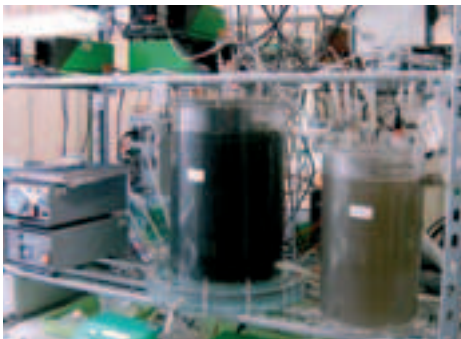


Biological Generation of Hydrogen from Renewable Resources using Fermentation

The SUPERGEN Programme

The SUPERGEN programme is the UK Research Councils' flagship initiative to help the UK meet its emissions targets through a radical improvement in sustainable power generation and supply. Thirteen areas with a potential major impact on the UK's energy future have been identified. The Engineering and Physical Sciences Research Council sets up multidisciplinary consortia of leading research groups to work on these topics. The Sustainable Environment Research Centre of the University of Glamorgan has been selected as a partner in two consortia, on hydrogen and biological fuel cells.

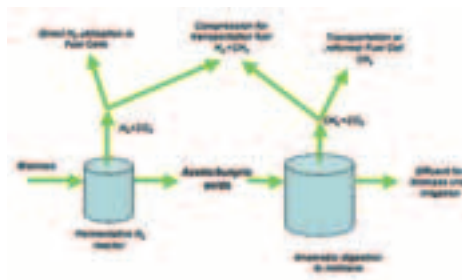


UK-SHEC

The SUPERGEN UK Sustainable Hydrogen Energy Consortium (UK-SHEC) is taking a multidisciplinary approach to the many problems associated with turning hydrogen into a commercial fuel source. The consortium's partners, 7 Universities and Institutes together with the Greater London Authority, are tackling everything from the sustainable generation of hydrogen to how it may be stored and public attitudes to using it. See www.uk-shec.org

Biological hydrogen production from crops

Food industry co-products and crops rich in carbohydrates can be fermented in the dark to produce hydrogen. There is world-wide interest in this process since it uses well-known reactor technology, but the biological aspects must first be studied. Mixed microbial communities obtained from natural



sources convert the range of carbohydrates present in organic materials to hydrogen and fermentation end products. These end products are good substrates for anaerobic digestion to methane. Conditions which allow stable operation of the hydrogen reactor and maximise hydrogen yield are only now becoming known.

The main objectives of our work in UK-SHEC are to:

- develop a renewable biohydrogen producing process able to operate at pilot scale on a range of crops available year-round
- integrate the fermentation process into a carbon-neutral sustainable system of biomass production/ utilisation operating with maximum energy efficiency

Fermentable biomass, such as crops commonly used as animal feed, could be grown in rotation on, for example, currently unused set-aside land to provide feedstock for an on-farm hydrogen reactor year-round. Methane can be generated in a second reactor and the liquid output, which retains N, P and K, used as fertiliser.

The project has identified suitable crops such as perennial rye grass, fodder and sugar beets and forage maize for hydrogen production in the UK. The selection criteria focused on crop yields per hectare, fermentable carbohydrate content and energy requirements in crop production compared to potential hydrogen and methane yields. In the laboratory our work demonstrated for the first time hydrogen production from forage maize and perennial rye grass in batch conditions. Previous we

showed hydrogen production from sugar beet extract in a continuous reactor.

We have a hydrogen-producing reactor followed by a methane-producing anaerobic digester operating in the laboratory on sugar. Pilot plant work at IGER, Aberystwyth, is now starting and will allow accurate evaluation of operation on crops.



Biological Fuel Cells

This new SUPERGEN programme brings together 6 Universities to focus on the potential of electricity generation by naturally-occurring bacteria and enzymes. This is a new and exciting field of world-wide interest. Our role focuses on bacteria consortia.

Related Work

The Hydrogen Research Unit of the University of Glamorgan has a large number of funded projects in the area of biological hydrogen production and wider aspects of hydrogen generation and use. These include the production of hydrogen from wheat starch industry co-products and sewage sludge, the Wales & Ireland rural hydrogen energy project, the TSEC Biomass consortium and the Hydrogen Wales project www.H2Wales.org.uk.

Contact:

**Sustainable Environment Research Centre
 University of Glamorgan
 Pontypridd,
 CF37 1DL
 Wales, UK**

E-mail: info@serc-wales.org.uk
 web: www.serc-wales.org.uk