

Welcome to the second newsletter of the Integrated Project BIOSYNERGY on biorefineries, co-funded under the 6<sup>th</sup> Framework Programme for Research and Technological Development of the European Communities.

Since the publication of the first newsletter in July 2007, several important events happened in the energy field. By the end of 2007 world oil prices reached record high levels, approaching the level of USD 100 per barrel. This trend brought up also the prices of other energy sources, such as gas and coal. Altogether, these market developments pushed up our energy bill quite a lot. At the same time, however, the high process of fossil fuels gave new and strong impetus to the development of alternative energy sources and technologies, as well as to the more efficient use of energy. In this new situation, the BIOSYNERGY project, looking for market competitive and environmentally friendly synthesis of various products from biomass (fuels for transport, chemicals, materials, electricity and heat) using novel transformation technologies, integrated in advanced biorefinery configurations, seems to be coming just at the right time.

### BIOSYNERGY update by work-packages

The work in all work-packages has been already initiated. Because of the early stage of the project, however, progress has been achieved mainly in the lab-scale experiments, while the desktop and pilot-scale activities are only in the beginning. For the same reason, the dissemination and training activities in the first 12 months of the project have been also modest.

#### WP 1: Advanced physical / chemical fractionation (Coordinator – WUR Agrotechnology and Food Innovations /A&F/, NL)

The subject of this WP is the lab-scale experimental development of promising technologies for physical and chemical fractionation of biomass in separate (C5/C6) sugar and lignin fractions. The main goal is to identify the optimum combination of various physical and chemical treatments for separation of cellulose, hemicellulose and lignin, their

monomeric constituents (sugars, aromatics) or structural derivatives. A small activity on enzymatic hydrolysis is also foreseen. The biomass feedstock to be analysed is barley and wheat straw (both raw and pre-treated with steam), clean soft wood and Distillers Dried Grains with Solubles (DDGS). Selected highlights from 2007:

- Laboratory set-up design and establishment of experimental facilities;
- Distribution and delivery of feedstock;



Delivery of sample feedstock (Photo: WUR A&F)

- On-going literature review - characterisation of feedstock, development of analytical protocols for lignin, sugars, identification of main fractionation routes, etc.;
- Start of the work on innovative pressurised fractionation and enzymatic hydrolysis;

#### WP 2: Innovative thermochemical conversion (Coordinator – ECN, NL)

Within this WP, lab-scale (catalytic) processes of staged degasification and pyrolysis for the fractionation/conversion of lignin/biomass into chemical intermediates and/or secondary energy carriers are being developed. This includes development of:

- ✓ Thermo-chemical conversion technologies for co-production of power and/or heat and/or fuels for transport and/or (high) value-added chemicals and materials.
- ✓ Staged (catalytic) degasification concepts (thermo-chemical refineries) for technical, economic and environmental optimisation of the co-production of fuels for transport, power

and/or heat and/or bio-products (chemicals and materials).

- ✓ High-efficiency and low-cost separation technologies for chemical intermediates from thermo-chemically derived product mixtures.

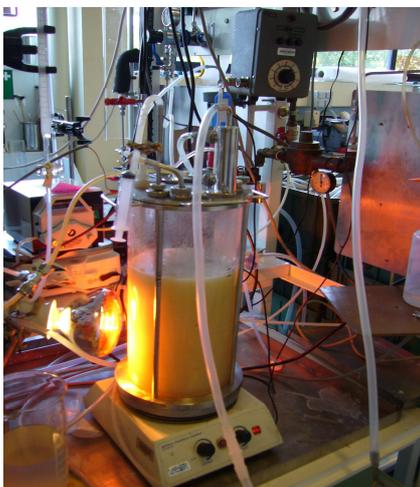
Substantial progress in meeting these goals has been recorded in 2007, namely:

- Elaboration of procedures for the production of low-mineral homogeneous bio-oil;
- Development of Proof-of-Principle for staged degasification concept;
- Assessment of separation technologies for thermo-chemically derived products from mixtures;

**WP 3: Advanced biochemical conversion**  
(Coordinator – Institut Français du Pétrole /IFP/, FR)

Within this WP, advanced biochemical processes for conversion of sugars and lignin into value-added products or intermediates - higher alcohols, sugar acids, functional lignin derivatives etc., will be developed. In 2007, significant advancement has been achieved in the lab-scale experimental work on:

- Acetone-butanol-ethanol (ABE) fermentation;



*6-L Fermentor for production of acetone, butanol and ethanol (Photo: IFP)*

- Production of platform chemicals;
- Production and analysis of functional lignin derivatives;
- Membrane separation based Multiphase Rotating Contactors (MRCs).

