

CONTACT

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CLARIANT

Cellulosic ethanol from agricultural residues **THINK AHEAD, THINK SUNLIQUID®**



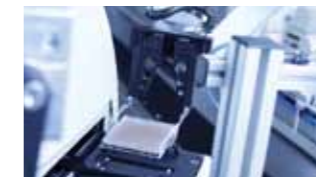
sunliquid® process design on demand **COMPREHENSIVE PLANNING BASIS, FLEXIBLE REALIZATION**

Clariant's sunliquid® Process Design Package offers you a sophisticated plant concept for the industrial production of cellulosic ethanol from lignocellulosic agricultural residues which, due to its modular structure, is highly flexible. The package includes a detailed planning guide for the construction of a commercial plant. At the same time, it is open to your requirements, laying the foundation for swift, but feedstock and site-specific realization.

Clariant – your partner for setting up high-performance cellulosic ethanol production

The sunliquid® process is designed for industrial plants with a production capacity of 50,000 to 150,000 tons of cellulosic ethanol per year. Clariant provides the know-how, technology and full-scale support for all unit operations – bundled into a single package. In this way, the innovative strength of biotechnology is combined with our experience in the fields of process development and engineering.

sunliquid® development milestones



LAUNCH 2006

Development of highly-specialized microorganisms and enzymes in the laboratory.



SINCE 2009

sunliquid® pilot plant at Clariant's Biotech Research Center in Munich. Extensive tests and process optimization for converting various feedstocks.



SINCE 2012

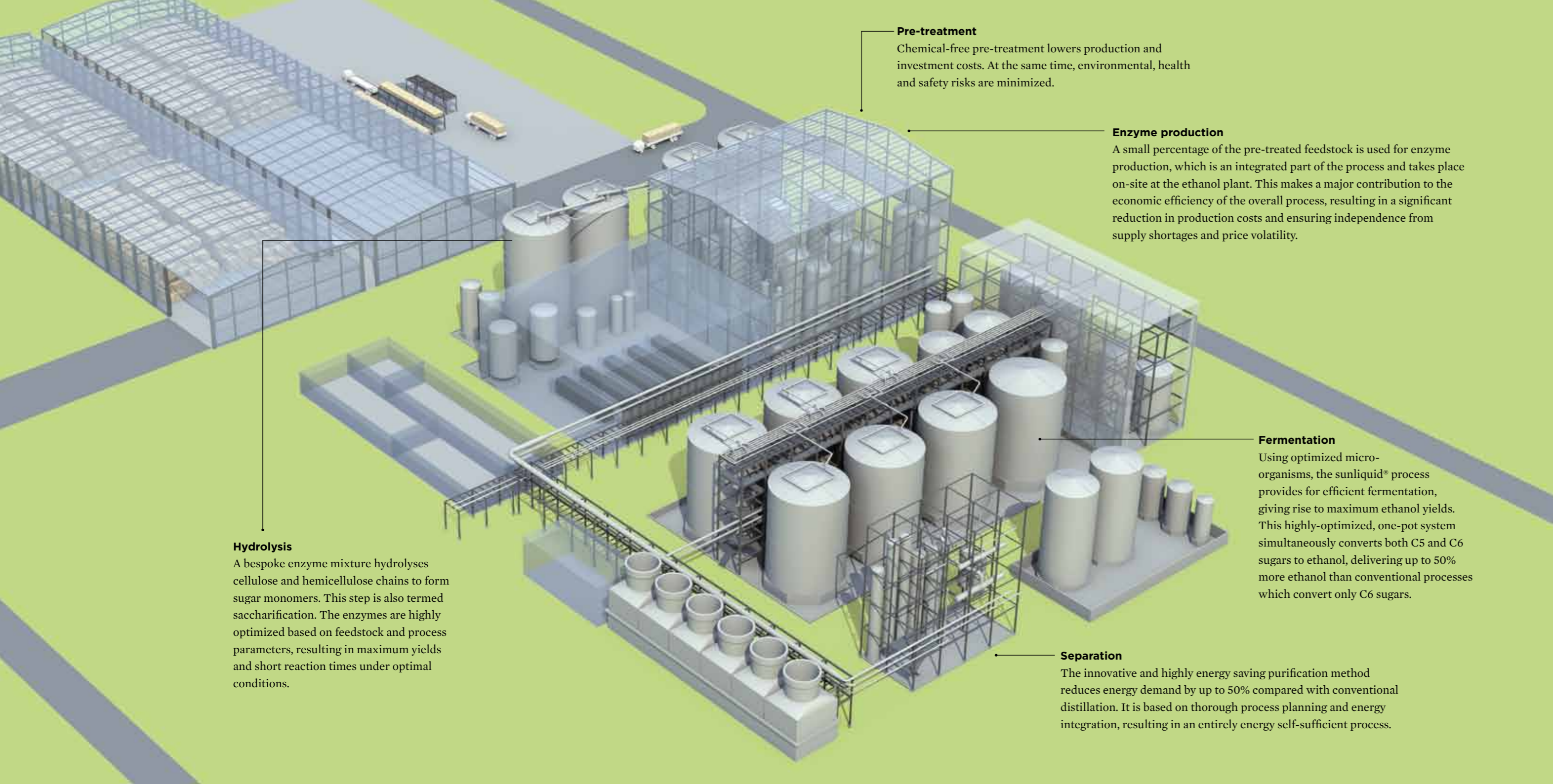
sunliquid® demonstration plant in Straubing-Sand, Germany. Validation of the entire process on an industrial scale. Feedstocks tested to date: wheat straw, maize straw, sugarcane bagasse. ISCC certification since September 2013.



