lems like poor substrate (lactose) utilization(in case of *S.cerevisiae*), substrate (lactose) and product (ethanol) inhibition affecting final ethanol concentration (batch) and ethanol productivity (continuous).

Biofilm technology has been extensively applied in wastewater treatment, but its potential application in bioethanol production has not been explored. In general, advantages of biofilms include selective substrate and product diffusion due to layered microbial structure, prevention of cell wash out due to EPS (extra polymeric substance) formation, operational stability due to high resistance to external environment. This latter advantage is in particular sought in the bioethanol fermentation process.

Kluyveromyces marxianus yeast strains has shown excellent ethanol tolerance (free and immobilized) and biofilm forming ability without any selective preference of support in the cited literature. The present research work involves studying the feasibility of anaerobic fermentation of cheese whey using *Kluyveromyces marxianus* DSMZ 5422 biofilm on particle support in batch and continuous mode. The first phase of the research involves characterization of *Kluyveromyces marxianus* DSMZ 5422 by fermentation of cheese whey powder solution at different concentration, pH and inoculum concentration. Natural supports such as olive pits and artificial supports such as polypropylene chips are tested for the holding capacity of *Kluyveromyces marxianus* DSMZ 5422 biofilm. Direct qualitative and indirect quantitative evaluation of the biofilm formation on the different support is carried out.

References

Ghaly & El-Taweel (1997) *Biomass Bioenergy*, 12(6), 461-472.
Gianetto, A., Berutti, F., Glick, B., Kempton, A., 1986. Appl.Microbiol.Biotechnol 24, 277–281.
Lewandowska, M., Staniszewski, M., Kujawski, W., 2007. J.Food Engg 82, 618–625.
Ozmihci, S., Kargi, F., 2007. Lett.Appl.Microbiol 44, 602–606.
Zafar, S., Owais, M., Saleemuddin, M., Hussain, S., 2005. J.Food Sci & Tech 40, 597–604.

doi:10.1016/j.jbiotec.2010.08.466

[P-B.114]

Applications of extractive fermentation and hot compressed water to enhance bioenergy production from food wastes

M.D. Redwood *, R. Orozco, A.J. Majewski, L.E. Macaskie

University of Birmingham, United Kingdom
Keywords: Bioenergy; Extractive fermentation; Hot compressed water; Food waste

We are at risk of energy poverty. Fossil fuels will last only a few more decades and nuclear installations cannot be built quickly enough to meet the expected shortfall as demand continues to grow Bockris, 2007. The transition to clean, renewable energy is urgent and will require multiple technologies, including biological Redwood et al., 2009.

Anaerobic fermentation is a cornerstone of bioprocessing applied in the generation of biofuels such as butanol, ethanol and hydrogen. However, fermentation is ultimately limited by its organic products. To prolong activity in hydrogen producing *E. coli* fermentations, we applied extractive fermentation to separate organic acids in response to pH, controlling pH and organic acid concentration simultaneously. The duration of biohydrogen production from glucose was enhanced without sacrificing conversion rate or yield.

UK domestic and food industry biodegradable wastes equate to 24 Mt annually Hogg et al., 2008, potentially providing ∼13% of our 2020 target (15% renewables by 2020) without considering other organic waste sources, e.g. agriculture. For this study, food wastes were sourced from commercial producers including catering kitchens and fruit traders. Simple sugars were separated by mechanical pressing and washing before treating the insoluble residue with hot compressed water to liberate further simple sugars. Fractions were characterised and tested in vial-scale reactions before progressing to extractive fermentations. These treatments proved effective in generating a sugary feed suitable for extractive fermentation with *E. coli* and free of significant inhibitory components. Despite the presence of non-sugar components in waste-derived feeds the efficiency of extraction remained high.

We conclude that extractive fermentation and hot compressed water are versatile tools offering noteworthy advantages for the integrated bioenergy refinery.

References

Bockris, J.O.M., 2007. Int J Hydrogen Energy 32, 153–158.
Redwood, M.D., et al., 2009. Rev Environ Sci Biotechnol 8 (2), 149–185.
Hogg D., et al., Dealing with Food Waste in the UK. WRAP http://www.wrap.org.uk/document.rm?id=3603. 2008.

doi:10.1016/j.jbiotec.2010.08.467

[P-B.115]

Production of gaseous or liquid *value-added* products in bioelectrochemical systems

M. Villano [1,2,*], M. Rosenbaum [2], F. Aulenta [1], M. Majone [1], L.T. Angenent [2]

[1] *Sapienza University of Rome, Italy*
[2] *Cornell University, United States*
Keywords: Bioelectrochemical systems; Biocathode; Biofuels

Bioelectrochemical systems (BESs) are devices that take advantage of the ability of bacteria to engage in extracellular electron transfer processes with solid-state electrodes. The most extensively studied BES is the microbial fuel cell (MFC), which is regarded as an innovative and sustainable technology for wastewater treatment. In a MFC, the electrons released from the bacterial oxidation of waste organic substrates (with an anode serving as terminal electron acceptor) are exploited for electrical power generation. Since the value of electric power is low, fortunately, BES can also generate chemical products, and much research effort is currently being dedicated to the development of novel BES concepts in which the oxidation of waste organic substrates is coupled to the production of reduced value-added products. Here, we are focusing on the development of efficient (bio)catalytic systems at the cathodes of BESs for the production of gaseous or liquid biofuels, such as hydrogen, methane, alcohols, and hydrocarbons. We found that biocathodes, teaming with living hydrogenase-containing microorganisms, are capable of catalysing hydrogen or methane production using graphite electrodes as direct electron donors for H^+ or CO_2 reduction, respectively. In parallel, we are also investigating the use of metal-based catalysts on cathodes to convert CO_2 into liquid fuels, such as alcohols and hydrocarbons. The obtained results pinpoint the remarkable potential of BES for extracting value from wastewater.

doi:10.1016/j.jbiotec.2010.08.468
