



BIOPROCESS PILOT FACILITY

A brief overview of BPF

- Location
- Facilities
- Origins
- Summary

*Have your process scaled up at BPF,
a reliable and experienced pilot scale partner.*



Investing in your future.
The Bioprocess Pilot Facility is partly financed
by the European Regional Development Fund
of the European Union.

*Scale me up Scotty!
Brussels, 18-April-2018
Raimo van der Linden*

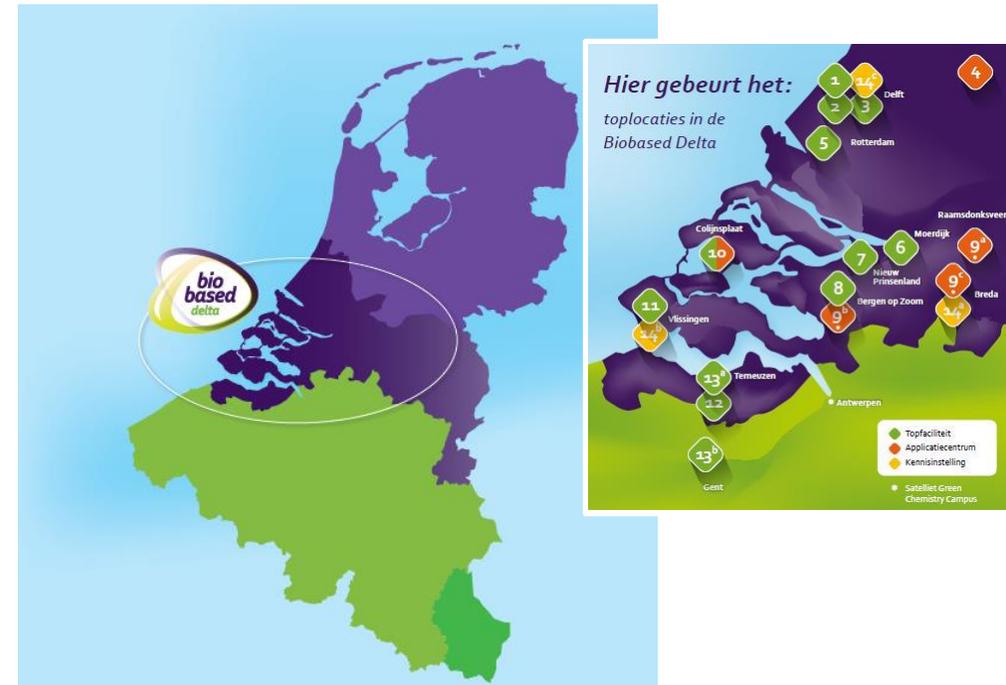
Bioprocess Pilot Facility (BPF)



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PILOT FACILITY

Spoiler alert: Your take-home messages

- Value chain from biomass to end product, all in one pilot
- Situated on an old industrial site
- Young company, but old roots
- Part of the Biobased Delta eco-system in the Netherlands



BPF facilities

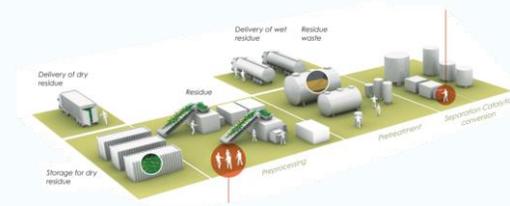


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An entire value chain at pilot scale



BPF equipment



Pre-treatment & Hydrolysis

- Pre-processing:
 - Indoor storage for biomass
 - Shredder
- Pre-treatment
 - Batch: 4 kg biomass (dry weight) per batch, ATEX
 - Continuous: 40 kg/hr, one or two-stage
 - Additives possible (e.g. acid, base, chemicals)
- Hydrolysis
 - 100 liter, 3 m³, 9 m³
 - Bring your own enzymes
 - BPF supplies enzymes too



Shredder



Continuous Steam Explosion reactor

BPF equipment



Fermentation

- Available process configurations:
 - Aerobic, anaerobic
 - In situ product removal (membrane, solvent extraction (ATEX))
 - Batch, fed-batch or continuous
- Fermenter sizes:
 - 10, 20, 70, 100, 300 liter, 1 and 4 m³
- Microorganisms
 - Bacterial, Fungal, Yeast
 - GMO and non-GMO



4x 300 liter, 4x 100 liter fermenters



4 m³ fermenter

BPF equipment



Downstream Processing

- Big playground with lots of equipment, for example:
 - (Bio-)chemical reactors (steel, glass lined)
 - Solid liquid separations
 - Evaporators, Spray dryers
 - Membranes
 - Extraction
- Connect in any sequence, also to fermentation section

