

Value recovery from confectionery waste

Food Waste Industry-meets-Science workshop
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Overview of current food waste activities

- The research projects been conducted in CeBER on **confectionery waste valorisation** seek to take advantage of the components of confectionery products:
 - carbohydrate (75%), fat (14%), water (6%) and protein (4%)
 - nutrient content: 50 000 – 80 000 ppm COD & 40 000 – 60 000 ppm BODto produce several products, thereby diverting the waste from landfill towards value addition.
- It was found that one confectionery industry could produce approximately up to 625 tonnes waste/ year,
 - it is an ideal bioprocess feedstock and can contribute to the national Bio-economy Strategy
 - with the focus on the industrial bio-economy, sustainable processes and cleaner production.

Overview of global food waste activities - confectionary

Confectionery source	Treatment	Product	References
Solid waste sources			
Confectionery waste	Biogas integrated gasification fuel cell	Electricity	Lunghi et al.2004
Confectionery waste	Cultivation	Single cell protein (SCP)	Hacking 1987
Confectionery waste products	Two-stage anaerobic digestion (AD)	Acetic acid, Lactic acid, Ethanol and Carbon dioxide	Magnusson (2010)
Flour waste streams	Batch fermentation	Bacterial cellulose	Tsouko et al. 2015
Flour rich waste stream	Batch fermentation	Polyhydroxybutyrate (PHB)	Garcia et al.2011
Flour rich waste	Fed-Batch fermentation	Microbial lipid	Tsakona et al 2014
Sweets waste	Fuel cell	Electricity	Media, 2016
Waste wafer material	AD	Biogas and digestate	Rusin et al 2015
Liquid waste sources			
Confectionery factory effluent	Shake flasks	Algal biomass	El-Kassas et al.2015
Confectionery wastewater	Activated sludge wastewater treatment plant	Water for irrigation	Diwani et al.2000
Confectionery wastewater	Aerobic	Xanthan Gum	Bajić et al
Confectionery wastewater	AD with enrich hydrogen producing bacteria (methanogens inactive)	Hydrogen	Yogeswari et al 2014
Chocolate wastewater	Microbial fuel cells	Electricity	Patil et al 2009
Chocolate wastewater	AD	Electricity	Dutch water sector 2014
Chocolate soup	AD	Electricity	Kane 2015
Candied jujube wastewater	Batch fermentation	Bacterial cellulose	Li et al.2015
Confectionery wastewater	Fermentation	Biofloculant	Huang, 2010
Confectionery wastewater	sloping pilot plant	Microalgae biomass, Enzymatic and non-enzymatic antioxidant	Kumar et al., 2011
Chocolate wastewater	AD	Electricity	Dutch water sector 2014
(Sugar syrups)	Dual anaerobic co-digestion	Methane	Lafitte-Trouque and Forster (2000)
Chocolate wastewater	AD	Biogas and COD reduction 96-98%	Nijhuis industrie
Confectionery wastewater	Anaerobic pretreatment and aerobic treatment	Methane and reduced COD levels by 88% and water for irrigation	Ozgun et al, 2012
Confectionery wastewater	Sequential two-stage anaerobic treatment	Reduced COD levels	Beal and Raman (2000)
Confectionery wastewater	Fermentation	Clean water with Reduced COD, BOD, FOG,TSS,odours	Bioamp system
Confectionery wastewater	Aerobic treatment using Trickling filter	Reduced COD levels 207-466 mg/l	Abdou-Elela et al,2008

Overview of current food waste activities

- CeBER: Value recovery from confectionery waste (2016-2018)
 - Production of poly-glutamic acid (PGA) from confectionery waste
 - Production of polyhydroxyalkanoates (PHA) from chocolate waste
 - Production of bio-ethanol from confectionery waste
 - Production of biogas using anaerobic digestion (AD) from confectionery waste

Obstacles to food waste management

- Very limited and not accessible data on waste generation from industries (e.g. confectionery waste).
- The variability and complexity of the waste substrate which may be dependent on the seasons and consumption behaviours.
- The cost of waste treatment mechanisms is currently higher than landfill disposal.
- Dialogue with industry.

