Valorization of Fermented Municipal Biowaste as Source of Added Value Chemicals and Intermediates.

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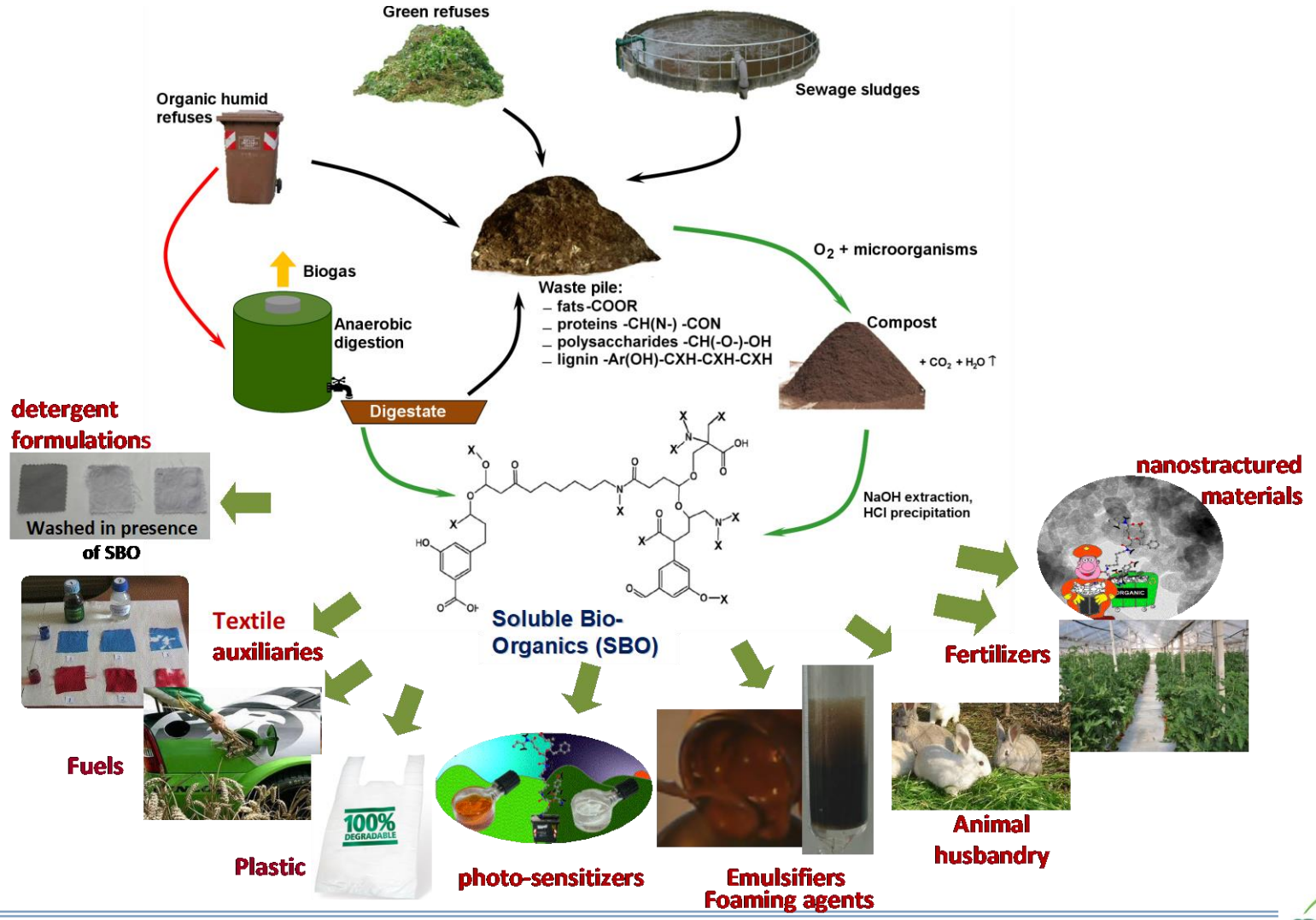
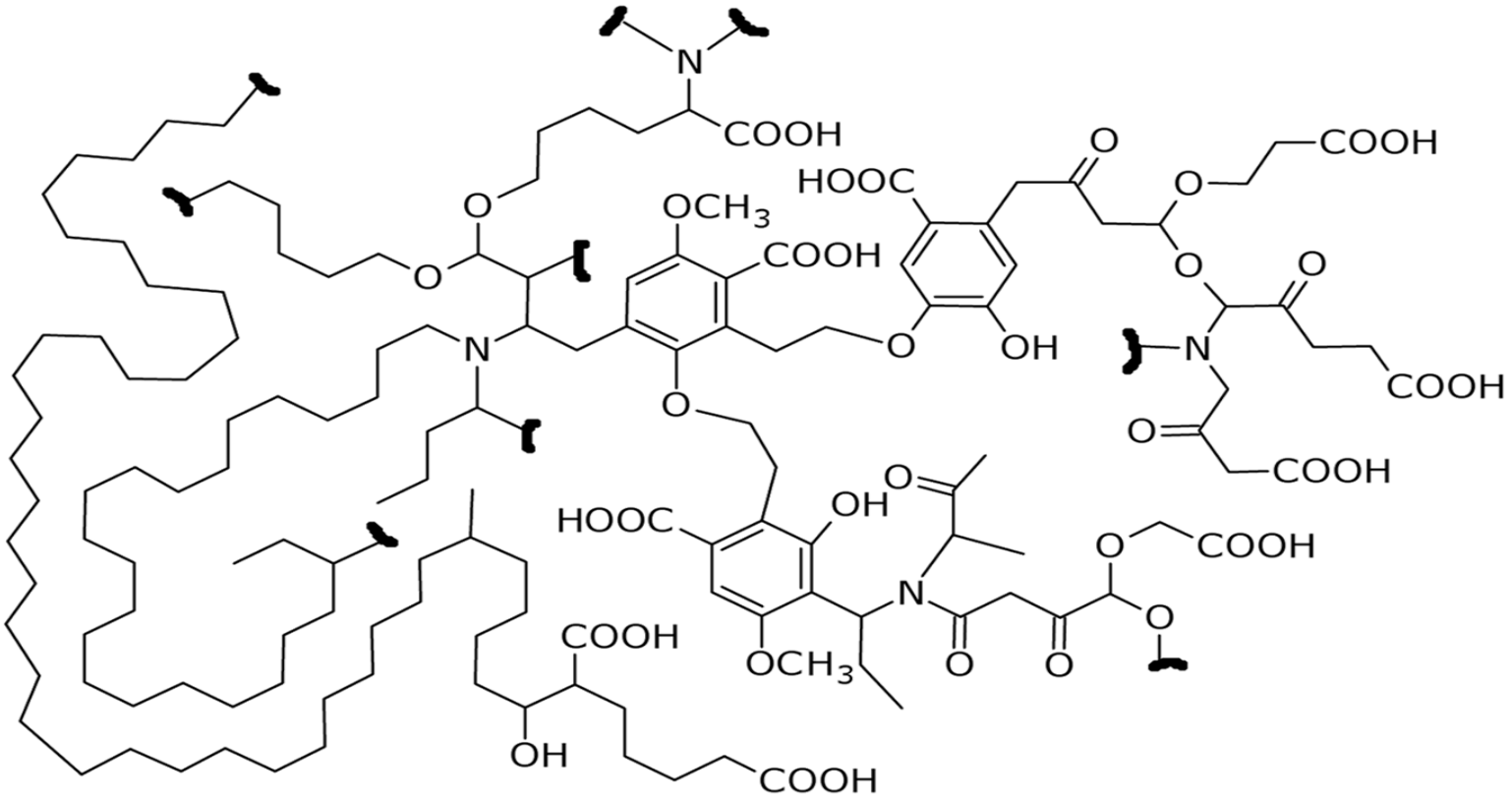
LIFECAB project. Coodinator: Hysytec (I). Associated Beneficiaries: ACEA Pinerolese Industriale S.p.A. (I), Agricultural University of Athens (GR), Cyprus University of Technology (CY), Organohumiki Thrakis (GR), POOL.ITI (I), Sewerage Board of Limassol – Amathus (CY), Università Degli Studi Di Torino (I).

