2-platform (C6 sugar, lipids) biorefinery to produce the biopolymer PLA & animal feed from food waste

Part A: Biorefinery plant

Food waste is the feedstock for PLA production. Accordingly, no up-stream process for feedstock supply is considered. The assumed biorefinery plant has the capacity to process 10 t food waste powder per hour. The platform for the biorefinery is glucose obtained from the carbohydrate rich food waste. Pre-treatment is followed by fungal hydrolysis in order to extract the sugar from the food waste. *Aspergillus awamori* and *Aspergillus oryzae* are used for hydrolysis. The fungal biomass is produced on-site in a solid-state fermentation step. After an extraction process lactic acid is obtained from the fermentation broth. Downstream processing of lactic acid comprises of lactide synthesis mixing lactic acid with zinc oxide nanoparticle dispersion. The lactide is polymerized in order to obtain PLA. The remaining solids are utilized as animal feed as it contain valuable carbohydrates, proteins and lipids.

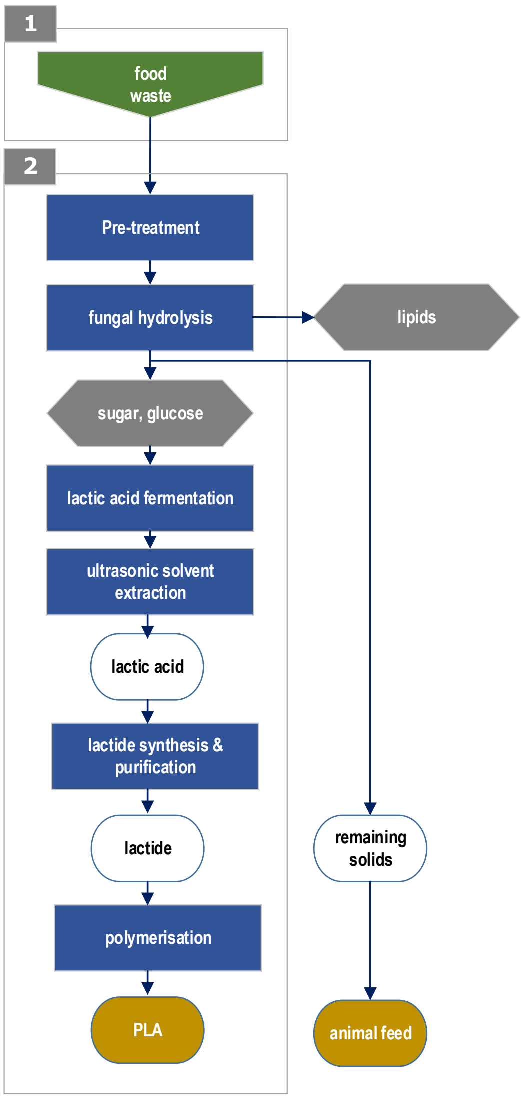

Figure 1: 3-platform using food waste to produce PLA, animal feed and lipids

Funding provided by Federal Ministry Republic of Austria Transport, Innovation and Technology FFG Promoting Innovation.

Key characteristics

2-platform (C6 sugar, lipids) biorefinery to produce the biopolymer PLA & animal feed from food waste							
State of technology	Pilot (TRL 4-6)						
Country	China						
Main data source	Literature						
Products				**Auxiliaries**			
	PLA	10,624	t/a		Electricity	10,439	GJ
	Lipids	12,118	t/a		Chemical inputs	22,438	t/a
	Animal feed	64,657	t/a				
Feedstock				**Costs**			
	Food waste	83,000	t/a		Investment costs	116.5	Mio. US$
					Feedstock costs	16.2	Mio. US$/a

