

The Star Tron[®] Ethanol Story

The sale of ethanol blended fuel (E10 and E15), is on the rise in the US as more states mandate its use. Ethanol is being used as a replacement oxygenate for MTBE which has been found to contaminate ground water supplies. While ethanol-blended fuel does result in some negative results, with smart fuel management, most of these issues can be resolved. The first problem encountered with transitioning to E10 or E15 is the loosening



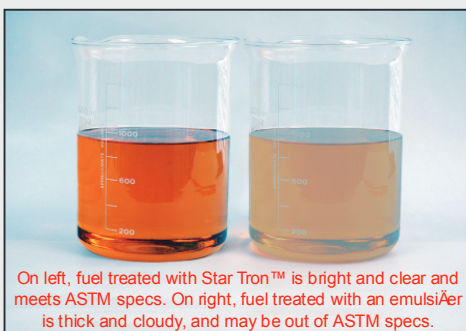
of sludge from the fuel tanks. Ethanol is a powerful solvent which will loosen buildups of varnish, gum, and resins normally found in fuel tanks. If this debris makes its way into the fuel system it can lead to clogged fuel filters, carburetors and injectors. The enzymes in Star Tron[®] will quickly and safely break down and disperse this sludge so that it can be burned off with the fuel charge.

Another problem is that ethanol produces less energy than gasoline, resulting in an overall loss of power and fuel economy compared to 100% gas. Ethanol is hygroscopic, meaning that it will attract water from the air. This water bonds to the ethanol; if the amount of water in the fuel exceeds .5%, the water/ethanol mixture becomes heavier than gas, falling to the bottom of the fuel tank to form a distinct layer and reducing the octane level of the remaining gas. This is Phase Separation; cold temperatures will accelerate this process. By neutralizing the electrical charges between water molecules (“de-ionization”) Star Tron[®] prevents the water molecules from forming into large clusters. Star Tron’s[®] powerful enzymes allow water to be dispersed throughout the fuel as sub-micron sized droplets that can be safely vaporized with the fuel charge while the engine operates, helping to keep the overall water content below the threshold level.

Fuel additives known as emulsifiers have begun to capitalize on ethanol-blended fuel problems. Ironically, some emulsifiers are made from ethanol or isopropyl alcohol or another alcohol. Some emulsifying products use chemicals such as ethanolamides or anolamides, which are detergents. Alcohol

has been used for years to “dry” out gas, but that was before ethanol was added. Adding more alcohol to E10 and E15 will further degrade the fuel issues noted above and can also violate the EPA regulations on limits of oxygenates (alcohol) allowed in the fuel, as well as the ASTM fuel specifications. Today, most engine manufacturers have certified their new engines to operate on a maximum of 10% alcohol/ethanol; an additive taking the fuel over 10% alcohol could void the warranty.

Emulsifiers have the ability to absorb their own volume in water, thus allowing more macro water clusters to bond with the fuel. Several of these “new” additives have been demonstrated via a neat sideshow trick in which water is added to gas in a test tube and the two fluids separate. When the emulsifier is added and the test tube shaken, the water appears to vanish, but in reality the water is still there. What emulsified water can do to an engine can be far worse than the original problem. Water, when sucked into an engine in volume, can shut it down. Emulsified water/ethanol causes a more serious problem; instead of shutting down the engine, the mixture can be partially combusted but not effectively, which can damage the engine and leads to significant carbon deposits. When emulsified water runs through an engine over a period of time, it causes excessive abrasion and wear, plus corrosion and wear on rings, pistons and valves. Emulsified water in the fuel can have other negative effects; water displaces gasoline which lubricates the fuel pump, causing premature wear on the fuel pump. Water reacts with various components in the fuel to form acids which can corrode the fuel injector tips. Water/gas emulsions tested by the SAE with ethanol were found to remove the plating from fuel pump internal moving surfaces (SAE 2005-01-2196, Rovai, Tanaka, Sinatora). More problems occur during combustion. The earliest reference to experiments with gasoline and water emulsifications is from 1913. Ever since then, products have been introduced that claim to eliminate water from fuel. Many attempt to do so by adding an emulsifying chemical to gasoline. General Motors and others conducted a significant amount of research on this issue in the 1970s and for several years after. In all cases, the negative effects of water/gas emulsions greatly outweighed any benefits gained. Water emulsions immediately increase the fuel’s viscosity. Even “microemulsions” that appear to be clear and stable as opposed to the milky look



On left, fuel treated with Star Tron[™] is bright and clear and meets ASTM specs. On right, fuel treated with an emulsifier is thick and cloudy, and may be out of ASTM specs.

generally associated with oil/water emulsions will thicken the fuel. Thickened fuel can destroy a fuel pump and fuel injectors. The ASTM specifications for fuel viscosity are very concise; thickening the fuel with water can take the fuel outside its specifications, which can void a warranty.

Because the emulsified water lowers the flame temperature in the combustion chamber, the combustion efficiency is greatly reduced and the amount of unburned hydrocarbons soars. This forms carbon deposits in the engine, especially on the piston crowns and on the spark plugs. In the General Motors tests (SAE 760547, Water-Gasoline Fuels, Their Effect on Spark Ignition Engines Emissions and Performance, Peters and Stebar) the deposit buildup was so rapid that the engine had to be disassembled for cleaning approximately every 20 hours. Drivability plummeted as well and fuel economy suffers in a direct ratio to the amount of water in the fuel. All negative effects increased as the water level increased. Eventually, GM abandoned their efforts with water in gasoline. The GM study reports that they did not bother to investigate the lubricity issues or long-term engine durability because the performance characteristics were so bad.