**WP 4: Innovative chemical conversion and synthesis**  
(Coordinator – Agro Industrie Recherches et Développements /ARD/, FR)

Various promising chemical conversion technologies for the valorisation of C5-sugars,

lignin and thermo-chemically derived bio-based intermediates will be developed at lab-scale in this WP. Furthermore, processes for the synthesis of final products from value-added intermediates will be analysed and developed. The research and experimental work in 2007 has focussed on the following items:

- Production and characterisation of platform chemicals;
- Products from platform chemicals (reaction and process design);
- Pentoses (C5-sugars) valorisation as raw materials for surfactants;
- Application of innovative membrane reactor concepts for product recovery;

**WP 5: Conceptual design biorefinery validation pilot-plant of Abengoa in Salamanca**  
(Coordinator – Abengoa Bioenergia, ES)

The goal of this WP is the conceptual design of an innovative biorefinery facility at the BCyL cellulose ethanol pilot-plant of Abengoa in Salamanca (Spain), currently under construction. The facility will include integrated physical / (thermo-) chemical fractionation processes, along with advanced biochemical or (thermo-)chemical conversion processes. The targeted output of the facility includes upgraded bio-products (chemicals and/or materials), refined fuels for transport, as well as power and/or heat.



*Abengoa's BCyL ethanol pilot-plant in Salamanca, status in 2007 (Photo: Abengoa)*

In 2007 the following has been achieved:

- Set-up of an extended component database with physical & chemical properties for process design.
- Definition of the base case and the up-grading concept for the demo-plant.
- First set-up of a draft economic model to evaluate different design concepts and scenarios.

**WP 6: Integral biomass-to-product chain design, analysis and optimisation (Coordinator – Aston University, UK)**

A comprehensive (technical, economic, environmental) assessment and optimisation of biorefinery chains (from feedstock to end-products) will be performed in this WP. The ultimate goal of this work is to identify the most promising biorefinery pathways (in coordination with WP5) and the possibilities for their integration with conventional oil refineries. Progress achieved so far:

- The methodology to identify the optimum process routes has been sketched.
- The IPSEpro modelling software has been selected for the process chain design.
- On-going literature review.

**WP 7: Demonstration at pilot-scale (Coordinator – WUR Agrotechnology and Food Innovations /A&F/, NL)**

The pilot-scale demonstration work will include running of Abengoa's bioethanol pilot-plant and other facilities. The aim of the demonstration tests will be to obtain representative market samples of bio-based intermediates for the development of laboratory and benchmark technologies from WP's 1-4, as well as to examine the potential for scaling-up these technologies. In 2007 the following has been done:

- Pre-treated raw material has been delivered;
- The adaptation of Abengoa's pilot facility has been started;
- The work on the pilot-scale pyrolysis has been initiated;

**WP 8: Training of people and knowledge dissemination (Coordinator – Joint Research Centre-Institute for Energy /JRC-IE/, NL)**

The objective of WP8 is to ensure the two-way communication of the project with the outside world. This includes general promotion of project results, exchange of views and information with external stakeholders, training of persons in relevant industries and institutions, dissemination of policy options and suggestions to national and European stakeholders and policy-makers

During 2007, the BIOSYNERGY project has been advertised on various occasions:

- CODON Symposium Biobased Economy, Wageningen (The Netherlands), 20 March 2007
- Press Release "Biorefinery Building Blocks", Aston University Bioenergy Research Group, April 2007, [http://www.aston-berg.co.uk/?\\_id=108](http://www.aston-berg.co.uk/?_id=108)

- BioRefintec Conference, Amsterdam (the Netherlands), 24-25 April 2007;
- 15<sup>th</sup> European Biomass Conference and Exhibition: Biomass for Energy, Industry and Climate Protection, 7-11 May 2007, Berlin.
- A Brief News Story in Biomass Magazine, September 2007, [http://www.biomassmagazine.com/article.jsp?article\\_id=1249](http://www.biomassmagazine.com/article.jsp?article_id=1249)
- Fresher Fuels – Materials World, Volume 15, Number 10, October 2007

For 2008, a number of PR activities at key biomass and bioenergy events are planned. Along these external PR activities, the project consortia foresees to hold in April 2008 a major event on advanced biorefineries concepts, targeting primarily the new Member States and potential Candidate Countries of the EU. More information about the workshop will be made available soon at the project's website.

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BIOSYNERGY started on 01.01.2007 and will last for four years, until the end of 2010.

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