



COMETHA

**Industrial scale pre-commercial plant
for second generation lignocellulosic ethanol**

Summary of activities

January 2018

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The final goal of COMETHA Project (FP7/322406) is the construction and operation of an integrated pre-commercial industrial second generation cellulosic bioethanol plant, first of its kind at European level and worldwide. The plant will be fed using lignocellulosic raw materials, such as dedicated energy crops and agricultural residues, and will include key innovative process units (such as innovative pretreatment, SSCF with the use of novel high performance enzymes and modified MOs, high efficiency integrated distillation and dehydration system, valorisation of secondary streams and process integration) in a second generation integrated facility.

The extensive and sustainable supply chain will be developed and demonstrated and the impacts of the whole plant (environmental, socio-economic) assessed.

The project started on January 1st, 2014. During the third Reporting Period (M37-M48), working to achieve some major goals:

- Evaluation of new possible plant location;
- Evaluation of the performances of the main sections of demo ethanol plant and design improvement for subsequent scale-up;
- Selection and development of high performance enzyme cocktail;
- Definition of the basis for obtaining an integrated assessment for the process;
- Elaboration of dissemination activities concerning the Project.

Definition of the Feasibility Study and Permitting procedure

During this third reporting period, Biochemtex continued to perform additional feasibility studies centred in Italy and East Europe as possible locations of the pre-commercial industrial plant. The delay in the realization of the ethanol plant was due to a complex local situation that is under investigation and to the recent period of financial distress that involved the industrial leader of the consortium.

Performances and scale up possibilities of the main sections for the pre-commercial plant

The main key sections of the second generation technology are pretreatment, viscosity reduction/enzymatic hydrolysis and co-fermentation, and their performance has been investigated in order to find the best engineering solution for the pre-commercial plant construction.

In order to diversify the feedstock supply chain, during 2017 the research on demo scale was mainly focused to the introduction of woody material (e.g. residual material and/or secondary products derived from poplar processing targeted at paper mill, chestnut chips, etc.) among the standard feedstock tested in the previous period (e.g. *Arundo donax* and agro-residues). Further researches are ongoing in order to fully optimize all the plant sections and validate the process improvements at demo scale.

Giving the complexity of the system in terms of number of components and its multiphase nature, a sustainable approach in the selection of the pre-treatment is to adopt a process that, even with a novel and innovative configuration, can be performed with equipment existing in established industrial processes, dealing with similar material. The pretreatment design, modified in the previous period at demo scale, led to an increased biomass transportation capacity without material flow interruption, improving moisture control in the feeding to the pressure zones. In 2017 the plant reliability and stability of operation was increased.

In 2017 focus has been put in optimizing hydrolysis time, also in the light of improved enzyme cocktail stability, requiring the introduction of new hydrolysis tanks at demo scale. Adjusted design will be reflected in the project for pre-commercial application of the technology.

The “hybrid SSCF” configuration selected by Biochemtex allows obtaining some advantages like a smaller reaction volume with a lower residence time: consequently the capital investment and production costs will be very advantageous. Developments of this new modifications focus to obtain higher tolerance to inhibitors, higher xylose consumption velocity and a consequent reduction of propagation and fermentation times maintaining the same ethanol yield.

Environmental assessment

The environmental assessment and sustainability certification are dependent on the site location and during the third reporting period (M37-M48), the activities related to the supply chain modelling, data gathering, data analysis and environmental impact assessment and sustainability certification were delayed due to a lack of site location. However, an interim LCA, WF and LUC assessments were completed for the first identified site location over the second reporting period. Within these activities, the methodologies to be applied, the system boundaries and the main steps needed for the environmental assessments were taken while the data gathering was started. In addition, during this third reporting period a new model to calculate the indirect land use changes at a project level has been under development and it will be applicable as soon as the selected plant location will be available with the rest of the environmental assessments.

Elaboration of dissemination activities

The project brand was created; all the main and most important tools for communication and dissemination were created: website, posters, leaflets, slides and presentations. The draft plan for dissemination and exploitation was approved by all partners and represents the main tool to steer the communication activities of the consortium. COMETHA project has been displayed and presented to hundreds of stakeholders and people directly involved in the topics of energy, industry and research sectors, and sustainable development. The project has been presented during some of the most important events on energy and renewables in Europe and Asian countries during the year 2017.