



Biobased Economy

Betaproces

KH *Engineering*

commissioned by

DSD BV

DUTCH SUSTAINABLE DEVELOPMENT BV

Biobased Economy

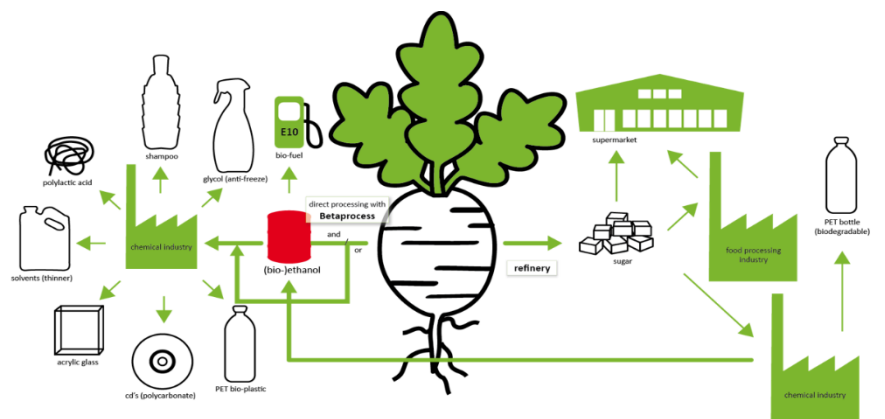
Direct processing with Betaprocess Technology

Improving the sustainable society is important for government and companies. The overall aim is to support the development of cleaner and renewable sources. Especially the right way for the utilization, conversion of resources in a circular way. The use of biomass is an interesting option, because of the worldwide availability of the biomass. It also can be produced and consumed on a CO₂-neutral basis. Sugar beet is seen as the most attractive Biobased crop: for the impact as soil improver, higher yield of the other rotation crops and for a stable farmers income.

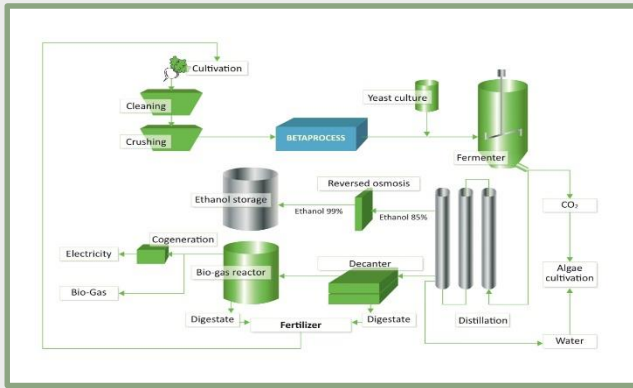
The transition is deployed from fossil industries into more biobased chemical industries. Research found several critical points in the regular work process of conversion of the sugar beet into (food grade) bio-ethanol. Feedstock flexibility, CAPEX, OPEX, High Water Usage, Waste/residues and Robustness could improve in the work process. DSD invested to solve these problems and optimize the process, including an attractive cost price.

The aim of DSD is to integrate a new biomass pretreatment (Betaprocess) liberating sugars for processing. In the pilot installation in Lelystad sugar beet was treated and the released sugars were fermented (2 x 1,5 m³ capacity) into ethanol.

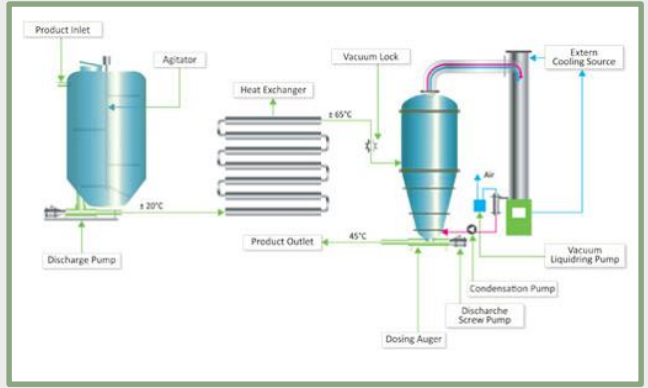
The pilot installation in Lelystad provided data for the design of the demonstration plant to produce ethanol from biomass, such as sugar beet and sweet sorghum. DSD has developed a direct processing concept with Betaprocess technology. The developed technological process scheme including the pretreatment solution serves as a basis for assessment of numerical economic output and environmental influence. The initial technological line included a raw material reception and preparation area, a raw material washing section, the slicing section, the Betaprocess pretreatment section and the alcohol fermentation and distillation section. The demo plant will demonstrate the economic and technical feasibility of a full scale commercial plant.



