

## Projects

The laboratory has recently participated in the following EU projects: **GRAIL, AMBITION and BRISK**.

At the national level:

### **REBIOCHEM - Biochemicals from 2nd generation biomass**

**(Coordinator Novamont)**

The REBIOCHEM project has the objective of developing waste biomass monomers available in the territory to obtain completely renewable biodegradable bioplastics, outlining chemical and above all biotechnological processes in a third-generation biorefinery logic integrated into the territory.

Therefore, a model of industrial development that is sustainable from an energy, economic and environmental point of view will be defined for the industrial production of chemical products with high added value capable of contributing to the revitalization of the regional and national economy.

The project is closely connected with two important initiatives: the enhancement of the Terni Chemical Hub and the conversion of an old fermentation plant in the Veneto region to the world's first plant dedicated to the direct production of an important monomer by fermentation: 1,4 butanediol (BDO).

### **BIT3G - III Generation biorefinery integrated into the territory**

**(Coordinator Novamont)**

Programme: PON –MIUR prot.n.257/Ric. 30 May 2012

Start date and end date of the project: January 2014, still in progress (2020)

The BIT3G project aims to develop a Third Generation Integrated Biorefinery in the Territory that starts from the identification of sustainable drylands, not in competition with food chains, to obtain bio-based chemicals with high added value and energy. In particular, agro-industrial supply chains of dry oil crops are studied in the project.

ENEA activities:

- Analysis of the most recent biomass pre-treatment technologies;
- Optimization of steam explosion pre-treatment catalysed by bases
- Hydrolysis with high solids load with different mixtures of cellulase / hemicellulase;
- Microbial production of lipids starting from thistle hydrolyzate;
- Development of lignin characterization and valorization methods.
- Metagenomic characterization of soil microorganisms for the production of ligninolytic enzymes

### **ALBE - Sustainable technologies for the production of new elastomeric materials**

**(Coordinator ENI-Versalis)**

Programme: PON –MIUR prot.n.257/Ric. 30 May 2012

Start date and end date of the project: March 2014 - February 2017, extended to May 2019.

The project involves the production of elastomeric materials and rubbers starting from alternative resources such as the guayule. It is planned the development of guayule cultures with the recovery of fermentable carbohydrates and the selection of microorganisms to obtain butanediol, the latter to be converted into butadiene, precursor of elastomers.

Furthermore, guayule is chosen as an alternative non-tropical plant for the production of natural rubber. It is proposed to reach 1 ton / year of rubber per hectare of guayule, with an estimate of production costs. The rubber will be used for the formulation of "green" tires. Another challenge is to be able to use

vegetable oils instead of extensor oils of fossil origin, improving the compatibility between vegetable oil and rubber.

ENEA activities:

- Analysis of different guayule pretreatment technologies and optimization of experimental parameters;
- Development of techniques for the fractionation of materials treated in carbohydrates and lignin;
- Development of techniques for the production of second generation fermentable sugars;
- Production of lignin for composites formulation

### **Collaborative Research and Development Agreement Comet Biorefining Inc**

**(Coordinator: Comet Biorefining Canada)**

Start date and end date of the project: started in April 2017, expected to end in 2020.

The three-year collaboration agreement concerns research and development activities in collaboration with the Canadian company Comet Biorefining in the field of biorefineries with a particular focus on the production of second-generation sugars. Comet is a company that boasts considerable know-how in the production of low-cost and extremely high-purity sugar from agricultural and forest biomass. These sugars, together with other bio-refining products, such as hemicellulose and lignin, can be used as raw materials in a wide range of biochemical, biofuel and animal feed processes.

ENEA provides the project with the high level of expertise acquired over the years and a pilot structure (Steam Explosion plant, with a capacity of 300 kg / hour of wet biomass) capable of treating and fractionating lignocellulosic biomass (mainly straw and wood ). The objective of the collaboration is to refine the definition of the process operating conditions with different biomasses and to demonstrate the commercial sustainability of the proposed process on a pre-industrial scale.

### **Autotone Mediterranean Crops and Valorisation with Advanced Green Chemistry Technologies (COMETA)**

**(Coordinator Novamont)**

Programme: PON – 2014-2020

Start date and end date of the project: 1 June 2018 - 30 November 2020

The general objective is to study and validate innovative non-food cultivation systems with low inputs and suitable for marginal areas at risk of erosion/desertification, underused, polluted and/or badly used. The specific objectives are to obtain fractions (seeds, hypogean and epigeal biomass) suitable for conversion through advanced technologies of low impact green chemistry in bioproducts of interest for the agricultural and industrial sector: animal feed, biodegradable bioplastics, biolubricant, cosmetics products, biostimulants, green panels for building.

ENEA activities:

- Study of a thistle breeding program to increase the content of oleic acid (up to > 70%) and inulin in the roots
- Study of an innovative process of extraction of inulin from the roots, subsequent fructose hydrolysis and chemical conversion in building blocks (FDCA) of interest for the production of biodegradable bioplastics
- Set up an optimal reactor configuration for the pyrogasification of lignocellulosic waste for the production of syngas for bio-energy
- Develop innovative biotech processes for the production of biochemicals starting from syngas purified by pyrogasification of tested biomasses