disco News

To Begin at the Beginning

There are many different potential sources of lignoceullosic biomass, so one of the first steps in the DISCO project was to decide on which material the project should focus. After careful deliberation, three sources were chosen, based on suitability and availability for the trial, and going forward as a viable source of second generation biofuels

Wheat straw

Wheat straw is highly abundant throughout Europe, essentially as a waste product of agriculture. Wheat is the most commonly grown crop in the EU, covering 24 million hectares, 46% of all EU cereal production.

Spruce

Spruce is one of the main sources of wood for paper-making, and is cultivated in large scales for this purpose especially in Scandinavian countries. This makes it an ideal source of biomass in these countries.

Wheat bran

Wheat bran is made up of the hard outer layer of grains that is usually removed during the refining process, and represents an interesting side stream to the wheat milling industry, and thus is readily available in most areas.

These materials represent the starting materials for the DISCO project, and screening is now being carried out using them. In addition, a number of pre-treatments for the material were developed and optimised by the partners, and in fact only pretreated spruce will be used in the project due to the enzyme-resistant nature of the untreated material.

About DISCO

The DISCO Project (Targeted DISCOvery of novel cellulases and hemicellulases and their reaction mechanisms for hydrolysis of lignocellulosic biomass) is part funded by the Seventh Framework Programme for research and technological development (FP7), the European Union´s chief instrument for funding research over the period 2007 to 2013.

Focus On….

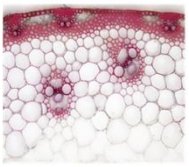
BIOGOLD

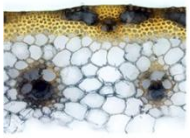
Biogold is a small, privately owned company established in 2006. It was founded with the aim of building up a commercial scale bioethanol plant in Estonia based on local lignocellulosic biomass, in the form of straw. Initial activities are evaluating the optimal size plant, based on availability of resources in the local area, as well as understanding the economic aspects of production.

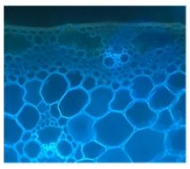
Biogold has 4 engineers working in research and development, in collaboration with several universities. Within the DISCO project, Biogold is providing pretreated lignocellulosic material to the project partners for assessment, and will also participate in the evaluation of enzymes in pilot scale experiments.

The Institute of Food Research (IFR)

The Institute of Food Research in based on the Norwich Research Park in the UK and is a world leader in research into harnessing food for health and controlling food-related diseases. One of the research themes is the Sustainable Food Chain led by *Prof. Keith Waldron*. The purpose of the Sustainability in the Food Chain Exploitation Platform is to initiate and exploit research relevant to environmental and economic sustainability of the food chain. The research focuses on improving the effective exploitation of food-chain residues and co-products by developing a greater understanding of how to disassemble plant structures.







Within DISCO, IFR has selected key biologically and economically representative, and readily available lignocellulosic raw materials from traceable sources. The modification of pretreated lignocellulosic raw materials has been carried out using physical and chemical mechanisms. The raw materials and recalcitrant residues will be assessed for their different degradative compositions and characteristics using biochemical techniques such as carbohydrate analysis, fractionation studies, spectroscopic analysis including FT-IR screening and NMR. IFR will also evaluate structural heterogeneity using microscopy and relevant histochemical staining following pretreatment.

Studies so far have yielded some interesting results. Carbohydrate analysis of samples pretreated with hot water released predominantly arabinoxylans although some glucose was also detected suggesting a higher extractability of the cell-wall polymers following pretreatment. The results and methodology developed for DISCO will provide useful tools for assessing recalcitrant residues resulting from enzyme digestion and comparison of the various lignocellulosic materials.

Budapest University of Technology and Economics (BUTE)

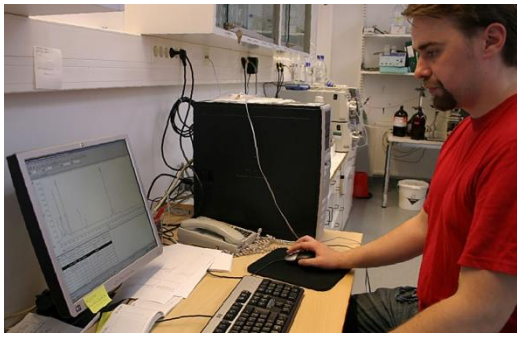
Budapest University of Technology and Economics (BUTE; formerly Technical University of Budapest, TUB) is the second biggest university in Budapest, with approximately 14,000 students. Dr. George Szakacs is a senior research scientist in the Department of Applied Biotechnology and Food Science, within the Faculty of Chemical Engineering and Bioengineering. He has been working with microorganisms and enzymes for many years, and in the last ten years his group have focussed on the production of hydrolytic enzymes by solid state fermentation.

Dr Szakacs manages a microbial culture collection at BUTE, containing over 4000 microorganisms. This has been a valuable resource for many international research projects, and the group has previously collaborated with groups across Europe, the US, Asia and South Africa. Within the DISCO project, Dr Szakac's group have screened their microbial culture collection and worldwide soil collection for mesophilic filamentous fungi with cellulase and hemicellulase production activity. From this, a number of promising strains have been isolated and passed on the DISCO partners for further evaluation.

The University of Helsinki

The University of Helsinki (UH) with 38 000 degree students and 7 600 employees is a member of the League of Research Universities in Europe.

The team at the University of Helsinki is led by Prof. Maija Tenkanen. Prof Tenkanen has long experience on enzymatic degradation and modification of cellulose and hemicelluloses. Since joining UH in 2002 she has focused on the structural characterization and functional studies of various hemicelluloses from wood and annual plants.



In the DISCO project, the UH team are screening for enzyme activities which impede efficient saccharification of hemicelluloses, and characterising novel hemicellulose-degrading enzymes and their possible synergisms with cellulose degrading and other cell wall modifying enzymes or treatments. They are also involved in mechanistic studies to better understand how different substituents restrict the action of hemicellulose-degrading enzymes. They have discovered a novel enzyme activity, which is needed for the efficient hydrolysis of structurally complex xylans. Purification and characterisation of this enzyme is going on, and will hopefully result in a new and efficient component to be added to enzyme cocktails used for saccarification of cereal lignocellulosics.

Photographs by *Miia Collander, University of Helsinki*