NEXT STEP

Construction and commissioning of first commercial plant for the production of cellulosic ethanol.

what is precious to you?



Pre-treatment
Chemical-free pre-treatment lowers production and investment costs. At the same time, environmental, health and safety risks are minimized.

Enzyme production
A small percentage of the pre-treated feedstock is used for enzyme production, which is an integrated part of the process and takes place on-site at the ethanol plant. This makes a major contribution to the economic efficiency of the overall process, resulting in a significant reduction in production costs and ensuring independence from supply shortages and price volatility.

Fermentation
Using optimized micro-organisms, the sunliquid® process provides for efficient fermentation, giving rise to maximum ethanol yields. This highly-optimized, one-pot system simultaneously converts both C5 and C6 sugars to ethanol, delivering up to 50% more ethanol than conventional processes which convert only C6 sugars.

Separation
The innovative and highly energy saving purification method reduces energy demand by up to 50% compared with conventional distillation. It is based on thorough process planning and energy integration, resulting in an entirely energy self-sufficient process.

Hydrolysis
A bespoke enzyme mixture hydrolyses cellulose and hemicellulose chains to form sugar monomers. This step is also termed saccharification. The enzymes are highly optimized based on feedstock and process parameters, resulting in maximum yields and short reaction times under optimal conditions.

sunliquid® Process Design Package CLARIANT MODULES FOR SUCCESS

Clariant offers everything you need to set up and operate your own cellulosic ethanol plant, including a fully-integrated process design, highly-efficient enzymes and microorganisms, as well as sustainable processing technology. Added to this is an extensive service package covering the entire value creation process – from engineering and the supply chain to commissioning and training. As a result, you systematically benefit from both our experience, our development and plant know-how in the form of highly-efficient ethanol production. Here is an overview of our modules and services.

Licence agreement
· Integrated process technology package including all steps along the ethanol production chain.

Supply agreement
· Starter cultures for process-integrated enzyme production. We deliver optimized starter cultures for each new propagation to maintain top performance.
· Starter cultures for proprietary fermentation organisms which convert C5 and C6 sugars into ethanol. We deliver optimized starter cultures for each new propagation to maintain top performance.
· Proprietary ethanol separation, material delivered by Clariant to maintain high product purity.

Service agreement
· Testing your specific feedstock in our demonstration plant and in the laboratory, as well as pilot scale operations for enzyme optimization.
· Support during basic and detailed engineering.
· Support during commissioning and regulatory approval of the plant.
· Support during certification.
· Training of your employees in our sunliquid® demonstration plant.
· Feedstock support in terms of sourcing and logistics.