DEINOVE
The deinococcus way

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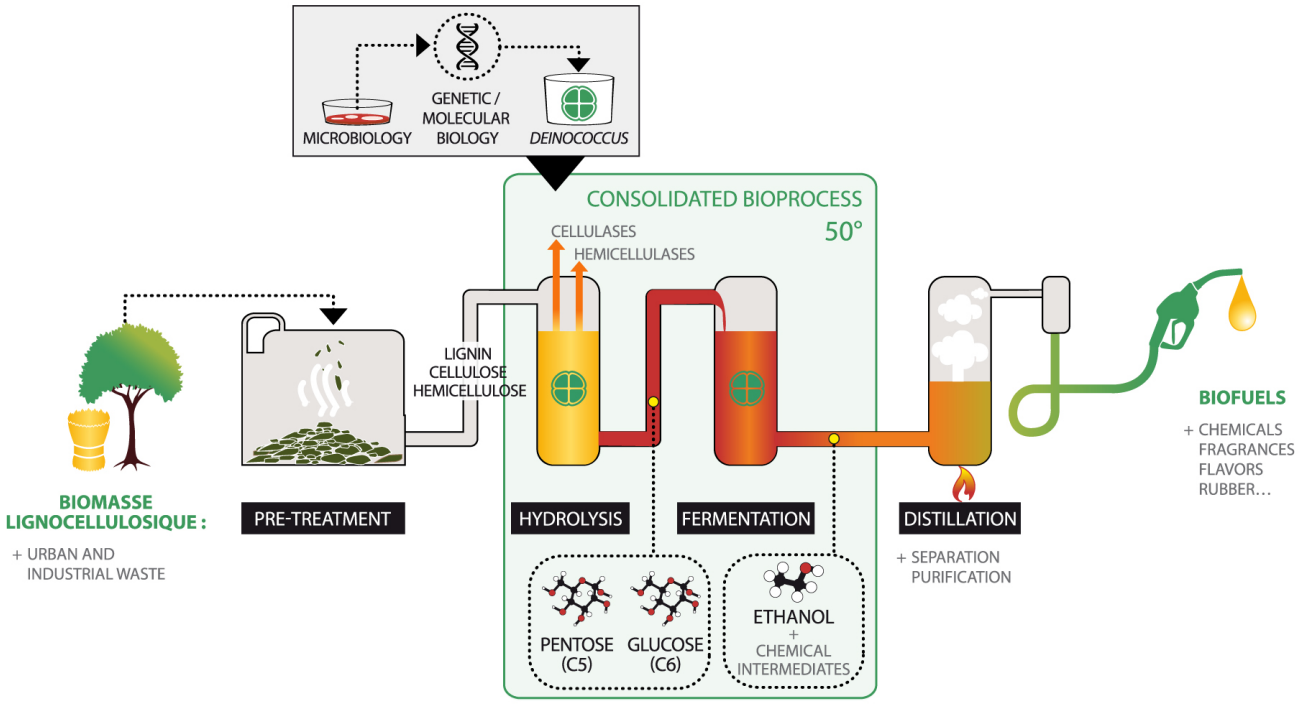
DEINOL

DEINOL, POTENTIAL STANDARD FOR PRODUCTION OF SECOND-GENERATION BIOETHANOL

Launched in 2009, DEINOL is a collaborative program of R&D amounting to €21 million which benefits from the support of OSEO, the French agency for innovation. DEINOL aims to develop an integrated production system able to pave the way for the production of second-generation bioethanol. Having established the proof of this innovative concept, DEINOVE initiated the pilot plant phase of this technology.

DEINOL is a new production system that aims to convert industrial biomass based on wheat to ethanol. The major industrial interest of the DEINOL solution lies in the ability of Deinococci bacteria to degrade waste green complexes contained in the biomass into simple sugars and then converting them into ethanol, all in a single operation and without additives (such as enzymes, yeast or antibiotics).

An "all in one" process for producing cellulosic bioethanol



The first process originating in the deinotechnologies, DEINOL now offers a series of advantages to manufacturers embarked on the path of cellulosic bioethanol:

- High reproducibility: once in the fermenter, the Deinococcus retain enzymatic and metabolic properties they have acquired and naturally resist physical and chemical stress,
- A high and constant productivity from hemicellulose, cellulose and starch,
- A unique ability to co-ferment C5 and C6 sugars,
- A decrease in production costs and maintenance: the selected and optimized strain ensures first enzymatic hydrolysis and then alcoholic fermentation at high temperature without using additives.

In 2012 the Company obtained a first validation of the approach through the DEINOL program. For the first time ever a DEINOVE bacterium turned wheat-based biomass into ethanol, in a single operation and without additives (enzymes, yeast, antibiotics or antiseptics). In 2013, DEINOVE confirmed and improved these results when its optimized bacteria have been able to exceed an alcohol content of 5% wt/v, a threshold for considering an industrial operation process in 2nd generation biofuels.

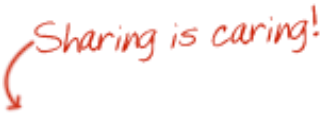
In 2014, an optimized bacterium produced ethanol with an alcoholic strength by volume of 9%, the highest levels ever obtained by means of bacterial fermentation.
Based on these results, DEINOVE has engaged in the pre-industrialization of this process with a series of tests in a 300L fermentor. DEINOVE is expecting the first revenues from its technology by 2016.

Three industry-leading partners

In 2014, DEINOVE signed three partnerships to industrialize the DEINOL process:

- With Abengoa, the first ethanol producer in Europe and a major player in the United States and Brazil, the world's leading markets for biofuels. Initially, developments will be made from corn stover. Other types of substrates can also be tested later on, including bagasse or forest residues. The two partners will result in a non-exclusive license agreement on the process may therefore be implemented in full-scale factories.
- With Suez Environnement, the world leader exclusively dedicated to water and waste management operations on five continents. This two-year contract is the first step in a project to explore the potential for development of an industrial sector of waste-to-ethanol transformation by the action of *Deinococcus* bacteria.
- With MBI, pioneer of AFEX technology, in a technological partnership designed to demonstrate the effectiveness of the DEINOL technology for producing biofuels based on lignocellulosic biomass. Preliminary DEINOVE lab results have demonstrated that *Deinococcus* assimilates over 95% of the sugars present in AFEX pretreated biomass and efficiently converts these sugars into ethanol, they represent an important step forward on the road to commercial production. The test campaign carried out with MBI makes it possible to work with biomass that is qualified for industrial use and accelerate the industrialization by envisaging scaling up to volumes of up to 3,500 liters. For DEINOVE, the first results obtained on the MBI substrates are an important step forward on the road to commercial production.

More information on DEINOL and the testing campaign



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