



E10 and Water

Here Tony Lake provides some useful information and clarifications of E10 and Water to help fellow Members understand some of the concerns for classic car enthusiasts. It follows a presentation he made at the V8 Technical Day in 2019.

Is E10 Hygroscopic?

The short answer is; not enough to worry about. Pure ethanol is hygroscopic; it will absorb moisture from air. Water is miscible with the ethanol in E10, it will dissolve readily in it. That property is valuable because the very small amounts of moisture found as condensation in a fuel tank are easily transported harmlessly through a fuel system to the engine to allow the combustion process, where any water combines with the products of combustion as more steam. E10 is poor at absorbing moisture from air. It is commonly reported that E10 is hygroscopic and can absorb moisture vapour from humid air with vague but always nasty consequences. That cannot happen quickly enough to generate a harmful quantity of water. Corrosion inhibitors are blended with E0, E5 and E10 that protect fuel systems from damage.

The Environmental Protection Agency

EPA is the U.S. emissions regulator. See attachment below.

[Memorandum on Water Phase Separation in Oxygenated Gasoline](#)

The EPA published this paper in 1995 as a rebuttal to earlier misleading reporting. At a temperature of 60°F 0.5% water by volume will dissolve in E10, 0.66oz/US gallon. An imperial gallon is 20% larger. In the UK at 60°F 0.8oz of water/gallon will dissolve in E10 before saturation. Water is a contaminant that can find its way into petrol, take care to keep ground water/rainwater out of storage cans.

More extracts from EPA data

E0 at 60°F will absorb .02% water by volume before becoming saturated. A gallon of E0 left in an open can at 100°F and 100% relative humidity will take well over 200 days to become saturated with water vapour from air. At 70°F and 70% relative humidity it will take over 2 years. E10 with 25 times more water dissolving capacity will take even longer, in an open can.

Saturation

When the ethanol in E10 becomes saturated with water and the ambient temperature falls then the ethanol/water solution will drop out of the fuel and collect at the bottom of the tank. In a 12 gallon closed tank that could amount to 10ozs or half a pint of water. That is highly unlikely unless water has been poured into the tank deliberately. The fuel is then low in oxygenate and octane number and is unusable. Water absorbing products have long been available to dry out fuel tanks, they are alcohol based. Follow the instructions and let the engine consume the fuel with an alcohol/water solution dissolved in it, no different to running on E5 or E10.

BP position

This article titled "Fuel for Thought" was published in Motoring Classics Spring 2013 issue after an interview with BP Germany. BP say that the ethanol they use is not hygroscopic but is miscible with water, more of which can be harmlessly dissolved by E10 than E5, in this state there is no risk of corrosion. See attachment below. The BP interview really asserts that there isn't a case to answer. [Fuel for Thought](#)

Hard Evidence

There is no published data that supports claims that E10 is hygroscopic and will cause problems in road vehicles. There is a lot of conjecture but nothing that explains the mechanism or the time frame or how the quantity of water required to cause saturation might enter the fuel tank of a road vehicle, it is most unlikely to result from condensation from the tank walls.

Mercury Marine webinar

It is a different story in marine and inland waterways applications of engines. Here water is the enemy, hydraulic systems, gearboxes, engines, fuel and oil tanks, cooling systems all have a filler cap, pressure cap, breather or dip stick where fresh or salt water can penetrate. Mercury Marine have a similar story to tell, they really do know about water in fuel. This is the extreme case but serves to illustrate how it is dealt with and given the seasonal nature of pleasure boating followed by lay-up talks explicitly about the myths and what to do. This information is commonly found in service bulletins so to have it on line is very useful.

[Mercury Marine – water in fuel](#)

Long Term Storage

In a closed sealed fuel tank the only source of water is a very small amount from the walls caused by condensation of moisture from any air trapped in the tank at the last fill. MGs have been taken off the road for winter storage long before E5 became available. The same condensation conditions applied with E0, which has a low water saturation threshold, but without the exhortation to brim the tank. E0, E5 and E10 are blended with the appropriate corrosion inhibitors, they have to meet limits called out in BS EN228 for unleaded fuel. So those MGs that run on 97 octane and eschew ethanol should be at greater risk of a water in fuel problem if mythology holds sway; but that is not the case.

Sources

The EPA, BP and Mercury Marine reports and data are in the public domain.