

A biorefinery approach to bioplastics and microalgae products

Brígida Rodrigues¹
Supervisors: Sara Raposo¹, Raul Barros¹ and Rosa León²

¹ Laboratory of Engineering and Environmental Biotechnology, CIMA (Centre for Marine and Environmental Research), University of Algarve, Portugal (bgrdrigues@ualg.pt, sraposo@ualg.pt, rbarros@ualg.pt)

² Laboratory of Biochemistry, CEIMAR (Marine International Campus of Excellence, University of Huelva, Spain (rleon@uhu.es))

Bioplastics are plastics, that are bio-based made from renewable resources, or that biodegrade under controlled conditions at the end of their use phase.

Bioplastic products



3D filament



Cups



Food trays



Shopping bags



Cutlery



Bottles



Food packaging

Bioplastic vs Plastics Facts

- Most plastics are petroleum-based polymers, like polyethylene, PVC, polypropylene, polystyrene, polyester, nylon and acrylic.
- Bioplastics are produced from renewable biomass sources.
- Not all bioplastics are biodegradable and some petroleum based polymers are biodegradable.
- Many of the substitute bioplastics derived from agricultural materials may present a potential threat to food security and eco-systems.
- Plastics are a major contaminant in the environmental ecology due to their recalcitrant biodegradation, poor management and risky disposal.

Main types of bioplastics

PLA

(polylactic acid)

- It is typically made from sugars
- Cost efficient to produce
- Similar to PP (polypropylene), PE (polyethylene) and PS (polystyrene)
- Biodegradable

Sugars used in bioplastic production comes from agro-based feedstock!

Due to competition with food production for arable and fresh water, non-crops feedstock sources have been researched.

Not marine biodegradable like PHAs!

Making it unsuitable to combat plastic waste leaking into the environment.

PHA

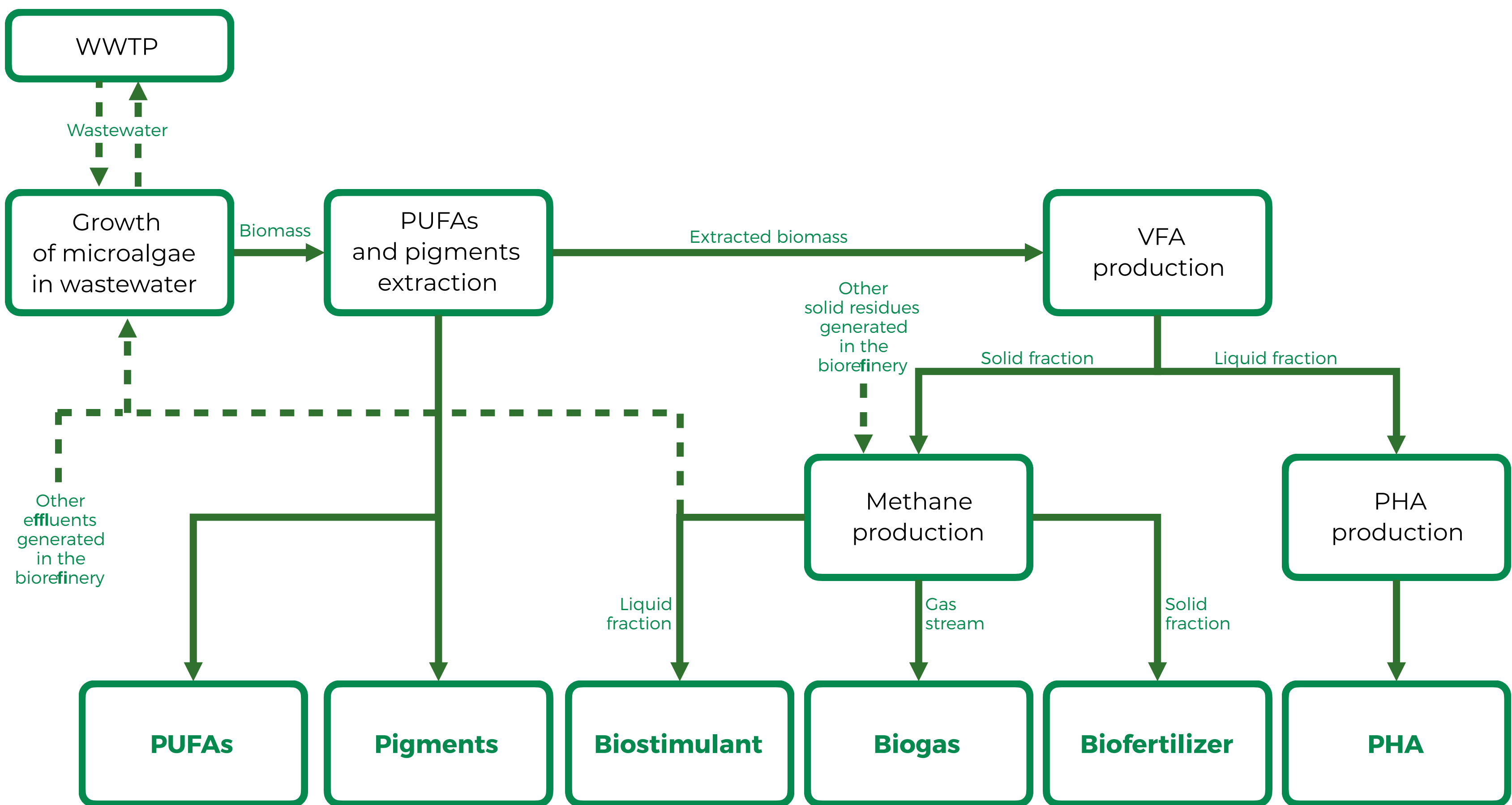
(polyhydroxal kanoate)

- Large scale of PHA production it still limited
- It is typically made from microorganisms
- Biodegradable and biocompatible
- Similar to PP (polypropylene) and PE (polyethylene)

Must increase PHA competitiveness!

Our main goal is to develop an integrated biorefinery concept with the production other high-value products and by-products, and minimization of the generation of wastewater and solid waste.

Our production plan



A contribution to increase the competitiveness of PHA production is the development of low-cost carbon and nutrient feedstocks, avoid monocultures using mixed microbial cultures (MMCs) and development of an integrated biorefinery concept with production of other high-value products and by-products and minimization of the generation of wastewater and solid waste.

The elected low-cost carbon feedstock is volatile fatty acids (VFAs) formed during anaerobic digestion of microalgal biomass grown in wastewater. PUFAs and pigments will be quantified in the microalgal growth process as other high-value products.