Opportunities for reducing food waste

- Treatment technologies that use waste substrates as feedstock for value addition for example:
 - energy production (AD),
 - production of valuable bio products (PHAs, PGA),
 - biofuels (ethanol) and
 - platform chemicals.
- Research and development of food waste biorefineries.
- Dialogue & collaboration

Opportunities for reducing food waste

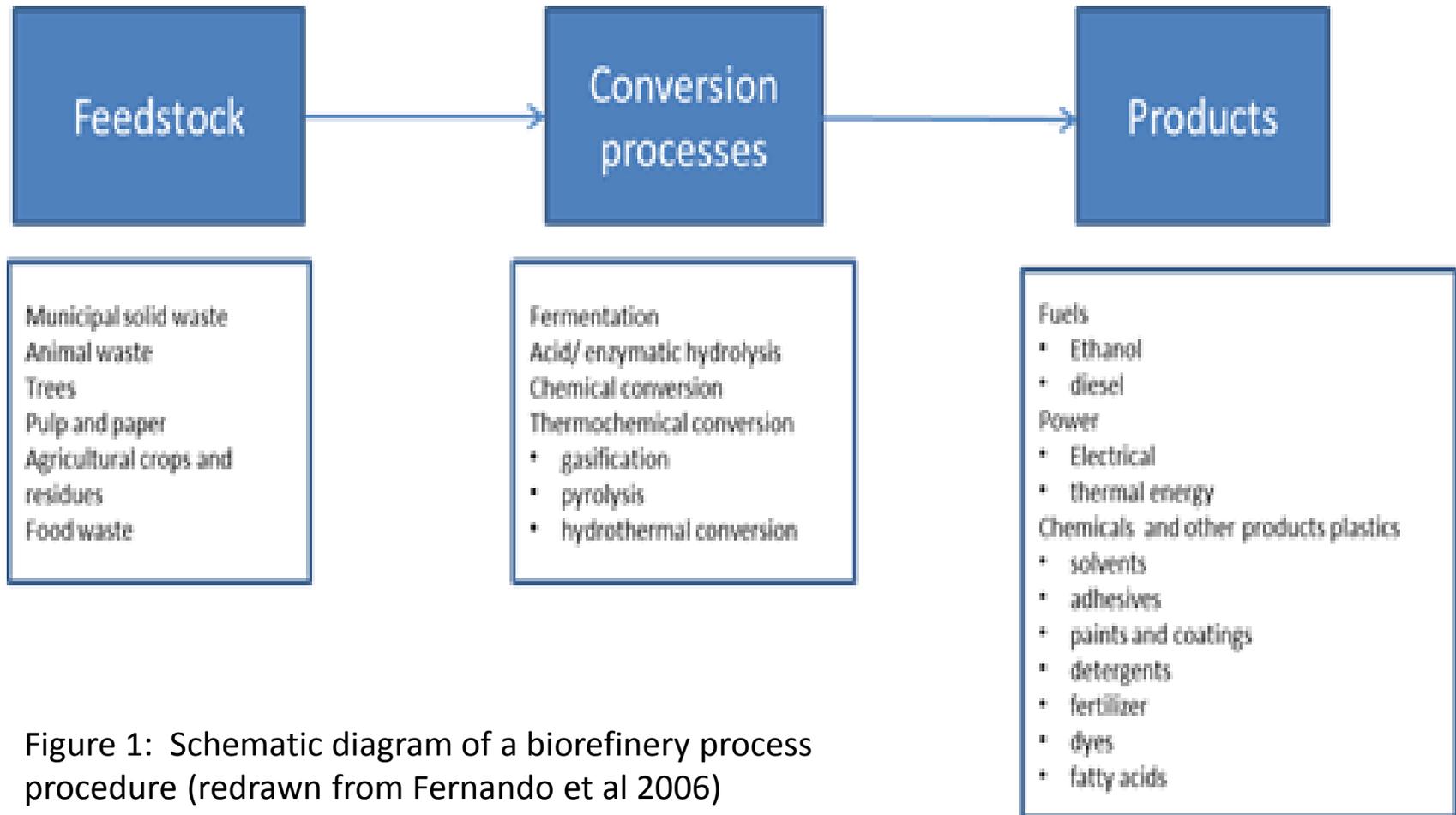


Figure 1: Schematic diagram of a biorefinery process procedure (redrawn from Fernando et al 2006)

Current gaps in knowledge

- The actual amount of waste generated from confectionery industries in South Africa.
- The characteristics and composition of the food waste for method design.
- Application of solid waste streams for production of value added products.
- Extensive research on waste water and agricultural waste has been conducted and not solid waste.
- Utilisation of solid waste streams for value added products.
- Would the products obtained from confectionery waste be economically feasible based on the yield and productivity achieved?



THANK YOU

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