Star Tron[®]’s various enzymes will actually de-emulsify water, which is the best way to treat contaminated fuel. The advantage to removing water in microscopic amounts is that Star Tron[®]’s enzyme technology is totally harmless to an engine and will not change the ASTM specifications for fuel. Star Tron[®] will not remove water from a glass jar but it will remove water from operational boats, cars, ATVs, motorcycles or outdoor power equipment. The real Star Tron[®] advantage goes beyond just how it eliminates water or even how it cleans up sludge. Star Tron[®] is also a combustion catalyst that reduces emissions, including deadly carbon monoxide, while it increases power and fuel economy. Star Tron[®] removes combustion chamber carbon deposits, reducing an engine’s octane demand and eliminating engine knock, as well as cleaning the entire fuel system. Star Tron[®] breaks down and safely disperses gum, sludge and varnish, and it outperforms conventional chemical-based gas stabilizers, keeping fuel fresh for up to 2 years. Star Tron[®] can also restore stale fuel to serviceable condition. It can improve octane in old, sub-standard or non-spec gasoline. It does all this at the lowest cost-per-gallon-treated of any additive.

For more info, visit www.startron.com

ETHANOL 101: WHAT YOU NEED TO KNOW ABOUT ETHANOL FUEL



4 MAIN PROBLEMS WITH ETHANOL FUEL

PROBLEM 1: DEBRIS IN FUEL

Gums rapidly form in the fuel tank and fuel delivery systems as ethanol fuels age. However, ethanol is also a powerful solvent that will strip away and disperse this build up back into the fuel as large, performance-robbing particles. This leads to clogged filters, injectors and carburetors.

STAR TRON® SOLUTION: Star Tron®'s enzymes break down debris into sub-micron sized particles that can be easily burned during the combustion process, restoring full performance.

PROBLEM 2: EXCESSIVE WATER IN THE FUEL AND PHASE SEPARATION

Ethanol attracts moisture from the atmosphere, forming an ethanol/water solution mixed in the gasoline. Ethanol-blended fuel will naturally hold .5% water in suspension, but when water levels exceed this threshold, or when the fuel cools significantly, the water/ethanol mix drops out of suspension. This is phase separation. Excessive water in the fuel tank causes engines to run rough, stall, and can lead to internal damage to engine components. Ethanol provides a significant amount of the fuel's octane, so when the ethanol/water solution separates and drops to the bottom of the tank, the remaining fuel is left without enough octane to properly operate the engine. Additionally, the ethanol/water solution can become partially combustible, which can lead to engine damage.

STAR TRON® SOLUTION: Star Tron®'s enzyme formula reduces interfacial surface tension between fuel and water. The molecular cluster size is greatly reduced, allowing more water to be dispersed throughout the fuel. These sub-micron sized droplets are safely eliminated as the engine operates. Star Tron®-treated fuel helps prevent phase separation by allowing more water to be burned off than with untreated fuel, drying out the tank and preventing water buildup.

PROBLEM 3: ETHANOL FUELS BREAK DOWN QUICKLY

Over a short period of time ethanol fuel begins to break down. As ethanol and other components evaporate, the fuel loses octane and becomes "stale." This causes hard starts, pinging and engine knock, which robs your engine of power and can cause damage.

STAR TRON® SOLUTION: Star Tron® is a powerful fuel stabilizer which helps prevent fuel breakdown for up to two years. This results in easier starts and prevents pinging and knocking. Star Tron® improves octane levels of sub-standard, non-spec or old fuel and in many cases can rejuvenate stale fuel, restoring it to serviceable condition.

PROBLEM 4: ETHANOL CAUSES LOST POWER, PERFORMANCE AND DECREASED FUEL ECONOMY

Ethanol fuel does not produce as much energy as traditional fuel. This results in inefficient combustion, decreased performance, reduced throttle response and poor fuel economy.

STAR TRON® SOLUTION: Star Tron®'s enzyme formula helps to break apart large clusters of fuel molecules, creating more surface area. This allows additional oxygen to react during combustion, which results in a more complete burn of the fuel, improved fuel economy, engine power, throttle response and reduced toxic emissions. Star Tron® removes carbon deposits, keeping your engine clean and operating at peak performance.

Star Tron® is a unique, multifunctional fuel additive that addresses all ethanol issues. Star Tron® has been solving fuel problems for boaters across the US since 2003. It will improve the performance of: boats, cars, trucks, motorcycles, snowmobiles, ATVs, PWCs, generators, lawn & garden equipment and all other gas-powered engines. Star Tron® is safe for use in all engines under all conditions, even in ethanol fuels. Star Tron® is an ideal all-season, all-purpose additive, and does all this at one of the lowest costs of any fuel additive.

Be careful of what additive you use – many contain alcohol. Adding more alcohol to ethanol fuels can lead to engine problems. Read the MSDS of any fuel additive before using it with ethanol fuel. Star Tron® does not contain any alcohol and is 100% safe for use in all ethanol blends from E-5 to E-85. Star Tron® is easy to use, effective and cannot be overdosed.



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To learn the entire Star Tron® story and to find the nearest retailer, call (800) 327-8583 or log onto WWW.STARTRON.COM

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