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A novel pressurised and instrumented bioreactor system for process intensification of anaerobic digestion

In this project, the Department of Chemical Engineering at the University of Chester will work together with a company, Blue Sky Bio, based on the same site, to build and test a reactor system to improve the efficiency of anaerobic digestion. This reactor system will be quite different from the usual reactors. It will be small (0.75 to 1.5 litres in volume) but will allow important variables like temperature and pressure to be precisely measured and controlled. This will start a valuable partnership in which academics and industrialists can help and learn from each other.

Anaerobic digestion is a natural process in which bacteria convert plant, food, or sewage sludge waste streams into energy rich biogas. The biogas contains methane which is the same compound as the natural gas that is used to heat homes and to make electricity. The natural gas we currently use is a fossil fuel since it is extracted from underground reserves and so the net effect of burning it is to release carbon into the atmosphere which increases global warming. The advantage of biogas is that the carbon released by burning it has been recently captured by plants so there is no net release of carbon into the atmosphere.

The reactor will be built at low cost using existing components from advanced reactor systems that are used in pharmaceutical processing and it will use similar instrumentation. The higher operating pressures (4 to 6.5 bar) will give biogas containing more methane than unpressurised fermenters. The system will also allow us to concentrate the methane producing bacteria and demonstrate higher rates of biogas production than conventional systems. It is also hoped that it will form the basis of a much better type of lab bioreactor for investigation of C1 fermentations with better control over variables like pressure and much finer measurement of temperature to allow metabolic activity to be monitored online.