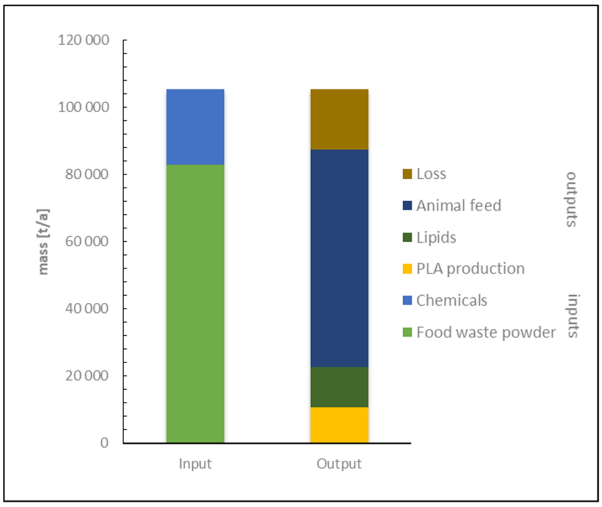

Figure 2: Mass balance of biorefinery plant

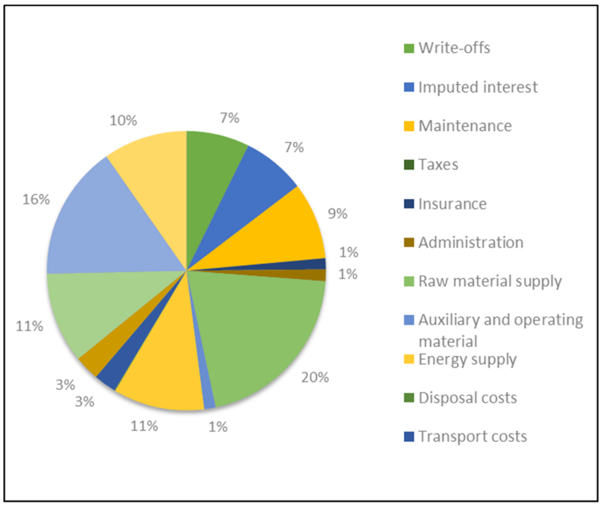

Figure 3: Share of costs

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Part B: Value Chain Sustainability Assessment

2-platform (C6 sugar, lipids) biorefinery to produce the biopolymer PLA & animal feed from food waste

Conventional reference system

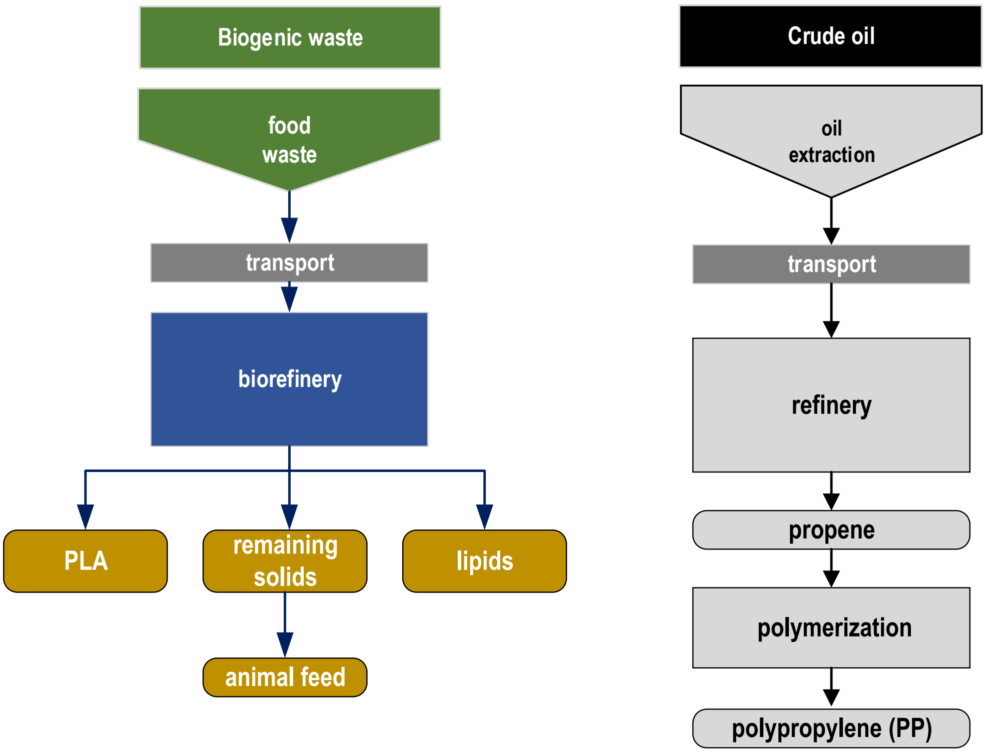

Figure 4: Biorefinery and reference system - value chain (cradle to gate)

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Key characteristics of biorefinery value chain

