Team develops device to detect biodiesel contamination

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In 2010, a Cathay Pacific Airways plane was arriving in Hong Kong when the engine control thrusts seized up and it was forced to make a hard landing—injuring dozens. The potential culprit? Contaminated fuel.

The probability of contamination of diesel fuel is increasing as biodiesel becomes more popular and as distribution and supply systems use the same facilities to store and transport the two types of fuels.

A professor and student team at the University of Tennessee, Knoxville, has developed a quick and easy-to-use sensor that can detect trace amounts of biodiesel contamination in diesel.

The work of chemistry professor Ziling (Ben) Xue and doctoral student Jonathan Fong has been published in the journal *Chemical Communications*.

"The ability to detect biodiesel at various concentrations in diesel is an important goal in several industries," said Xue. "There is particular concern over biodiesel contamination in jet fuel, because at higher levels it can impact the thermal stability and freezing point of jet fuel leading to deposits in the fuel system or gelling of the fuel. These issues can result in jet engine operability problems and possible engine flameout."

Xue and Fong tested several dyes and found that the dye Nile blue chloride dissolved in alcohol, can be made into a thin film with high sensitivity toward biodiesel contamination in jet fuel. They tested small

strips of the sensor and found it could successfully detect amounts of biodiesel contaminant in diesel as low as 0.5 parts per million—ten times below the allowable limit of 5 ppm in the U.S.—in less than 30 minutes.

With diesel, because it does not displace alcohol in the dye, the sensor remains blue. However, biodiesel replaces the alcohol, changing the sensor color to pink. This change can be seen with the naked eye.

"Right now, there is a dire need for quick, easy and direct detection of biodiesel in diesel and biodiesel-diesel blends to ensure safe and efficient-performing fuels," said Fong. "The sensors we developed are intrinsically small, easy to use, inexpensive and can be mass produced for disposable applications"

The researchers say the sensor can be deployed in a portable reader for use in the field. The sensor can also be used for drivers delivering biodiesel-diesels to gas stations to quickly verify that the blends are accurate.

They are working with the UT Research Foundation to find partners to commercialize the technology.

Provided by University of Tennessee at Knoxville