BIOLYFE PROJECT

Second generation BIOethanol process: demonstration for the step of Lignocellulosic hydrolysis and fermentation

Arianna Giovannini
Biolyfe - Description

Lignocellulosic ethanol is one of the most promising second generation biofuel technologies. Even though different conversion technologies are available on the market, there are still challenges to overcome before launching a large scale industrial production.

- The BIOLYFE project, supported by the EU Commission through the FP7 funds, aims at improving critical process steps and demonstrating the industrial-scale production of second generation bioethanol, covering the whole supply chain, from feedstock sourcing via fuel production to product utilisation.
- In the framework of the project the first industrial demonstration-scale plant in the world for the production of bioethanol from lignocellulosic biomass was engineered and constructed in Crescentino (VC, Italy) with a capacity of 40,000 tons per year with a dry biomass input of about 180,000 tons per year.
- The plant is designed to produce bioethanol through hydrolysis and fermentation of cellulose and hemicellulose starting from lignocellulosic biomass (agri-cultural by-products or energy crops not suitable for food consumption).
Biolyfe - Scientific focus

The BIOLYFE project specifically seeks technologies which have the highest undiscovered potential to enhance the technical and economic feasibility of the hydrolysis process and the complete conversion of all sugars into ethanol through an optimized fermentation process. The main objectives of BIOLYFE are to develop at industrial scale:

- investigation of energy crops in relation to feedstock supply and pretreatment;
- enzymatic hydrolysis in a viscosity reducing step of pretreated material;
- efficient hydrolysis of the chosen pretreated lignocellulosic raw materials: BIOLYFE project aims to minimize the enzyme loading;
- simultaneous saccharification and co-fermentation of derived C₆ and C₅ sugars to ethanol with a yield of 75% and a final ethanol concentration exceeding 5% within 72 h fermentation time (most likely around 7-8%);
- efficient integration of hydrolysis and fermentation processes at industrial demonstration scale.
Biolyfe – Scientific focus

- Construction, start up, operations and data collection for industrial scale up of demo scale plant (40,000 ton EtOH/y)
- Environmental, social and economic assessment;
- Market assessment.
BIOLYFE: Demonstrating large-scale bioethanol production from lignocellulosic feedstocks

Biolyfe - Partnership

Agriconsulting IT
Novozymes DK
biochemtex IT (Coordinator)
Univ. Lund-SE
IUS – DE (IFEU-DE)
EC-FP7

ENEA - IT
WIP – DE (ETA - IT)

BIOLYFE: Demonstrating large-scale bioethanol production from lignocellulosic feedstocks
BIOLYFE: Demonstrating large-scale bioethanol production from lignocellulosic feedstocks

**Timing and Activities**

Year 1

- Selection and supply of pretreated feedstock

Year 2

- Selection of enzymes cocktails
- Selection of microorganisms
- Basic design of enzymatic hydrolysis reactor
- Basic design of SSF reactor
- Preliminary and detail design of complete industrial demo plant
- Plant construction and assessment of test

Year 3

- Work done

Year 4

- Plant construction and plant testing
- Investigation of the critical levels for ethanol parameters with regard to vehicle endurance/ performance
- Set up of a functioning infrastructure to demonstrate the distribution and the use of 2nd generation bioethanol
- CO -ORDINATION (and DISSEMINATION)
Biolyfe - Main Activities

- Selection of feedstock and supply
- Creation of functioning infrastructure
- Integrated assessment of sustainability
- High gravity hydrolysis and fermentation
- Selection enzymes cocktails
- Fermentation technology

BIOLYFE: Demonstrating large-scale bioethanol production from lignocellulosic feedstocks
• Agronomy: Field experimentation.
• Certification system of the biomass origin.
• Biomass supply for the demo unit.
• Supply of optimised enzyme cocktail for demo plant.
• Follow operative condition and parameters in the demo plant.
• Defining process strategies for efficient xylose conversion
• Feed strategy of hybrid SHF/SSF process.
BIOLYFE: Demonstrating large-scale bioethanol production from lignocellulosic feedstocks

- Effect of the pretreatment on the biomass hydrolizability
- Effect of various feeding strategies on the cellulose hydrolysis
- Performances of the enzymatic blends provided by Novozymes
- Effect of the reactor geometry and mixing
- Process strategy (SSF, SHF, hybrid process)
- Resistance of some yeast strains at industrial relevant process conditions
BIOLYFE: Demonstrating large-scale bioethanol production from lignocellulosic feedstocks

- Integrated assessment of sustainability.
- Technological, environmental, economic and social aspects
- **SWOT analysis**

* : on subcontract basis
• Creation of functioning infrastructure.
• Mobilization of FFV fleet.
BIOLYFE: Demonstrating large-scale bioethanol production from lignocellulosic feedstocks

- Demo plant engineering, construction, start up.
- Data collection.
Thank you, for the attention.