materials of construction
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From Little Acorns to Tall Oaks

My recent article on the replacement of the small brass T-fittings on the fuel lines of the rugged Cushman golf course maintenance truck with thermoplastic fittings made of KYNAR® polyvinylidene fluoride (PVDF) caused quite a stir. The reason for the unusual reaction was not the fact that the fluoropolymer fittings cost substantially less than the brass fittings they replaced. That was just an extra bonus.

The excitement and the interest this short article raised was based on the fact that the brass fitting had to be changed because the maintenance truck was now running on an alternative fuel that corroded the brass. The golf cart engineers decided to switch from brass to PVDF because their researchers found the fluoropolymer was the recommended material of construction for components required to safely and efficiently handle ethanol, the widely used alternative fuel helping to reduce our dependency on oil.

My own curiosity was aroused by the questions being asked by system designers and consultants faced with material selection problems related to producing, storing and dispensing ethanol, as well as those product manufacturers offering engineered products such as pumps, valves, tubing, pipes and fittings required for transferring this relatively new fluid that has caught the imagination of the whole world. The ethanol boom by which it is frequently called, also touches everyone who drives an automobile or truck and anyone else concerned with the air we breathe and the environment we live in.

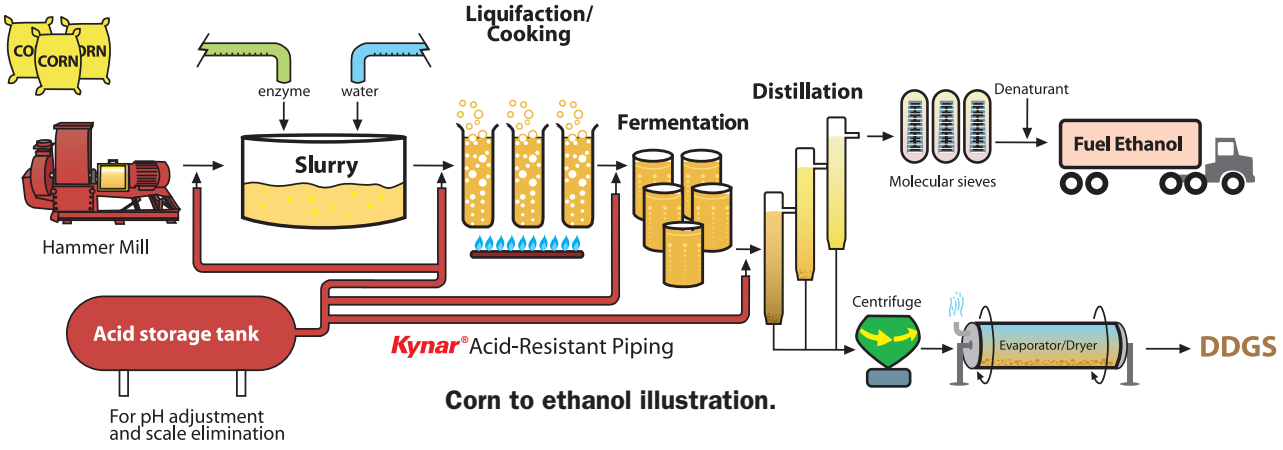
My curiosity led me to the intensive research being done by our government through the National Renewable Energy Laboratory, a Department of Energy national laboratory and the National Ethanol Vehicle Coalition. In April 2008, they published a handbook that covers every phase of handling, storing and dispensing fuel ethanol, and it also includes a separate chapter on Material Recommendations. It is interesting to note that in this section they specifically state that for vane-type pumps, the impellers should not be made of "soft metals such as zinc, brass lead or aluminum." They suggest using stainless steel or an engineered polymer with high chemical resistance.

My attention was also called to the research being done by Arkema on the suitability of their PVDF resins for fuel transfer. This question was raised by the manufacturer of the golf course tractor who asked for assurance that the KYNAR PVDF fittings would meet the compatibility requirements for E10-E85 grades of ethanol.

Here's the response from Arkema: "This letter is to confirm that Kynar® PVDF and Kynar® FLEX PVDF have good compatibility with blend gasoline ethanol CE85 and CE10 and blend biodiesel B20. They have been used in automotive fuel lines, gas station piping and off-shore umbilicals for more than ten years."

From the viewpoint of material selection in the equipment needed to store or transfer the various grades of ethanol, it is obvious that the engineered thermoplastics, particularly the fluoropolymers, play a major role. There is, however, a dark cloud on the horizon. I view it as the giant oak that is growing from the ethanol acorn we have planted.

The optimists among us point to the rapid growth of the jobs created by the building of new plants and the potential lowering of our dependence on foreign oil reserves. These are the benefits of the ethanol boom.



Corn to ethanol illustration.

Last January we had close to 100 ethanol processing plants delivering five billion gallons of ethanol and our government is pushing for continued growth that will bring us to tripling that production by the year 2012. I agree that is a production boom to be proud of, but here's the rub: Ethanol is a biofuel and biofuels divert crops, such as corn, from food to fuel. A Purdue University study points out that in 2007 the cost of food in the United States went up $22 billion, and that $15 billion of that—$130 per household—were caused by the diversion of crops to fuel.

I include this negative aspect concerning the production of and use of ethanol because various articles on the subject have been appearing in the local and national magazines and newspapers, and I don't think the thoughts they express should be ignored. It is true that corn is the primary feedstock for ethanol production in the United States, but it need not be. Sugar cane and sugar beets are the most common feedstocks outside of North America.

Ethanol can also be produced from other organic sources such as barley, wheat, rice, sorghum, potatoes as well as from wild grasses, wheat straw and other organic matter currently considered wastes such as rice straw, timbering waste and plant stover. Corn stover (mature stalks of grain) is the most abundant agricultural debris in the Americas.