

MUCH ADO ABOUT ETHANOL!

There have been many reports of fiberglass fuel tanks failing due to ethanol in the fuel. Most of the boats were over twenty years old. However, this has raised concern among other boat owners about the safety of their fuel tanks. So what are the facts?

The truth is ethanol has been around in gasoline for a long time. It was first introduced in the 1970's as a means to reduce smog and as a replacement for lead. Gasohol was a special blend of gasoline that was 10% alcohol or more. This was not very successful at the time because it was not widely available, was more expensive than regular gasoline, and caused problems with carburetors. Plus, it wasn't normally added to marine gasoline. So if you filled up at the local auto gas station you may have gotten gasoline with alcohol, but if you filled up at the marina you didn't.

The only problem that arose with boats was with fuel hoses. In the 1980's, surveyors, marine repairers, ABYC and the Coast Guard began to notice that fuel hoses were deteriorating much more rapidly, sometimes in one season. The cause was alcohol leaching out the compounds in the hose that made it pliable. ABYC, SAE, the Coast Guard, and UL developed a new standard for fuel hose that was alcohol resistant. The regulations and standards were changed to require use of this hose, and that seemed to solve the problem. At the same time the Coast Guard did a two year long test on plastic fuel tanks and found that gasoline alone and gasoline with alcohol had no measurable effect on plastic tanks.

Soon the EPA found other compounds to add to gasoline that were less corrosive to the car and cleaner for the air. The most widely used was MTBE (methyl tertiary butyl ether). California was the first to mandate the use of MTBE and soon after the EPA began requiring its use in other states. By the 1990's it was being put into gas most everywhere in the USA.

Then MTBE began showing up in our drinking water. This was blamed on two sources, leaky underground fuel tanks, and unburned gas from boat exhaust. It also turned out to be a carcinogen, an agent that can cause cancer. There were also some anecdotal reports of headaches and other breathing problems in geographical areas where the concentration of MTBE in the fuel was highest, but these were never confirmed. So, in the early 2000's MTBE was again replaced, and the only viable and reasonable alternative was ethyl alcohol, aka ethanol. It can be made easily from all kinds of vegetable products, corn being the most common. It does not require any modifications to automobiles because by now most cars are fuel injected, and it is readily available. Proposals have been made to add as much as 85% ethanol to gasoline (E85) and some would even like to see pure alcohol fuel. This is common in Brazil, and the engine and fuel systems are built with alcohol in mind.

Where does this leave boats? Marine fuel is a very small percentage of the total fuel sold in the USA. It is already expensive and to produce separate fuels for cars and boats would

make it even more expensive, and is simply not cost effective. So now fuel for boats also has alcohol in it. Many boats still have carbureted engines, and some boats, not a huge number by anybody's count, have fiberglass fuel tanks. Most boats have aluminum or roto-molded cross-linked polyethylene tanks (plastic). Each of these reacts to alcohol differently. Fiberglass is the worst case.

In the 1980's a few boat builders were building fiberglass tanks into their boats. They were using the polyester resins that were commonly used at the time. At that time it was not known that alcohol could have a corrosive affect on fiberglass. It was known then, as it is now, that gasoline itself can dissolve fiberglass laminates, but if the builder used resins that were resistant to gas, and gel coated the tank, it was thought that it would not be affected. Unfortunately they were wrong.

A few years ago there began to be reports of fiberglass tanks failing. Over the last few years the trickle became, if not a flood, a running stream. The Boat Owners Association of the US (BOATUS) commissioned a laboratory to do testing of fiberglass tanks and found out the alcohol can dissolve the resins in the laminate. As we now know, fiberglass is not impermeable, as had been thought back in the 60's and 70's. When boats began blistering in the 1980's, the Coast Guard and others began studies to find out what was going on. To make a long story short, fiberglass reinforced plastic or FRP, is actually a semi-permeable membrane and liquids will penetrate the resins. This is what led to blistering. Alcohol will penetrate FRP as well and dissolve uncatalyzed resins. That is, resins that were not mixed well with the catalyst and never set up. If alcohol dissolves these then eventually the damage will be extensive enough that the laminate will fail. This does not happen overnight. It takes years, and it takes long exposures to alcohol. Boats typically sit for long periods of time with full fuel tanks, allowing the components of the fuel to do the damage. This has not been seen on automobiles or trucks because fuel simply does not sit in the tank and system for very long. However, the research shows that the potential exists for tanks to be damaged in a short time span, 6 months to a year, depending on the laminate, the resins used and how well the FRP laminate was made. But almost all of the tanks that have been reported as leaking have been built in the 1980's or earlier.

What about other types of tanks? It has been known for years that aluminum tanks can corrode from the inside out due to alcohol in the fuel. If the tank is left in storage for many months phase separation can occur, resulting in separate layers of fuel, alcohol and water in the tank. Acidic compounds form at the boundary between the water and alcohol and this corrodes the tank. Pin holes develop in the bottom of the tank. Boats left in storage over the winter with full tanks have been found in the spring with empty tanks and full bilges.

Plastic tanks do not appear to be affected by this. However the EPA is proposing changes to the evaporative emission standards for marine fuel systems, which will result in a change to the compounds currently used to make roto-molded polyethylene tanks. So the jury is still out.

If you have an older boat with a fiberglass tank and it is leaking, replace the tank. If its not leaking, have it pressure tested. If you will be putting your boat in storage, store it with empty tanks. This goes for aluminum tanks as well. If you have aluminum or polyethylene, take the usual precautions. Have the system pressure tested annually, inspect the hoses and fittings and use stabilizers and co-inhibitors if you store the boat with the tanks full.

It was, and still is common practice to use fiberglass tanks in diesel powered boats. Diesel apparently has no affect on fiberglass. There have been no reports of problems with these tanks.

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There are many good sources of information on the web about this subject. Here are a few.

BoatUS SeaWorthy Magazine <http://www.boatus.com/seaworthy/default.asp>

Ethanol Problems for Boaters

http://boatingsailing.suite101.com/article.cfm/ethanol_fuel_problems_for_boaters

A Pain In the Gas: Professional Boatbuilder. <http://www.proboat-digital.com/proboat/200608/?pg=32>

New Bedford Yacht Club: Notice to Boaters http://www.nbyc.com/HTMLObj-1594/Reformulated_Gasoline_Fuels.pdf

Chesapeake Bay Yacht Club Association: Republishing Coast Guard Press Release: <http://www.cbyca.org/Boating%20News/odds.htm>

Rhode Island Marine Trades Association:

http://www.rimta.org/pdf/RIMTA_News_May_2006.pdf

Professional Boatbuilder <http://www.proboat.com/> , also published an update on this in the June/July edition on page 49. **Lessons From Ethanol's Freshman Year.** Since this is the current issue as of today, June 22, 2007 it is not yet available on their web site, but when the August/September issue hits the new stand it should be.