

ANNEX 9 TO THE LICENSE AGREEMENT BETWEEN BETA RENEWABLES S.P.A. AND GRAAL BIO
LLC (NOW GRANBIO LLC) OF MAY 15, 2012
PROCESS DESCRIPTION

1. Process Description

Bioflex technology is a single-step process pretreatment concept with an additional mechanical treatment to enhance enzymatic access and efficiency.

1.1. Area: Biomass pretreatment

The biomass is received in GranBio's biomass handling unit to reduce impurities and proper fiber cutting. After that, biomass is conveyed to the Bioflex pretreatment.

The Bioflex hydrothermal pretreatment process comprises a new single step liquid hot water cooking concept, which operates at mild pressure and temperature steam conditions to provide complete solubilization of hemicellulose and partial lignin removal from the cellulose fibers. No additional chemical is added at the pretreatment stage. The technology includes a mechanical pretreatment system downstream the liquid hot water pretreatment to assure efficient enzymes access. There is a single pretreated stream leaving the pretreatment section.

The differential of Bioflex technology is that the reduction of fiber accessibility due to the mild conditions is offset by the reduction of the degradation products of hemicellulose and glucose generated, which improves fermentation yields by lowering the inhibitors, reducing production costs. The Bioflex pretreatment technology brings higher operational reliability due to the process cooking conditions.

1.2. Area: Enzymatic hydrolysis

The single stream exiting the pretreatment section is fed into the enzymatic hydrolysis tanks.

To reestablish the proper hydrolysis performance, the new Bioflex hydrolysis technology was designed to operate on a Dry Matter content range of 13-19% and a residence time higher than 80 hours. New hydrolysis tanks configuration was designed.

A new concept of heat exchangers for hydrolyzated cooling customized to the streams characteristics was also designed.

A new customized enzyme cocktail has been developed and is being deployed.



1.3.Area: Fermentation and MO propagation

Bioflex technology has a new proprietary yeast propagation system with two new tanks, with different aeration rates and chemicals recipe. This leads to a minimal sugar consumption and no ethanol co-production during yeast propagation, in compliance with the Renewable Fuel Standards - RFS, Low Carbon Fuel Standards- LCFS and other sustainability programs in Europe. The technology also includes a new pump design with higher reliability and low chemical consumption.

The stream exiting from the hydrolysis tanks, which is cooled in the heat exchangers mentioned above, is sent to the fermentation section. The Bioflex fermentation basic concept is co-fermentation of both glucose and pentose by using its own proprietary genetically modified yeast. The fermentation cycle time is below 40 hours. The fermentation yield is above 90%.

1.4.Area: Distillation and Ethanol Dehydration Section

The Bioflex distillation concept is similar to a typical corn ethanol distillation and dehydration unit, which comprises a vacuum beer column, a beer rectifier column and molecular sieves ethanol dehydration. A new energy integration scheme was designed to assure optimal steam consumption. The bottom stream of the beer column is sent to the Lignin separation section.

1.5.Area: Lignin separation

The bottom stream from the first distillation column is fed to a set of standard press filters to separate the lignin from the stillage. The lignin cake exiting the filters is sent to a step of size reduction in order to be fed to the boiler. The stillage stream is sent to the stillage evaporation unit.

1.6. Area: Stillage evaporation unit

Bioflex installed a complete stillage evaporation unit with the purpose of reducing the logistics cost to send the stillage back to the cane fields across the year.

