

# Ethanol = Octane

## How Vehicles and Fuel Work Together

Access to higher ethanol blends is on the rise. Consumers in many cities are buying fuel at blender pumps with choices such as E10, E15, E20 and E30. These blends with 10–30% ethanol provide an octane boost, reduce emissions and cost less. As ethanol blends become more popular, it's important to note that vehicles adapt to varying levels of ethanol just like vehicles adapt to varying gasoline properties.

When discussing the use of higher blends of ethanol, it should be specific to on-road vehicles built since model year 2001 and for vehicles with a functioning exhaust system and no check engine lights. These vehicles are able to adapt because of the OBDII requirements. All cars 2001 and newer are approved to run E15 and most automakers warranty E15 fuel for nearly 90% of vehicles.

### Myth vs Science

One of the most common things you hear about ethanol is that it damages engines. This is simply not true. Ninety seven percent of gasoline in the United States contains 10% ethanol.

Numerous studies conducted by the auto industry as well as research institutions show that when you simply add higher levels of ethanol to gasoline, ethanol lowers emissions, improves performance and actually cleans the engine.

One way to monitor this is to record a vehicle's Long-Term Fuel Trim (LTFT), which provides valuable information to determine how modern vehicle adapts to varying fuel properties. As long as vehicles are operating at nominal LTFT settings, vehicles have shown to easily adapt to blends up to E30. For performance reasons, this and ignition timing are key engine parameters.

For example, a 2018 test by North Carolina State University (NCSU) compared engine computer data along with emission differences between a Flex Fuel Vehicle (FFV) and four non-FFV's.

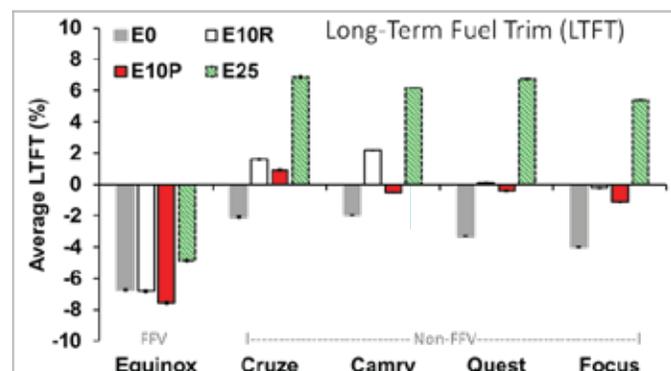


As noted in the chart below, all four non FFV's responded the same to E25 which was created by simply adding 15% more ethanol to the E10 Regular (87 AKI) fuel. Emissions were lower for CO<sub>2</sub>, CO and particulate emissions with no increase in Nitrous Oxide Emissions (NOX).

### Mileage Loss?

Ethanol blends are known for having a potential for mileage loss. Pure ethanol has about 2/3 the energy output compared to gasoline. For the Regular E10 used in most cars today, the energy loss is not noticeable. It does become more of an issue with E85, which can only be used in Flex Fuel Vehicles. But the cost of E85 usually offsets most mileage loss.

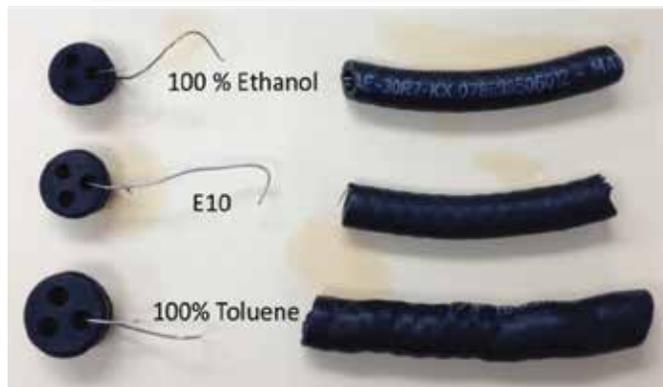
Research has found that with mid-level blends like E15, E20 and E30, there is little to no mileage loss because the vehicle's computer is adapting to the increased octane. This improved performance along with the often lower cost of ethanol blends is helping reshape the mileage argument.



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### Aromatics Causes Swelling



### Concerns about Material Compatibility

Another concern about ethanol is that it damages hoses and seals in engines. The problem is not ethanol, it is in fact the solvents found in gasoline. Aromatics such as benzene and toluene make up about 25% of every gallon of gasoline. These are the most toxic compounds and have material compatibility warning labels on diesel and jet fuel, but not gasoline.

A simple soak test using some small engine parts shows how toluene, being the most common aromatic in gasoline, can cause significant swelling in these grommets and fuel lines in just a few weeks.

What really clouds this issue regarding material compatibility is that ethanol is continually tested with a two part solvent being a 50:50 mix of iso-octane and toluene. There is no test fuel used today to test the variation of aromatics.

### Clean Octane Matters

If it wasn't for ethanol, aromatics would be a lot higher than 25% of gasoline. Since E10 was adopted, ethanol has reduced eight billion gallons of aromatics annually. This is because ethanol has twice the octane blending value of any one component of gasoline. Aromatics are the most expensive components of gasoline and often used to raise octane.

Being that aromatics create the most toxic tailpipe and evaporative emissions, the use of higher ethanol blends significantly reduce ozone and SMOG.

As new cars today start to use turbo charged engines along with smaller sized engines, the benefit for higher octane fuel will become more noticeable to consumer.

Octane plays a key part in achieving the best mileage and this mostly occurs during highway (freeway) driving conditions as well as operating under heavy loads or warmer temperatures. Simply adding 5% more ethanol to current E10, creates E15 which meets mid-grade performance as an 89 octane. Increasing ethanol to an E30 blend provides an octane rating greater than 93, which is better than a premium fuel on the market today.

Ethanol is a clean, high octane component of fuel that improves the combustion of gasoline, while cleaning your engine and the environment.



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