



RED TRAIL ENERGY, LLC

“Our Farms, Our Fuel, Our Future”

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Ethanol Corrosion Test

Here at Red Trail Energy in Richardton, North Dakota, we have been battling the myth of how corrosive ethanol is to metal. Almost 3 years ago, we decided to do our own independent testing. Here are the results we found (Figures 1–4). On March 29, 2016, we added a Grade 8 locking nut to the bottom of two different bottles. One was filled with super unleaded gas with 10% ethanol; another held our 200-proof ethanol without a wedded corrosion inhibitor. Two days later, decided to include a third bottle with a Grade 8 locking nut filled with premium gas with no ethanol. We then sealed the bottles with lids and did not touch them for 5 and a half months. At that 5-1/2 month point, we noticed that there was no effect on either the fuel or locking nuts. We decided to add 2 mL of water to see what effect it would have on the test. As you can see in the pictures, the premium gas was by far the most corrosive, followed by the super unleaded gas and, last but not least, the 200-proof ethanol, which was the least corrosive.

You are probably wondering why ethanol was the least corrosive. The reason is that ethanol is hygroscopic. This means ethanol is soluble in water because it is polar—that is, it has a partial negative charge (carbanion $C_2H_5O^-$) and a partial positive charge (hydrogen ion H^+). These charges allow ethanol to form a hydrogen bond with water; hence, ethanol dissolves in water. Not so for gasoline. With water being a polar molecule and gasoline being a primarily nonpolar molecule, water and gasoline will tend to separate when they come in contact with one another. Now let's look at the weight of ethanol and gasoline. That might make it clearer why gasoline and water separate: a gallon of gasoline weighs ~6.3 lb in comparison to a gallon of water, which weighs ~8.34 lb. Because water is heavier, it will sink to the bottom of the test vessel and rust anything at the bottom. If you look at the weight of ethanol, a gallon of ethanol weighs ~8.32 lb compared to that same gallon of water that weighs 8.34 lb, so the water and ethanol will dissolve and mix together instead of separate.

In conclusion, the myth that ethanol is corrosive and will rust out anything that it comes in contact with couldn't be further from the truth.