MBW feedstock, Processes and Products: Integration of Biochemical and Chemical Processes



Virtual representation of SBO: mixtures of molecules with different molecular weight (35-400 kDa), different content of C types and functional groups bonded to mineral elements.



Problem

Technological transfer from experimental to industrial and commercial scale

- **SBO new products, not known in the market**
- **Need market and regulatory assessment**
- **Entrapeneurial risk.**

Solution based on virtuous biowaste cycle: SBO assisted anerobic fermentation process

SBO obtained from compost added at 0,05-0.2 % in anaerobic fermentation slurry feed to produce digestate with reduced ammonia content without affecting biogas yield and quality.

LIFECAB objective: Demonstrate in real operational environment the processes

Organic humid fraction (OHF) $\Rightarrow$ biogas + digestate $\Rightarrow$ compost $\Rightarrow$ SBO

OHF + SBO $\Rightarrow$ 4 % more biogas + lower ammonia production

$$N_{org} \Rightarrow N_{NH3} \Rightarrow N_2$$

Key actions

1. Fabricate hydrolysis prototype (HP) with 50 t/yr SBO production capacity

2. Install HP in the Acea MBW treatment plant (Pinerolo, Italy)

3. Validate the SBO assisted anaerobic fermentation process using one of the two OHF fermentation reactors of 2600 m^3 capacity as control and the second for the SBO tratment

