

Residual Streams From Sewage Treatment Plants As A Source for PHA-Bioplastic End Products

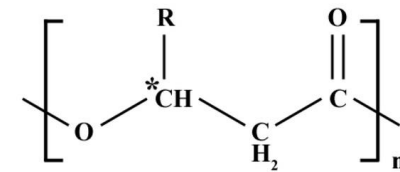
29 October 2020

Guillaume Lebouteiller – NaturePlast



PHA Bioplastics At A Glance

- PHA: Polyhydroxyalkanoate
- Polymer consists mainly of two monomers:
 - 3HB (3-hydroxybutyrate)
 - 3HV (3-hydroxyvalerate)=> Copolymer: PHBV



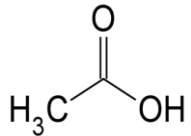
Poly(3-hydroxyalkanoate)

<i>R</i> group	Carbon no.	PHA polymer
methyl	C ₄	Poly(3-hydroxybutyrate)
ethyl	C ₅	Poly(3-hydroxyvalerate)

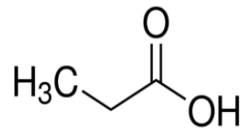
- Composition determines properties
- Worldwide production capacity of 30 kT in 2019
- Biobased, biodegradable and biocompatible (non-toxic)
- **Currently mainly produced from corn starch or sugars** (sugar cane or sugar beet)

Standard PHA Production Process

Acetic Acid
(AA)

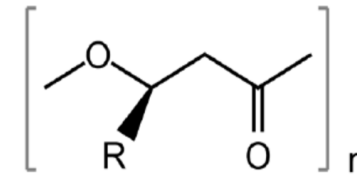


Propionic Acid
(PA)

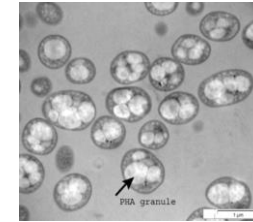


**Volatile Fatty Acids (VFAs)
from sugars**

Fermentation



R	PHA
C ₁ -C ₂	scl-PHA
C ₃ -C ₁₁	mcl-PHA
CH ₃	PHB
C ₂ H ₅	PHV



Mixed Microbial Culture (MMC)



