From green canola to green fuel

Biofuels provide an important, lower-emissions renewable alternative to fossil fuel. One major challenge facing the industry is biomass sources that don’t cut into the food supply, as global food needs continue to increase. Grasses with high growth rates, such as Reed canary grass (RCG), could be a lucrative match. To prepare the oil for biofuel processing without chemically shifting the canola oil too significantly, researchers from the University of Saskatchewan tested catalysts for their ability to produce biodiesels cleanly and efficiently.

Looking at canola

The canola plant is the world’s largest canola producer. Green seed canola oil is a great, inexpensive alternative to corn. Green canola oil as a fuel source could be a crucial match. To prepare the oil for biofuel processing without chemically shifting the canola oil, researchers from the University of Saskatchewan tested catalysts for their ability to produce biodiesels cleanly and efficiently. 

Biofuels that don't cut into the food supply

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Keeping Nuclear Power Safe

Using the CLS, researchers from Savannah River National Laboratory in South Carolina looked at the structure of concrete, which is used in the construction of nuclear facilities. They found that concrete is a composite material made of hydrated cement and aggregate, which can withstand the high temperatures and pressures that are common in nuclear facilities. The concrete is made by heating a mixture of water, cement, and aggregate to about 1200°C and then pouring it into a mold. Once it cools, the concrete is allowed to cure for several days. This process helps to bond the components together and create a strong, durable material. The concrete is used to protect the radioactive materials stored within the nuclear facility, such as fuel rods and reactor cores. It is also used to contain any radiation that may escape the facility in the event of an accident. The concrete is typically made from Portland cement, which is a mixture of cement clinker and fine aggregate.

Airplanes and climate change

According to Transport Canada, in 2013 domestic aviation accounted for 6.6 per cent of transportation-related greenhouse gas emissions. This large input into the airline sector is a result of the fact that airlines are one of the largest sources of uncertainty in climate models, but a crucial look at their structure provides new insight into global environmental processes. Condensation trails, more commonly known as contrails, follow aircraft as water condenses into ice crystals around engine soot. Aix-Marseille University researchers have observed the unusual structure of aircraft contrails that may help explain how contrails contribute to climate change, especially improving models of light scattering in the atmosphere. Understanding properties of matter at the molecular level will help us understand environmental effects at the global scale of our planet.

A fuel source from the air around us

The atmosphere of the earth is about 78 per cent nitrogen, making nitrogen a potential abundant and renewable fuel source. Under pressures millions of times stronger than the atmosphere at sea level, simpler nitrogen from the air can hold the key to the most powerful explosives. A University of Ottawa team is using the CLS to probe the strange chemistry and physics of nitrogen solids under super high pressure to understand how to stabilize this ultra-stable material at room temperature so it could be harnessed as a clean fuel.

From greenhouse gases to plastics

Polyethylene, the most common plastic used today, has an annual global production of around 80 million tonnes, and can be made from ethylene. A University of Waterloo-led group has improved the conditions necessary to convert carbon dioxide to ethylene efficiently, using a new catalyst to manufacture ethylene production while minimizing the methane output to nearly nothing. By pairing their catalyst driven method with carbon capture technology, this could lead to an incredibly green production mechanism for everyday plastics, meanwhile counteracting harmful greenhouse gases by diverting CO2 from the atmosphere and reducing the need for fossil fuels to make products.

From plant matter to jet fuel

According to Natural Resources Canada, renewable energy sources currently provide about 18.9 per cent of Canada’s total primary energy supply. Plant materials are one of the oldest renewable energy sources, and today scientists are looking to produce ultra-clean premium fuels from plants. Producing synthetic gas, or syngas, from plant biomass is a relatively straightforward process, but the process often leaves behind impurities such as ammonia, chlorine, and sulfur compounds, which make it harder to transform the gas into usable fuel. By pairing the threshold at which such chemical reactions blocks efficient conversion to usable fuel, researchers from University of Kentucky, Wichita State University and the CLS hope to improve the clean fuel production process. The CLS is one of only a few facilities that can access the right energy ranges to study these chemicals and their effects on catalysts, making it an ideal place to access the right energy ranges to study these chemicals and their effects on catalysts, making it an ideal place to access.