Greenhouse gas emissions		
Biorefinery	10,164	t CO_2eq.
Reference system	28,685	t CO_2eq.
Savings	18,521	t CO_2eq.
Cumulated energy demand		
Biorefinery	10,439	GJ
Reference system	844,077	GJ
Savings	833,638	GJ
Costs		
Annual costs	79.5	Mio. US$
Specific costs	7.49	US$/$kg_{PLA}$
Investment costs	116.5	Mio. US$
Revenues		
Revenues PLA	55.4	Mio. US$
Revenues lipids	6.1	Mio. US$
Revenues animal feed	29.1	Mio. US$
Food waste treatment	6.4	Mio. US$

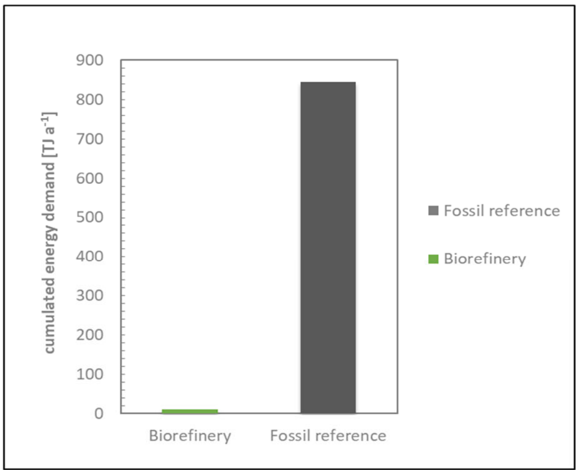

Figure 5: Cumulated energy demand of biorefinery and reference

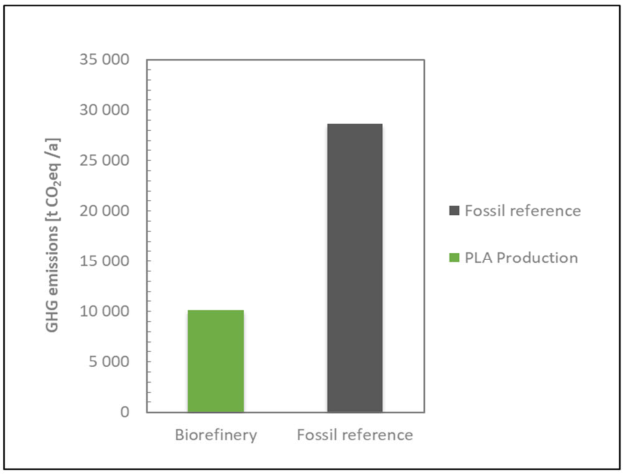

Figure 6: Greenhouse gas emissions of biorefinery and reference

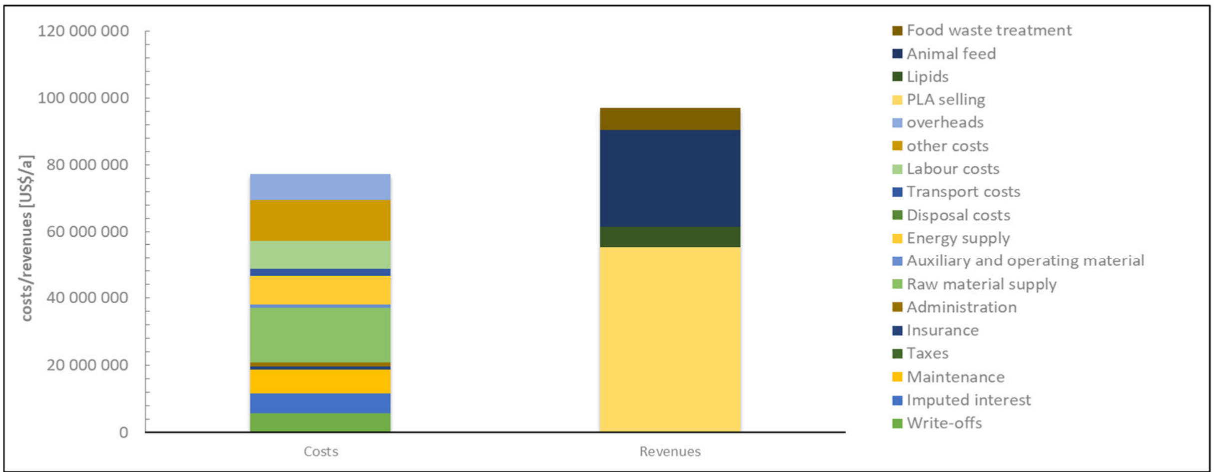

Figure 7: Estimated costs and revenues of biorefinery plant

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