4. Replicate the SBO assisted fermentation process in Greece and Cyprus using local biowastes

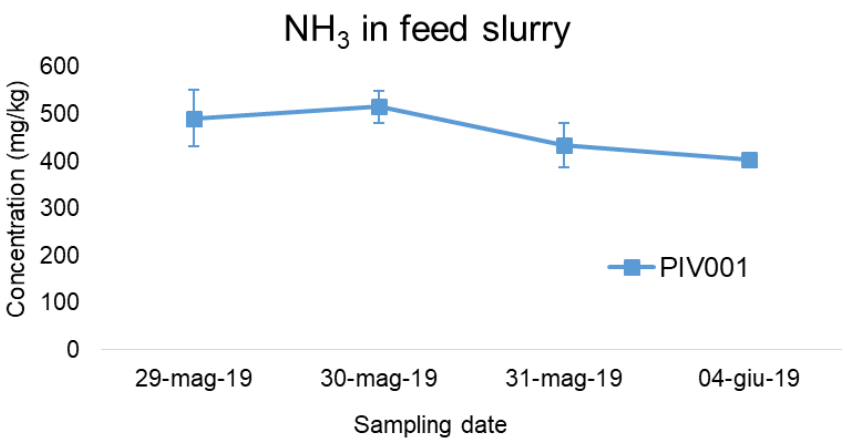
Prototype producing SBO

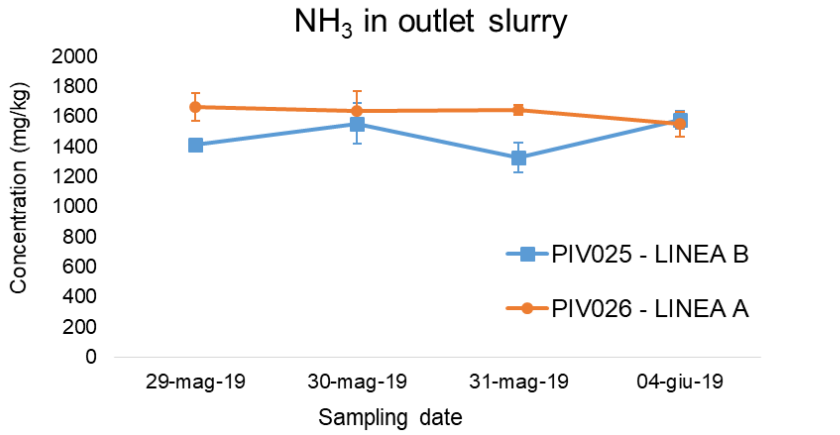
Feeding SBO to Acea bioreactor

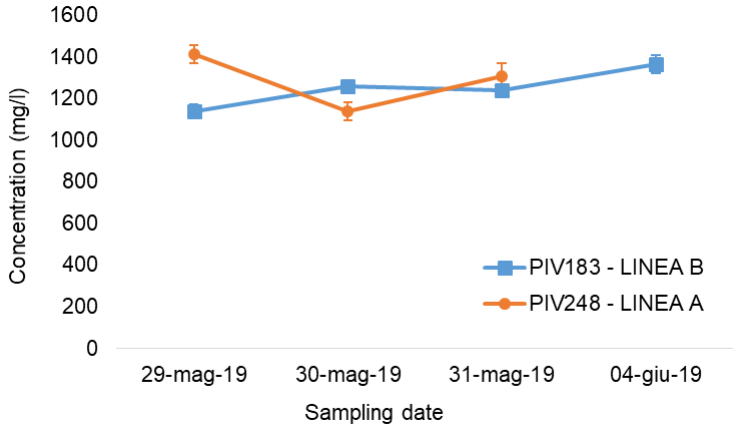
Anaerobic Fermentation Trials at Acea plant: experimental conditions

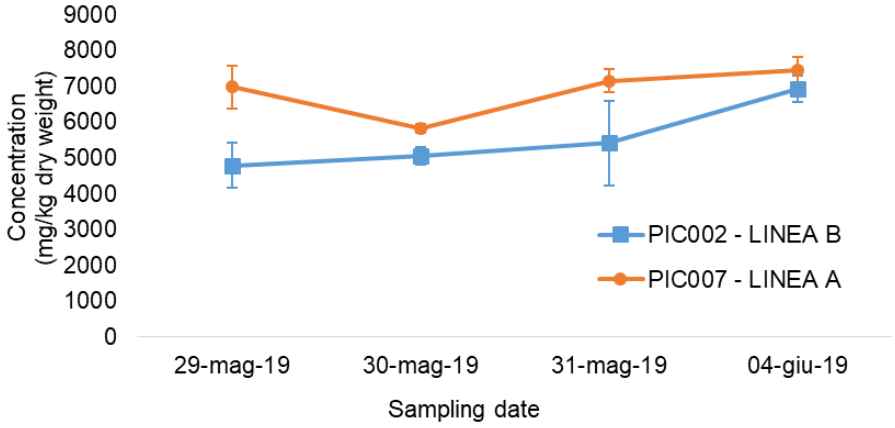
- 2 reactors (A and B), each with 2550 m^3 working volume
- A → control daily slurry;
- B → daily slurry + 11 m^3 of 10 % SBO water solution added to the B reactor at the onset to establish 0.05 % SBO concentration in the slurry;
- 55 °C;
- continuous feeding of daily slurry (no added SBO) to both A and B;
- hydraulic residence time 14 days

Anaerobic Fermentation Trials at Acea Plant: Results









Anaerobic Fermentatio Trials at Acea Plant: Discussion

1st day

- Reactor A produced 1.17 g/kg NH_3/feed slurry, equivalent to 2.99 t NH_3 in total.
- Reactor B produced 0.92 g/kg NH_3/feed slurry, equivalent to 2.43 t NH_3 in total.

- NH_3 concentration in B was lower than in A reactor by 15 % for the slurry, 19 % for liquid digestate and 31 % for the solid digestate.

SBO effect: 21 % lower NH_3 production in B compared to A reactor.