Purified PHA

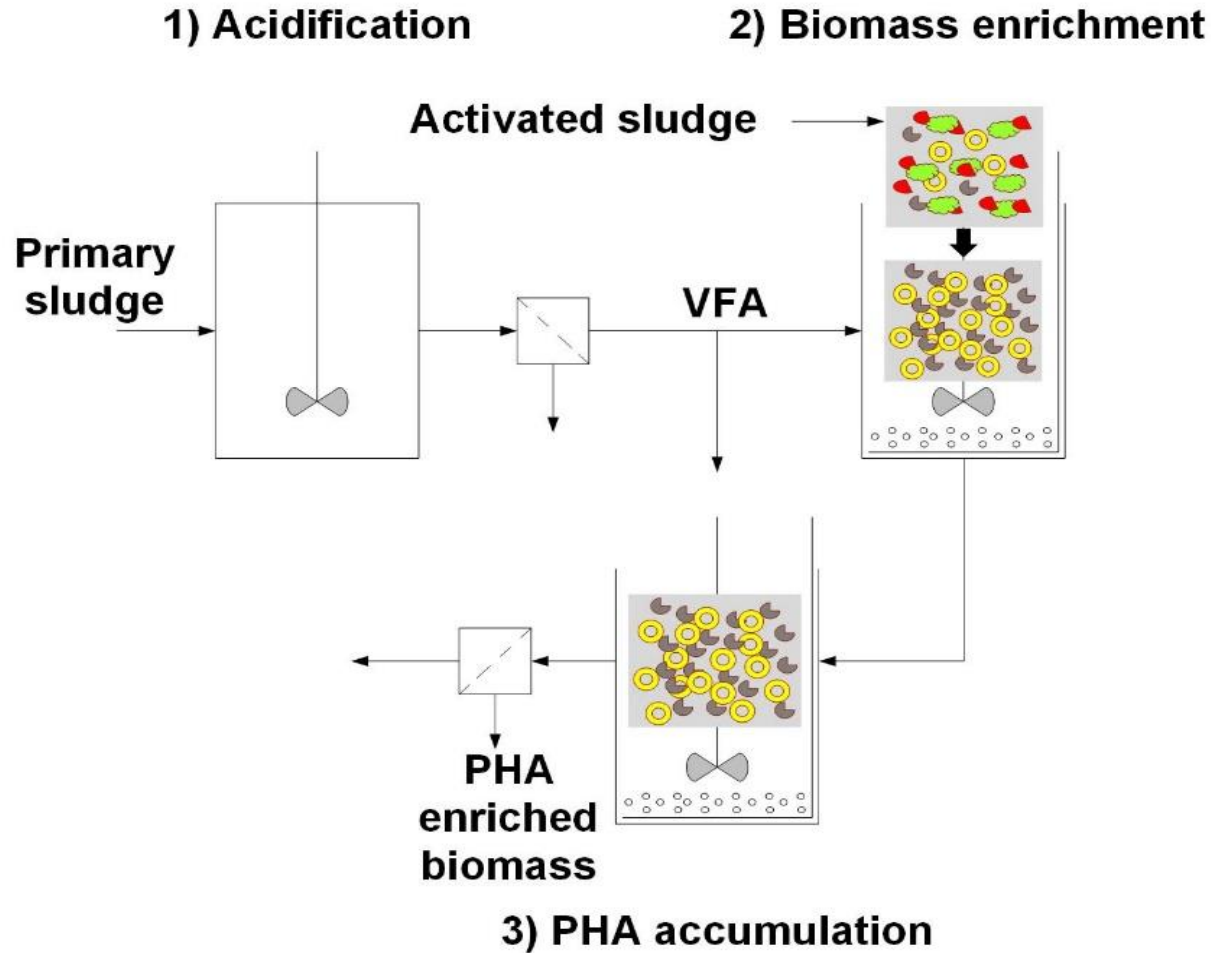
Purification



Extracted PHA

Extraction

WOW! PHA Production Process



PHA Pilot Team



Pilot scale bacterial PHA production



Extraction + Lab scale PHA fermentation



Extrusion and injection → Product



Techno economical analyses

Pilot Scale PHA Accumulation

1.3 m³ Acidification

Primary
sludge



Chamber filter press



1 m³ VFA storage



VFA



0.8 m³ Enrichment
and accumulation

VFA



Chamber filter press



Drying
cabinet



PHA-
enriched
biomass



Pilot Scale PHA Accumulation



Extraction and Purification

Biomass



Dimethyl Carbonate



PHA



PHA



1-Butanol



Solvent Recovery



Purified PHA

Pilot Scale Extraction

avans
hogeschool

Interreg 
North-West Europe
WOW!
European Regional Development Fund



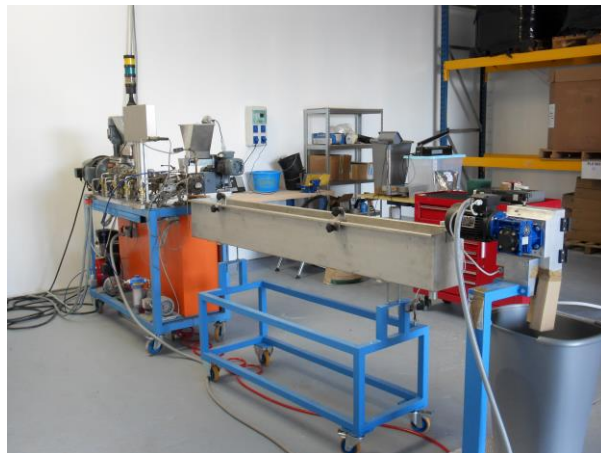
Extraction process
uses a non-harmful
and reusable solvent :

Dimethyl Carbonate

Pilot Scale Extrusion and Injection



PHA



PHA Compound



21 mm Twin-screw Extruder



PHA Products



Injection Machine



PHA End-Products & Applications



Coffee
Capsules



Water
denitrification



Vineyards
Clips



Food
packaging



Cosmetic

Conclusions & Future Research

- Pilot finalization: operation will start in November 2020
- WOW! PHA evaluation (extrusion, injection and properties characterization) in 2021.
- WOW! PHA compounding in order to adapt to market needs in 2021