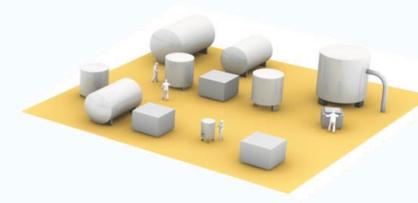


Glass-lined chemical reactors



Membrane filter press

BPF equipment



Food grade fermentation & downstream processing

- Fermenters: 4, 40, 400 liter, 2x 2 m³
- Various downstream process steps
 - Filters / membranes
 - Evaporators / spray dryers
 - Centrifuge
- FSSC 22000 Certified
- Organisms: GMO & non-GMO
- Materials for Pre-clinical trials possible

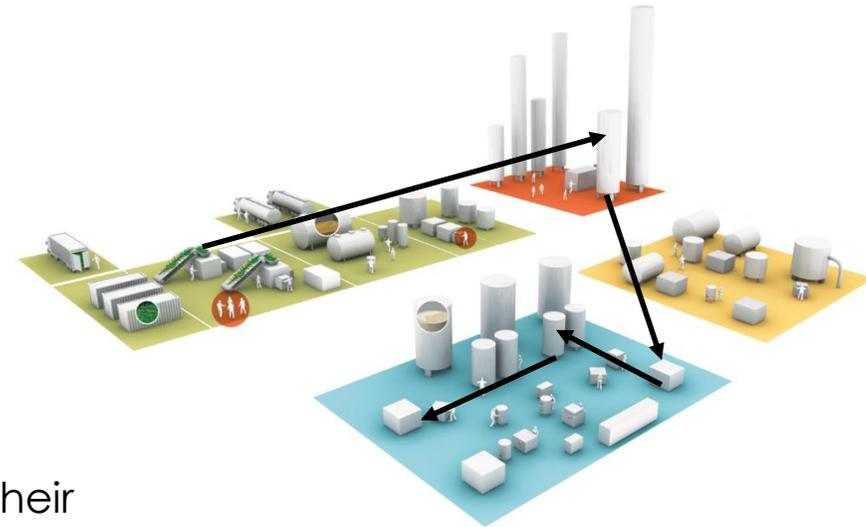


2x 2m³ food-grade fermentors

Customer in the lead

No two experiments are the same...

- Customer defines the pilot experiment:
 - Goals (what do you want to learn?)
 - Product specifications
- BPF will support with advice, based on industrial experience
 - Scale down approach to process design
- Customer is always welcome to be present when their projects / experiments are conducted
 - Optimal usage mutual expertise
 - Easier tech. transfer



BPF origins

A brief history of our pilot facility

- *De Nederlandsche Gist- en Spiritusfabriek* was established in 1869 (Yeast and denatured alcohol factory)
 - Production since 1869
 - Product portfolio broadened, food ingredients (yeast), antibiotics (penicillin)
- Pilot built in 1960
 - Fermenters in various sizes
 - Downstream processing



BPF origins

A brief history of our pilot facility

- 1968, merge with Brocades, become Gist Brocades
- 1992, take over by DSM
- Meanwhile, pilot facility has always been operational



BPF origins

2012: A public pilot facility is created

- BPF is an independent public pilot facility since 2012
 - Joint venture of DSM, CSM-Purac (now Corbion) and Delft University of Technology
 - Partially funded by EFRD, Dutch Ministry of Economic Affairs, province of Zuid-Holland and the municipality of Delft.
- Additional investment of 37 M€ made in 2012

2012: A public pilot facility is created

- Main reasons for spin-out
 - Existing facilities not fully occupied fully by owner (DSM)
 - New / different equipment needed to make pilot relevant for the future
 - Improve business model of pilot plant, which is broader than business scope of DSM

BPF right now



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The Bioprocess Pilot Facility

Industrial heritage: Scale up by scaling down

- BPF facilities:
 - A scale down of a commercial factory
- Origins of the commercial factory still felt
 - Experienced operators with industrial experience
- Strict confidentiality
- IP remains with the client



BPF track record



BIOPROCESS
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A young company with a long history

- Decades of experience in piloting of biobased processes
- Customer base:
 - Small, medium & large companies
 - Institutes



Names published with explicit permission

Summary



BIOPROCESS
PILOT FACILITY

BPF is a truly multi-purpose pilot facility

Open access
Confidential
IP remains with
client



Large variety
of scale,
technologies
and unit
operations

(covering full supply chain from large variety biomasses to end product)

Long-standing
historical track
record in bio-
process piloting

(Fermentation & DSP)



Hands-on,
professional
know-how and
scaling up and
scaling down
experience of
bio-processes



Proven experience

with GMP- and food quality regimes, resulting in reliable engineering as well as process/product data



Biotech Campus Delft:

Perfect embedding in a strong knowledge infrastructure and perfect fit with regional developments





BIOPROCESS
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BPF is a truly multi-purpose pilot facility

Raimo van der Linden
Raimo.linden-van-der@bpf.eu
M: +31 6 42 48 07 54

www.bpf.eu