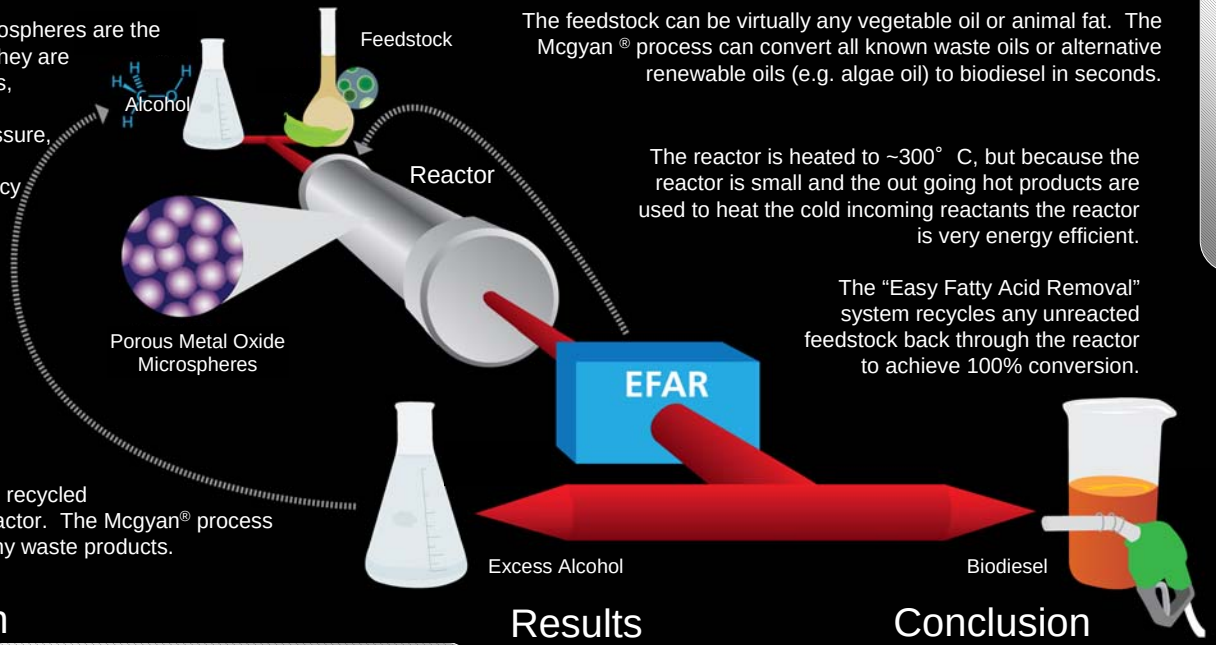
Brian Krohn,
Augsburg College
Sponsor: SarTec Corporation

A Path to Energy Independence: The Mcgyan® Biodiesel Process

The Mcgyan® Process

The metal oxide microspheres are the key to the process. They are highly stable catalysts, even under extreme temperature and pressure, and show no loss of conversion efficiency over time.



The feedstock can be virtually any vegetable oil or animal fat. The Mcgyan ® process can convert all known waste oils or alternative renewable oils (e.g. algae oil) to biodiesel in seconds.

The reactor is heated to ~300˚ C, but because the reactor is small and the out going hot products are used to heat the cold incoming reactants the reactor is very energy efficient.

The "Easy Fatty Acid Removal" system recycles any unreacted feedstock back through the reactor to achieve 100% conversion.

All excess alcohol is recycled back through the reactor. The Mcgyan® process does not produce any waste products.

Fuel grade biodiesel is easily separated from the alcohol layer. There are no washing or neutralizing steps required, which means the process produces no waste stream.

The Benefits

- Can utilize a variety of inexpensive, not food grade feedstocks
- Can produce biodiesel in seconds not hours
- Does not produce any waste
- Small in physical size

Introduction

Biodiesel is derived by the transesterification of triglycerides or by the esterification of free fatty acids (FFA) that are found in plant oils and animal tallow.

The traditional process for producing biodiesel requires expensive food grade feedstocks. As a result, the process cannot utilize inexpensive waste oil or oil from nonfood sources. Current economic models show that more than 88% of the cost of biodiesel production is attributed to the cost of refined vegetable oils, such as soybean or canola oil. Alternative sources of oil, algae for example, have significantly greater annual production capacity per acre than traditional biodiesel crops and can be farmed on low quality land. Alternative oils typically contain high FFA content, which is problematic for the traditional process but are easily converted to biodiesel with the Mcgyan® process.

Results

Feedstock	Acid number	Single pass percent conversion
Rice oil	0.09	90.1
Soybean oil	0.35	92.6
Algae oil	0.71	90.2
Beef tallow	5.17	90.9
Lard	7.88	93.0
Swine tallow	8.02	90.5
Used soybean oil	15.26	92.6
Yellow grease	15.26	92.6
Black oil	33.32	85.6
Acidulated soapstock	88.20	90.2
Tall oil FFAs	190.00	98.0
Stearic acid	200.00	98.2

Conclusion

We found that porous metal oxide microspheres are ideal novel catalysts for biodiesel production. The particles are chemically and thermally stable, which allows them to be packed into a tube reactor and to be operated at high temperature and pressure without loss of conversion efficiency over extended use.

As a result, we were able to develop a new continuous method, called the Mcgyan® process, that produces biodiesel in only a few seconds. Most importantly, *the process allows for the use of virtually any feedstock,* thereby, greatly reducing the cost of production and allowing for the use of nonfood based sources of oil. This new patent pending process, in combination with new oil sources such as algae farming, could help lead the United States to fossil fuel independence in the near future.

Contact information: Augsburg College, Brian Krohn, krohn@augsburg.edu; SarTec, Dr. Clayton McNeff, claytonmcneff@sartec.com; MRC, Dave Wendorf, davewendorf@mcneffresearchconsultants.com