity and reaches the water table, it will float because of its SG less than 1.0.
- MTBE will dissolve into the groundwater because of its high solubility.
- MTBE will travel more readily with groundwater flow than adhere to soil because it has low adsorption value.

MTBE Environmental Impact

- ☛ Due to MTBE unique physical and chemical properties, more than 30 public and private drinking water supplies have been impacted throughout the state.
- ☛ Research animals developed cancer or experienced other non-cancerous health effects when exposed to MTBE.

MTBE Environmental Impact

- ☛ MTBE does not degrade (breakdown) easily and is difficult and costly to remove from groundwater.
- ☛ Studies have shown that MTBE is detected in water roughly five times more often and at higher concentrations in areas where federal RFG is sold.

MTBE Environmental Impact

- ☛ MTBE is generally more resistant to natural biodegradation than other gasoline components.
- ☛ Some monitoring wells have shown little reduction in MTBE concentration over several years which suggests that MTBE is relatively persistent in ground water.

HOUSE BILL 1207

- ☛ Released May 11, 2006, requiring gasoline sold in Missouri to contain a 10 percent ethanol blend as of January 1, 2008.
- ☛ Ethanol contains more percent of mole fraction w/w of oxygen than MTBE, which provides a cleaner and more efficient burning fuel.

Exemption from the provisions.

- ☛ Aviation fuel and automotive gasoline used in aircraft are exempt from ethanol blend requirement;
- ☛ Premium gasoline;
- ☛ Bulk transfers between terminals;
- ☛ Any specific exemptions declared by the US EPA.

What do we know about Ethanol?

- ☛ It is being sold in many service stations state wide.
- ☛ All motor vehicles manufactured since the 1970s can run on a 10 percent ethanol blend without the need for engine modifications.
- ☛ More than 70 service stations state wide provide ET85 ethanol blend.

Future Ethanol Activities

- ☛ National assessment and remediation conference for ethanol and other oxygenates in Atlanta, Georgia (November 2007)
- ☛ Creation of web site for information on ethanol cleanups
- ☛ Future seminars and newsletter articles on ethanol cleanup.

QUESTIONS ?

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http://www.neiwpcc.org/neiwpcc_docs/oxygenates07atlanta.pdf