Direct Processing with Betaprocess

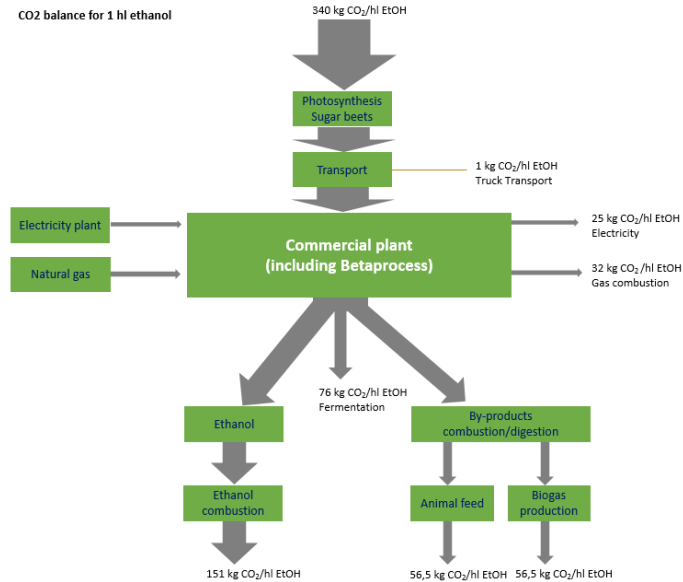


Process flow Betaprocess Technology

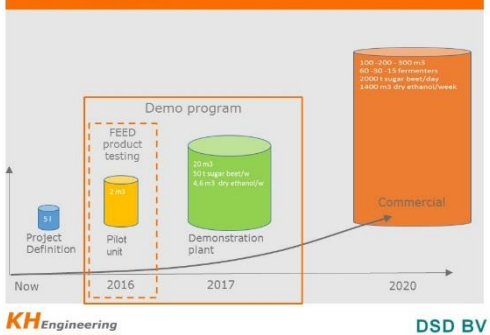


Advantage in using the Betaprocess Technology

- Energy efficient processing of biomass, such as sugar beet, sweet sorghum, but also rest- and by-products such as fruit products, potato peels, French fries waste;
- Efficient liberation of sugars from biomass resulting in a high yield of released sugars compared to traditional processes, such as steam explosion;
- Betaprocess is with low pressure and low temperature" compared with alternatives which are high pressure and high temperature
- Less formation of toxic byproduct due to the relatively low process temperatures;
- Higher yield of Ethanol;
- Fermentation easier, shorter fermentation time and without enzymes;
- At least 20% - 25% lower investment costs compared to traditional ethanol production from sugar beet;
- Short Return On Investment, attractive Cost price and positive Life Cycle Analyses;
- CO2 reduction compared with traditional → decentralized production.



Market introduction



Tested (proved by):

- Ecole d'ingenieurs de Changings (Mr. Serge Hautier - Switzerland);
- Wageningen University & Research – FBR and Acres (the Netherlands);
- University College Roosevelt (the Netherlands);
- Demonstration plant by ACRRES (part of WUR), Lelystad (the Netherlands);
- University of Warmia and Mazury , Olsztyn (Poland).

Factsheet

Dutch potential

Feedstocks:	Sugar beet (200 days), Sweet sorghum (100 days);
Supplier:	750 farmers (22.500 HA, distance 10 – 15km);
Capacity:	2.000 ton/day biomass;
Location:	The Netherlands;
Suppliers/Logistics:	Farmers cooperation;
Customers/applications:	Food grade and technical ethanol consumers;
Key partners:	DSD, Wageningen University, KH Engineering.

Parameter for one plant	Conventional Bio ethanol Plant (Food grade)	Betaprocess Bioethanol Plant (Food grade)
Capacity	2.000 ton sugar beet/day	2.000 ton biomass/day
Operation	300 days/year	300 days/year
Ethanol	51.977 m3/year	53.123 m3/year
CAPEX	90 million €	63 million €
OPEX	28,7 million €/year	26,3 million €/year
Revenue	41,7 million €	42,3 million €
Discounted Pay-back	>11 years	5,5 years

Feedstock price:	€ 30/ton;
Transport costs:	€ 4,5/ton;
Food grade Ethanol price:	€ 0,80/litre;
Technical Ethanol price:	€ 0,50/litre;
Products:	Food grade bio ethanol (57.000 m3/year)
By-products:	50% sold in technical ethanol market; CO2 (43.000 ton/year), Animal feed (62.000 wet ton/year, 12% dry matter);
CO2 price:	€ 50 / ton;
Animal feed price:	€ 100 /dry ton.

CAPEX:	€ 63 million;
OPEX:	€ 26,3 million /year (incl. € 18 million feedstock);
Revenue:	€ 42,3 million /year;
Gross profit:	€ 19 million /year;
Interest rate:	6%;
Discounted Payback:	5,5 years;
Market potential:	3-4 plants in the Netherlands;
Employment:	28 direct, 40-50 indirect.



KHEngineering

KH Engineering is an independent multidisciplinary company with proven experience in engineering, procurement and construction management with consultancy activities in the industry for more than 65 years.

As a member of the Ludan Group, with more than 1000 employees, they gained experience by providing complete Front-end loading & EPCM services for national and international projects to several markets and clients, using the latest project tools and approach.

KH Engineering serves clients in all disciplines by site based teams or Project teams situated in the offices in Schiedam , Amsterdam, Zaandam, Duiven and Antwerp. They provide innovative technological solutions, create value for the customers and shareholders, ensure sustainability and stability of the operations, with care of health, safety and environment.

The philosophy is 'Global experience, local approach.'

DSD BV

DUTCH SUSTAINABLE DEVELOPMENT BV

DSD is an independent company who's mission is to provide technical support and services in the Agri-Food & Bio-Fuel Industry as well as to contribute in the development of multi agri-based business parks. DSD is independent also in view to suppliers of seeds, chemicals, fertilizers, equipment or contractors. DSD the partner for the preparation of detailed cost & benefit calculations for mentioned projects and / or to prepare business plans. Besides these activities, DSD possesses the know-how to support with subsidy applications, attract financing and investors and to support on other financial, legal and organizational aspects.

DSD is capable to offer her unique capabilities to establish local partnerships and cooperating with local partners and connections to organize and manage factories for the production of bio-fuels, such as bio-diesel and bio-ethanol.

DSD is the linking pin and concept developer between the Agricultural and Chemical industry and a specialist for the entire chain.

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