

# TRANSFORM

## Energy Systems through Game-changing Technology

BUILDINGS | CARBON CAPTURE AND STORAGE | FUEL CELLS | NUCLEAR | POLICY | PLANNING  
RENEWABLES | SMART GRID | STORAGE | SUSTAINABLE MOBILITY | SUSTAINABILITY ANALYSES

**Yellow Grease**  
(feedstock)



**Biodiesel**  
(from yellow grease) (from yellow grease)



**Glycerol**



## CREATING CHEAPER BIODIESEL WITH SOLID ACID CATALYSTS

Flora T.T. Ng, Aijaz Baig

Each day, more than half a million diesel-powered trucks and tractor-trailers roar along Canada's highways, churning out air pollution and greenhouse gases. What if some of those vehicles could be fuelled by non-polluting, renewable biodiesel instead? It's a vision that has captured attention around the world.

The problem? Feedstock. Refined vegetable oils are too expensive to compete with petroleum. However, the cheaper alternatives — derived from used cooking oil and rendered animal fat — have high levels of free fatty acids (FFAs). The alkali catalysts used in standard industrial biodiesel production react with FFAs to produce soap that must be removed, driving up production costs. Not only that, the process generates high levels of glycerides, which can clog engines.

University of Waterloo researchers Flora T.T. Ng and Aijaz Baig turned to acid catalysts to solve these issues. Using a novel solid acid catalyst, the chemical engineers were able to produce biodiesel from high-FFA feedstock without the problem of soap byproducts.

Not only did the solid acid catalyst convert the oil's triglycerides into biodiesel, it also converted FFAs into biodiesel as well — all in a single-step process. Thus, instead of headaches, the FFAs actually created higher yields. Adding a water-stripping step produced biodiesel with glyceride levels and acid numbers that met international biodiesel standards.

With results like these, putting biodiesel promises to be not just a green alternative, but a cost-effective alternative as well.