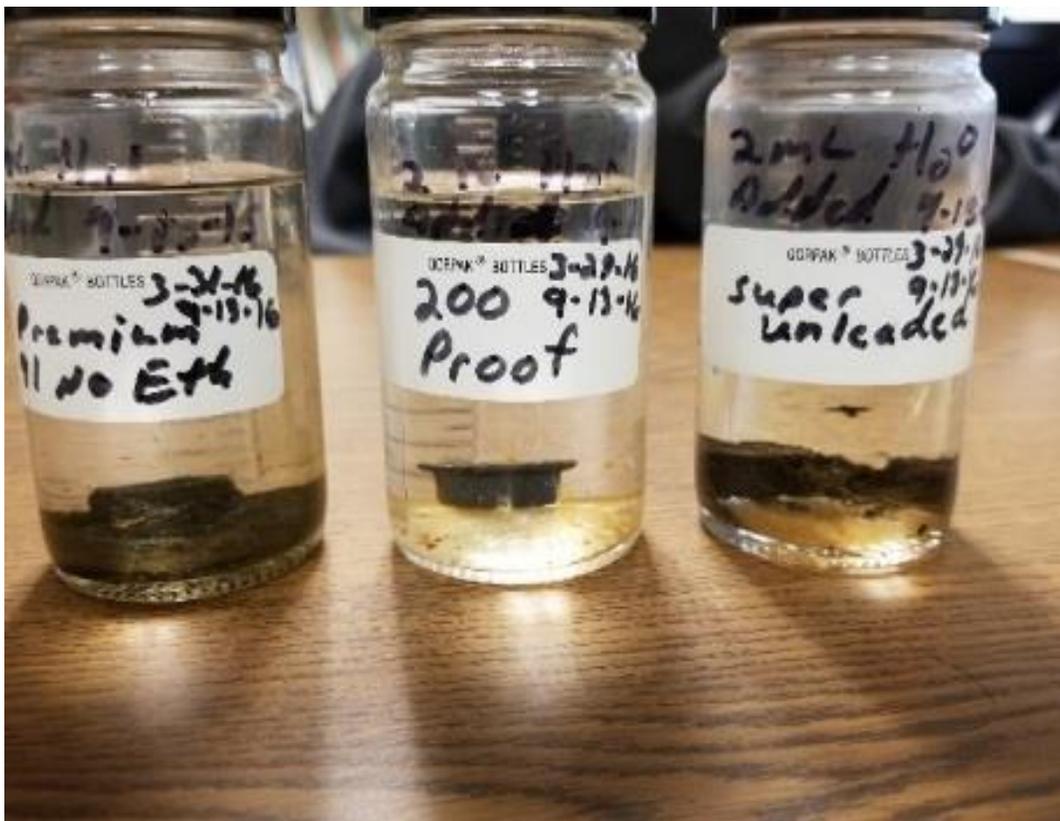


Figure 1.
Grade 8 locking
nut corrosion test

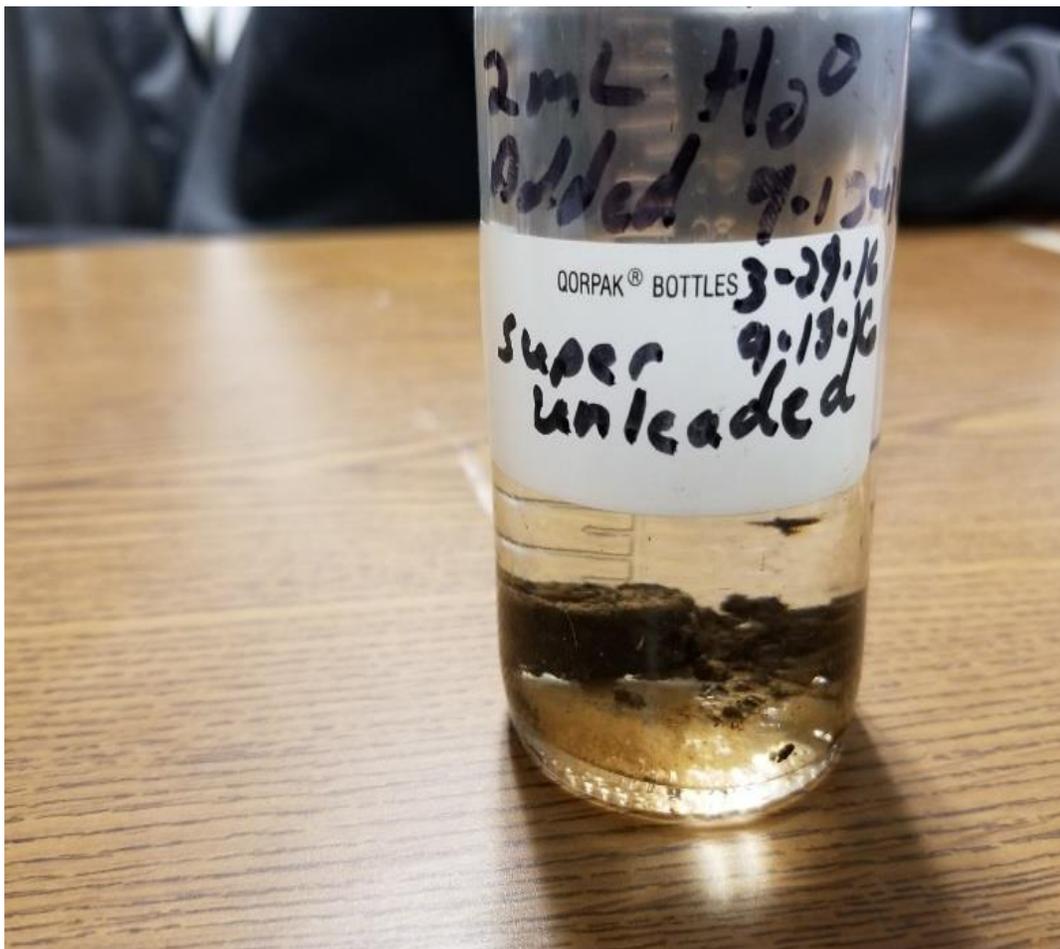


Figure 2.
Super unleaded gas
with 10% ethanol

