

## Prototype Biodiesel Production System

**Sponsor:** Dr. Greg Mowry, University of St. Thomas Engineering Academic Advisor

**Funding & Support:** Provided by U.S. Department of Energy, Emerson Process Management's Rosemount Division, and with significant consulting and component support from the SarTec Corporation and McNeff Research Consultants. Additional support was provided by Dr. Arlin Gyberg, research chemist and professor at Augsburg College.

**Senior Design Clinic I-II (ENGR 480-1) Project Mission Statement:** Take a revolutionary biodiesel process (the MCGYAN® process) and create a prototype for a portable system which can fit into the bed of a pick-up truck and produce 2,000 to 4,000 gallons of biodiesel per year. The intended target audience for this project's production system is for single users and developing country applications.

**General Statement:** McNeff Research Consultants is the exclusive intellectual property licensing company for the MCGYAN® biodiesel production process. This process is a revolutionary new way to produce renewable biodiesel fuel using a fixed bed flow-through reactor. This technology was initially conceived of for biodiesel production by Dr. Clayton McNeff, cofounder of Ever Cat Fuels, LLC and Vice President of Research at SarTec Corporation, Dr. Bingwen Yan (senior researcher at SarTec), Professor Arlin Gyberg of Augsburg College and Rhodes Scholar Brian Krohn (an Augsburg College student at the time).

**University of St. Thomas Team Members:** Phillip Buchner (ME), Timothy Cameron (ME), John M. Gorman (ME), Erich T. Loch (ME), Jacob D. Myers (EE), James R. Portmann (ME)

**Augsburg College Team Member:** Brian Krohn (B.S. Chem.)

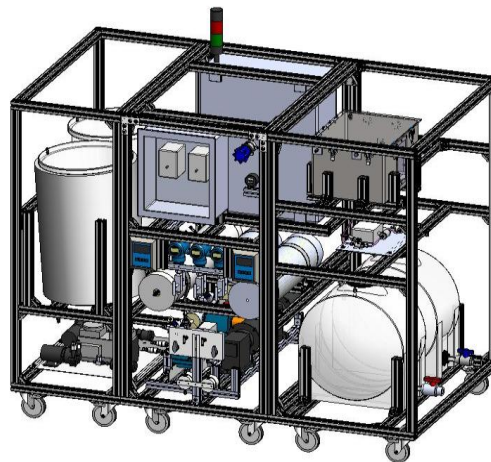
### Major Design Requirements:

1. Based on MCGYAN® Process
2. Adjustable and controllable process (adjustable temperature, pressure, flow)
3. Able to monitor pressure, temperature, and flow
4. Automated control of pumps, heaters, and valves
5. Design for producing 2,000 to 4,000 gallons of biodiesel per year
6. Compatible with any lipid or any alcohol
7. Fit within a footprint of 98 inches x 50 inches
8. Operate within a specified pressure and temperature range

**Senior Design Project Summary:** The purpose of this project was to take a new biodiesel production process, called the MCGYAN® process, and fully design, construct, and test a prototype system that is portable for smaller scale production. Unlike conventional production methods, this process operates at elevated temperature and pressure to efficiently and economically convert a variety of feedstocks (plant and animal oils) into biodiesel fuel, without the using harsh chemicals or water, in a matter of seconds. The goal was to create a system capable of producing 4,000 gallons of biodiesel per year with a budget of \$50,000. It was necessary for the system to be automated with the ability to adjust and control various aspects of the process. Initially the entire system was divided into separate sub-systems and various options were chosen based on the process requirements, cost, and chemical compatibility. After purchasing and procuring all of the components and testing each sub-system, the full system prototype was assembled. The main components of the final design include: two feedstock tanks, three oxygen removal membranes, two high pressure pumps, pressure and flow sensors, a pre-heater, guard reactor, fixed bed flow-through reactor, a heat exchanger, back pressure regulator, a gravity separation weir, automated valves, control system and biodiesel & alcohol storage tanks.



Actual System



CAD Model