European Biofuels
TECHNOLOGY PLATFORM

Biofuel Fact Sheet

Borregaard – commercial plant in Sarpsborg, Norway

Lab scale | Bench scale | Pilot Plant | Demonstration | Commercial

Introduction

Borregaard is a Norwegian company, established in 1889 in Sarpsborg in the Østfold County. Traditionally, Borregaard has been engaged in pulp and paper processing. Borregaard's core business is based on the concept of a biorefinery that processes chemical products based on different types of lignocellulosic feedstock.

The bioethanol that is produced in Borregaard's biorefinery is based on extracting sugar from wood (spruce), which is then fermented to make ethanol. The production started already in 1938. This means that Borregaard has never been engaged in producing first generation biofuels but only second generation bio-ethanol or more precise 'advanced bioethanol'. The bio-ethanol process in the commercial operation is technically almost the same as it was from the start in 1938. Among others, Borregaard supplies bio-ethanol to Statoil, a leading retail chain for petrol and diesel, but most of volumes are sold for use in chemical products or as solvents.

Technology description

Figure 2 illustrates the processing of biomass in Borregaard. Ethanol is one of several products coming out of the total process. The pulp for specialty cellulose is produced by cooking spruce chips with acidic calcium bisulfite cooking liquor. Hemicellulose is hydrolyzed to various sugars during the cooking process. After concentration of the sulfite spent liquor, the sugars are fermented and ethanol is distilled off in several steps. A part of the 96% ethanol is dehydrated to get absolute ethanol.

The ethanol process have low energy consumption, as most of it is recovered and used in other processes on site. Fossil fuels for energy production for the whole refinery have been replaced by renewable energy sources over the last 15 years.

Borregaard

Figure 1: Borregaard plant in Sarpsborg

Technical Details

Project owner	Borregaard AS
Project name	ChemCell Ethanol
Location	Sarpsborg, Norway
Technology	Chemical/biochemical
Raw Material	Lignocellulosic spruce (Norwegian spruce)
Project Input	Sulfite spent liquor (SSL, 33% dry content) from spruce wood pulping
Input Capacity	400,000 t DS (spruce)/a
Product(s)	Ethanol
Output Capacity	15,800 t/y; 20 Ml/y
Facility type	Commercial
Status	Operational
Start-up Year	1938
Web	http://www.borregaard.com

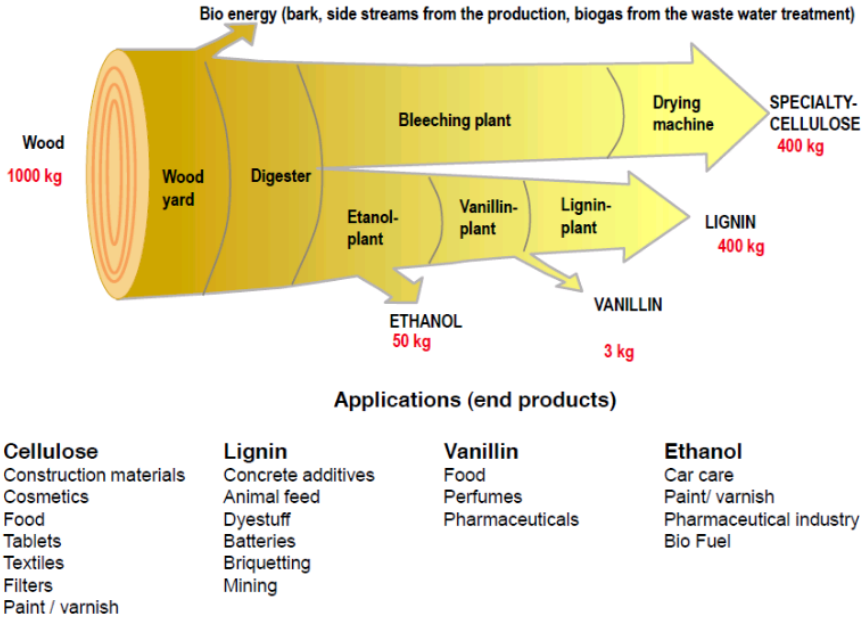

Figure 2: Borregaard – chart of products

Project background

Borregaard has been operating as a biorefinery for over 50 years, but the advanced ethanol production started already in 1938. Borregaard has been interested in optimizing these processes over the last decades. Borregaard has an additional 6 production plants around the world, and they do not produce bio-ethanol but only lignin performance chemicals. For bio-ethanol production Borregaard has only two plants and both located in Norway, the commercial plant producing between 20 million liters advanced bio-ethanol per year and the BALI demo plant. The experience gained over years in the commercial plant has been a valuable knowledge input into the demo project. The main difference to the commercial plant is that Borregaard will use all of the cellulosic fiber for cellulosic sugars or ethanol production, not just the hemi-cellulose as in the commercial plant

Borregaard- BALI Biorefinery Demonstration Plant

Project name	BALI Biorefinery Demo
Location	Sarpsborg,, Norway
Technology	Chemical/biochemical
Raw Material	Lignocellulosics (sugarcane bagasse, straw, wood, energy crops)
Product(s)	Ethanol, lignin performance chemicals, single cell protein, sugar based chemicals
Output Capacity	110 t/y
Facility type	Demo
Status	Operational
Start-up Year	2012

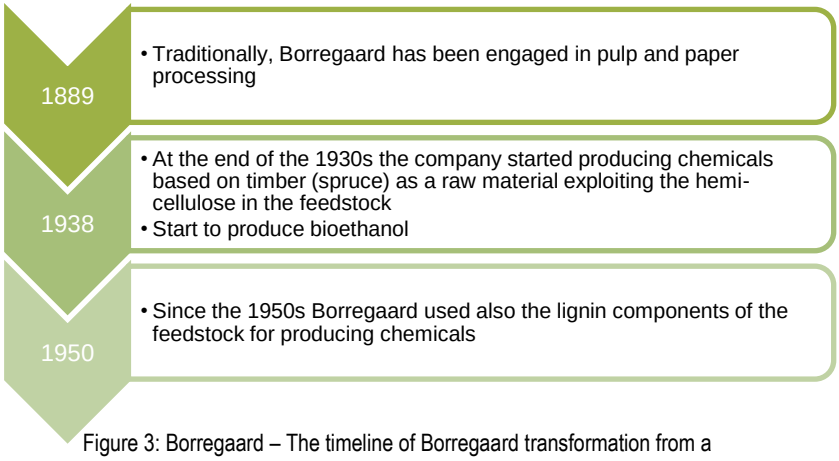

Figure 3: Borregaard – The timeline of Borregaard transformation from a conventional paper plant to a biorefinery