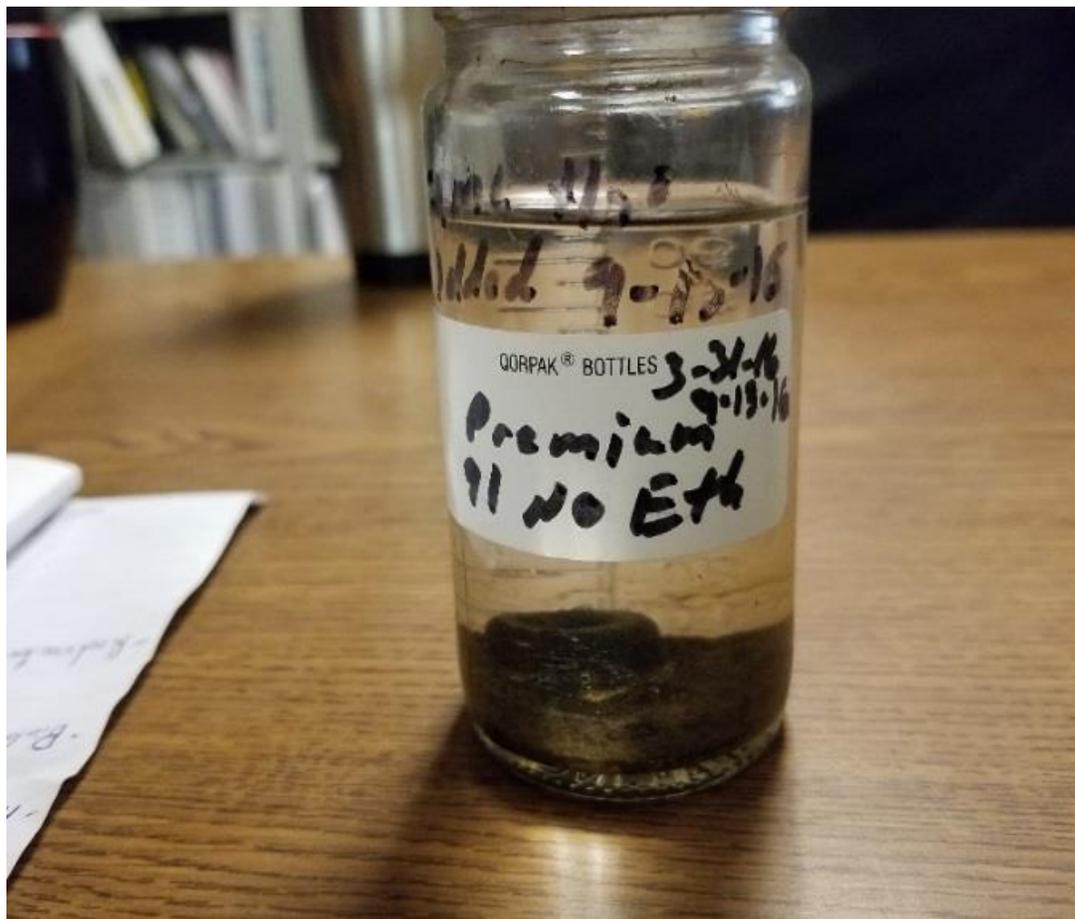


Figure 3.
Premium gas with
no ethanol

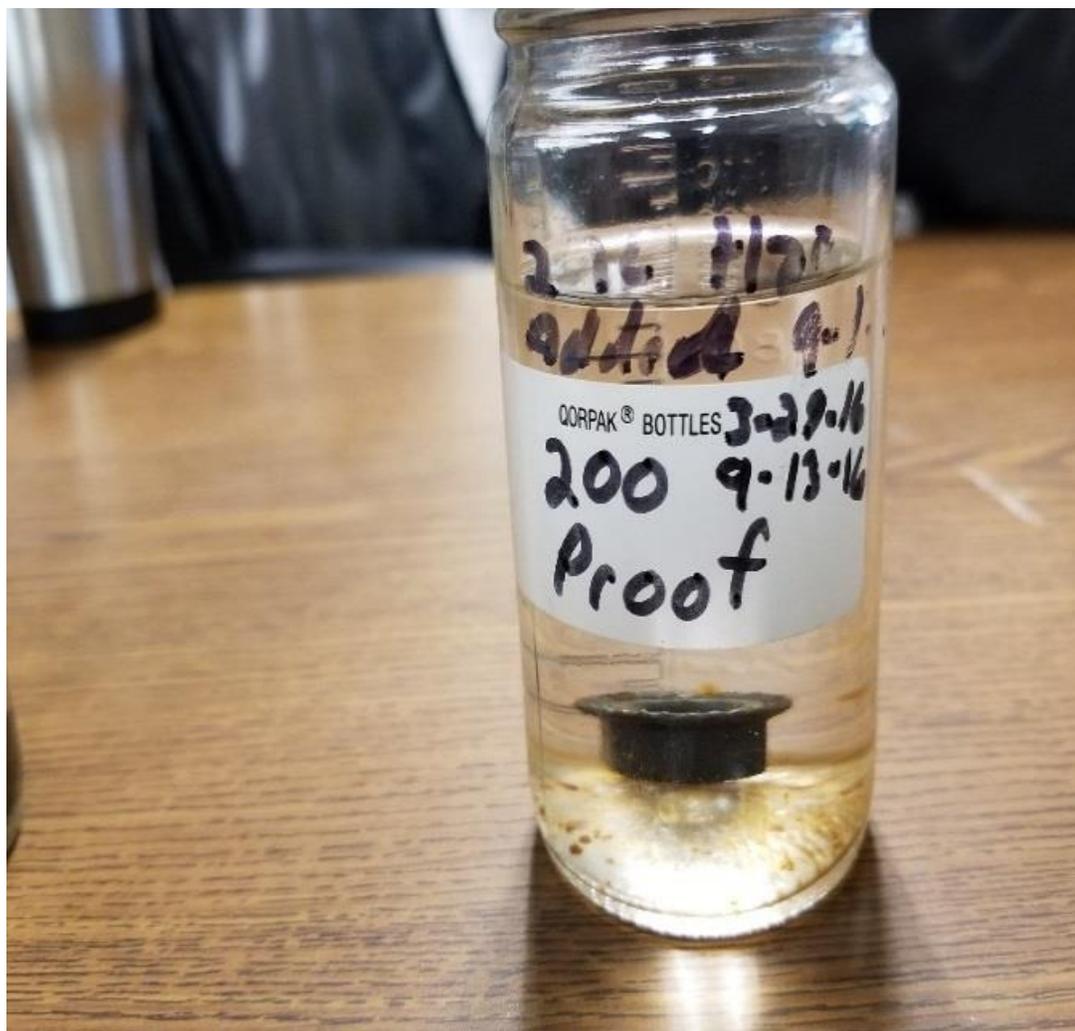


Figure 4.
200-proof ethanol
without a wedded
corrosion inhibitor