

# Development of improved industrial processes for conversion of crops into biofuels

Cristina Machado

*Embrapa Agroenergy, Parque Estacao Biologica - PqEB, Av. W3 Norte (final),  
Brasilia, DF - Brasil, CEP: 70770-901*

## Abstract

Biofuels promote a series of environmental gains (carbon sequestration, lower level of emissions), are Renewable (short production cycle, with entire process controlled by man) and generate positive socio-economic impacts (generation of new jobs, better income distribution, increase of exports and trade to fulfill the growing global energy demand).

A common view of the international trend in the development of biofuels shared by many indicates that the first generation biofuels (ethanol from sucrose or starch; biodiesel produced by transesterification of oils and fats with methanol or ethanol) currently available will be followed by the so-called second generation biofuels, that include diesel produced from synthesis gas by thermo chemical processes and ethanol from lignocellulose by chemical and enzymatic processes. Next, integrated biorefineries will be built to produce energy, biofuels and a wide range of chemical and biochemical products from biomass.

As for all countries, the challenge for energy policies is to guarantee energy supply security in the long term, to pursue cheaper prices for energy sources, but keeping local energy competitiveness. All this goals must be reached with respect to the environment, in accordance with the guidelines for sustained development, while minimizing the environmental problems caused by emissions. For this reason, the Brazilian Government has addressed efforts in energy policy fields to privilege the development of biofuels.

The objective of the Brazilian Bioenergy Program is to secure to Brazil the international leadership in this new economic sector: BIOENERGY. The country wants to consolidate its leadership in 1<sup>st</sup> generation biofuels and to develop the 2<sup>nd</sup> generation biofuels, the agrobiotechnology (seeds, enzymes and microorganisms), the concept of biorefinery and the biochemical & "green chemistry" products (polymers, resins, etc). The production chains of bioenergy shall be organized, including the biofuels of 1<sup>st</sup> and 2<sup>nd</sup> generation (bioethanol, biodiesel, H-Bio, among others) and bioelectricity.

To define the vision and expected actions of Embrapa for the technological development of the agroenergy sector, it is appropriate to use as a reference its Strategic Plan for the period 2008 - 2023. The strategic objectives of Embrapa describe scientific

and technological challenges, defining results of high priority that shall be reached within the time covered by the strategic plan. Embrapa's strategic plan has 5 strategic objectives (SO), one of them specifically dedicated to agroenergy. The second SO is to "reach a new competitive technological stage in agroenergy and biofuels".

Two medium term (2011) strategic priorities were selected: 1) the development of new technologies of energy (ethanol from cellulose, products of bio-refinery, hydrogen), and 2) the development of technologies for economical use of by-products and residues. For the long term (2023), three strategic priorities were selected: 1) Development of novel production systems and raw materials with superior characteristics for the production of energy; 2) Zoning and evaluation of environmental, economic and social impacts for the identification of areas for the competitive and sustainable production of agroenergy; and 3) Development of technologies and production systems aiming at using degraded areas for the production of bioenergy.

Present efforts by Embrapa in industrial processes in ETHANOL are mainly in 2<sup>nd</sup> generation developments: to prospect and select microorganisms for the production of hydrolytic enzymes and for the alcoholic fermentation of sugars with five and six carbons; to prospect, synthesize and characterize genes involved in the synthesis of enzymes that hydrolyze cell walls to increase their specific activity or aiming at the consolidation of the conversion processes; to develop more efficient conversion processes by using the improved raw materials, microorganisms and enzymes, for the sustainable production of ethanol from lignocellulosic materials.

For R&D in BIODIESEL, Embrapa has the following major scientific, technological and production challenges in industrial processes: improvement and study ethylic production routes; alternatives development for economical use of by-products (specially glycerin and oil extraction cake), development of a commercial prototype of a vegetable oil cracking equipment; characterization and testing processing technologies for the oil produced by alternatives crops to enlarge and diversify the feedstock sources for biodiesel production.

**Key-words:** ethanol, biodiesel, residues use; fermentation, transesterification

Corresponding author's e-mail : [Cristina.Machado@embrapa.br](mailto:Cristina.Machado@embrapa.br)