Source: *The Straits Times,* pB16
Date: 18 April 2015

Three better ways to upcycle waste oil

NUS researchers offer cheaper, greener methods to produce biodiesel

By FENG ZENGKUN
ENVIRONMENT CORRESPONDENT

SINGAPORE creates tonnes of waste grease each year, and researchers believe they can be put to better use.

A group from the National University of Singapore (NUS) claims to have created three cheaper and greener ways to turn the waste product into biodiesel for cars and other machines.

Currently, food establishments are required to provide grease traps and maintain them regularly by hiring licensed general waste collectors.

These traps are installed as part of the sewage system to prevent grease from clogging it.

The collectors use vacuum trucks to empty the traps and dispose of the waste at a designated reclamation plant managed by national water agency PUB. The grease is digested with used water sludge to form biogas, a fuel.

In 2013, PUB handled 91,000 cubic m of greasy waste, including grease, water and solids.

The NUS researchers believe, however, that more energy can be extracted from the waste grease by converting it into biodiesel using their methods. The team, from the Department of Chemical and Biomolecular Engineering, said waste grease contains fats known as triglycerides.

Methanol is typically used to convert these fats into biodiesel. A catalyst, such as sodium hydroxide or potassium hydroxide, is used to spark a chemical reaction between the methanol and fats.

Waste grease, however, also contains large amounts of free fatty acids, which can react with the catalyst to form soap. This increases the cost of the biodiesel production as the soap must be removed to purify the biodiesel.

This problem is typically resolved by blending the waste grease with pure oil to reduce the free fatty acid content.

The NUS researchers' three new methods sidestep this issue altogether by converting both the fats and the free fatty acids into biodiesel in a single step, without the formation of soap.

One method involves Escherichia coli (E. coli) bacteria cells that have been engineered to contain an enzyme derived from a type of fungus. In laboratory tests, these cells produced 97 per cent of the maximum theoretical yield of biodiesel from waste grease.

The other two methods make use of tiny, magnetic particles coated with acid or enzymes. They achieved yields of 98 per cent and 99 per cent respectively.

The E. coli cells and particles can also be recycled to produce multiple batches of biodiesel, although the tests showed the E. coli cells lost about 45 per cent of their efficiency after five uses.

NUS doctoral student Tian Kaiyuan said: "By coming up with three different methods, we can offer firms more options, as some may have expertise in nano-particles while others may be more familiar with biocatalysts."

The team, led by Associate Professor Li Zhi, is in talks with firms here and in China – which has been hit by food safety scandals involving the use of dirty, recycled cooking oil – to test the methods on a larger scale.

zengkun@sph.com.sg