Anaerobic Fermentatio Trials at Acea Plant: Discussion

1st week

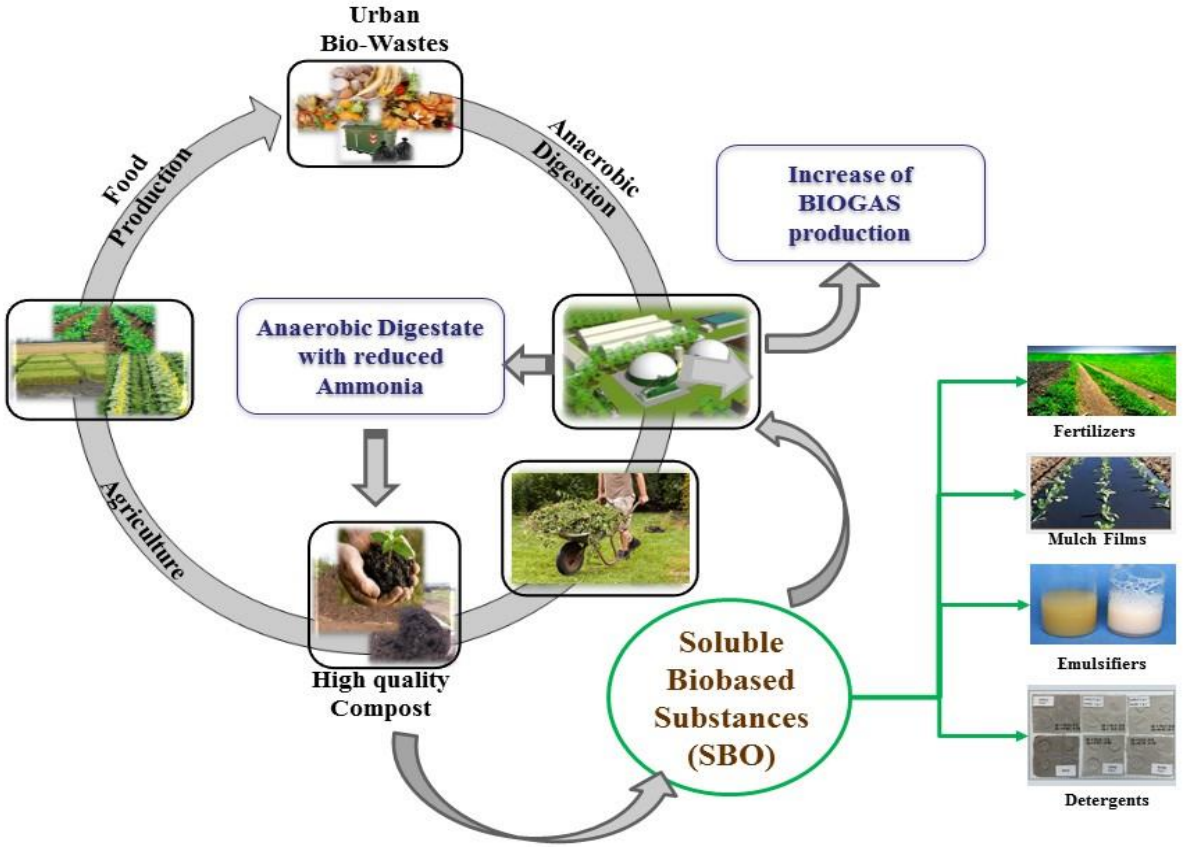
- From day 2 to 7, difference of NH_3 concentration of A and B decreased to nearly zero, due to the dilution of SBO in B reactor by the inlet feed slurry.

First results support the ecofriendly effect of SBO in the reduction of NH_3 content in fermented slurry.

Higher NH_3 reduction expected by increasing SBO concentration to 0.2 % and continuous feed of SBO containing slurry

Perspectives to be validated during and after project life

Recycling Renewable C over Urban, Agriculture and Industrial Environment



The SBO hydrolysate obtained from food wastes and gardening residues enhances biogas production, lowers ammonia in the digestate, and yields multipurpose biobased products

Ground for Realization of Perspectives

- 224 biorefineries in EU, only 6 % based on biowastes.
- Solid waste generation expected to increase over 11 Mt/day by 2100 (about 4000 Mt/yr), virtually enough to supply current energy requirements satisfied by oil consumption, largely exceeding C amount required to manufacture chemicals for the current market.
- Problem to implement biobased industry is not feedstock availability, but to develop sustainable processes.
- New processes (as in LIFECAB) → need LCA, LCC and SLCA, certification and standardization assessment to enter the market.