MTBE & Engine Performance

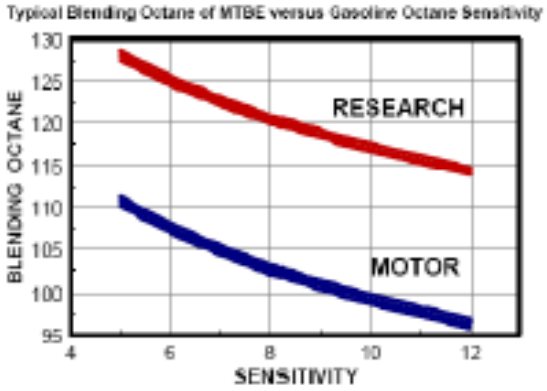
MTBE is a clear, low viscosity liquid with a terpene-like odour. Chemically, MTBE is an organic ether containing 18.2 wt% oxygen with physical properties consistent with other liquid hydrocarbons used as gasoline blending components.

In comparison to alcohols, MTBE is only slightly soluble in water, but is fully miscible with all gasoline- type hydrocarbons. Its gasoline blends are compatible with all types of gasoline distribution systems. Generally, neat MTBE is handled in the same manner as gasoline. MTBE has been shipped commercially in barges, pipelines, tank trucks, rail cars and ocean - going tankers much like gasoline. Extensive product research, as well as commercial experience, indicates that gasoline blended with MTBE has no adverse effect on automobile performance. In fact, blending MTBE enhances the properties of gasoline that generally improve the performance of the vehicles, and also reduces carbon monoxide, hydrocarbon and other pollutants from most gasoline engine vehicles.

OCTANE IMPROVEMENT

MTBE's blending octane values are nominally 117-121 RON and 99-103 MON with an octane sensitivity (RON-MON) of 17-18 octane numbers. MTBE's actual Blending Octane Values (BOV)(1) will vary depending on gasoline composition. Other factors, such as the influences of lead and MTBE concentration on octane blending value, tend to be secondary relative to that of base fuel composition. Using octane sensitivity (RON-MON) of the base fuel as a simple but reliable indicator of fuel composition, the blending octane value can be estimated as shown in Figure A.

Figure A



In general, the blending value of MTBE in unleaded gasoline will increase with :

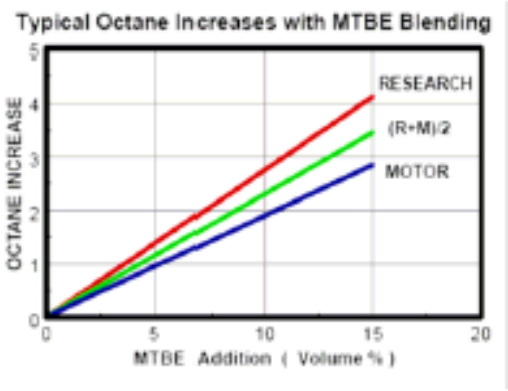
a. decreasing sensitivity of the base fuel,
b. decreasing content of olefins and/or aromatics in the base fuel, and
c. decreasing octane rating of the base fuel.

The high octane of MTBE provides a convenient way to upgrade low octane gasoline components, such as natural gasoline and low octane raffinate streams from BTX production units. For a refinery that is limited by octane capacity, each barrel of MTBE added to the gasoline pool can yield as much as 2.4 additional barrels of gasoline. With one of the highest octane blending values commercially available (higher than that of toluene, reformate or motor alkylate) MTBE is an excellent blending component in all grades of gasoline. A comparison of the (R + M)/2 blending values of MTBE and other high octane gasoline blending components is shown in the following table :

Comparison of Typical Blending Octanes in Unleaded Gasolines, (R+M)/2	
MTBE	117-121
Toluene	112-115
Xylenes	111-114
Alkylate	92-96

When used at the maximum concentrations (15 vol%) in the gasoline pool, MTBE can increase pool octane by about 4 RONs or nearly 3 MONs as shown in Figure B.

Figure B



With a relatively low RVP (Reid Vapour Pressure) and boiling temperature, MTBE is ideal for improving Front End Octane (FEON)(2) of gasoline without incurring a butane blending debit. A balanced distribution of octane in the gasoline distillation helps maximise gasoline performance under all load conditions. The FEON Number of MTBE and other high octane blending components are shown in the table below :

Typical FEON's of Various High Octane Components	
FEON	RON @ 100°C
Butane	97
Reformate	82
Alkylate	91
Toluene	68
MTBE	135

MTBE is particularly well suited for blending in premium gasoline which tend to have all its high octane components in the higher boiling range of the product. Blending MTBE lowers the 50% Point Temperature (T50) in premium gasoline, providing the refiner with added flexibility in producing a higher quality finished product. MTBE also provides a means of improving the octane of premium gasoline without increasing its already high aromatics content, which can contribute to performance problems in some vehicles. The use of MTBE in gasoline has been shown to have environmental benefits, as MTBE blends reduce hydrocarbon, carbon monoxide and other emissions from most automobiles. Because of MTBE's high octane and favourable volatility properties, MTBE blends generally realise an octane bonus for multi-cylinder engines. Gasoline containing 15 % MTBE by volume will perform like a non-oxygenated gasoline that is 0.4 to 0.8 octane number higher. As a result of these advantages (low RVP, lower T50, improved Front End Octane), MTBE is an economically attractive alternative for those refiners who face the problem of maintaining a high quality gasoline while

adhering to government imposed controls on gasoline composition. Because of MTBE's similarity to gasoline-type hydrocarbons, MTBE-gasoline blends may generally be handled in the same manner as hydrocarbon-only gasoline without the need for distribution system preparation or modification. MTBE- gasoline blends may also be mixed with hydrocarbon-only gasolines in distribution systems with no risk to final gasoline quality.