“Turning urban biowaste into bioplastics: a half-term overview on RES URBIS project"

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Nowadays, huge amounts of organic residues originate from the separate collection of urban solid waste (OFMSW) and the sludge from urban wastewater treatment plants (WWS). Although OFMSW and WWS originate from the same urban area and contain similar amount of organic carbon and of similar nature, these two streams usually are managed separately and towards low-value products such as biogas and/or compost.

On the other hand, the integrated treatment of civil wastewater along with organic solid wastes in a novel “urban bio-waste biorefinery” is a key option to practically implement a synergic treatment of all relevant bio-waste streams of urban origin and to transform them into higher value bio-products.

The RES URBIS project

The RES URBIS project (RESources from URban BIo-waSte) is a 3-year Research and Innovation Action funded under the H2020 Programme (Call CIRC-05, Grant agreement 730349). Started in January 2017, RES URBIS comprises 20 participants from 8 European countries, including academic and research institutions, companies and public institutions.

RES URBIS aims at making it possible to convert several types of urban bio-waste into valuable bio-based products, in an integrated single biowaste biorefinery and by using one main technology chain.

Urban bio-waste includes the organic fraction of municipal solid waste (from households, restaurants, caterers and retail premises), excess sludge from urban wastewater treatment, garden and parks waste, and possibly selected waste from food-processing (if better recycling options in the food chain are not available).

Bio-based products include polyhydroxyalkanoate (PHA) and related PHA-based bioplastics as well as ancillary productions: biosolvents (to be used in PHA extraction) and fibers (to be used for PHA biocomposites).

The feasibility of the proposed concept is presently being investigated in four territorial clusters, in different European countries (Italy, Portugal, Spain, and United Kingdom) which present different waste management systems. Territorial and economic analyses will be done either considering the ex-novo implementation of the biowaste biorefinery or its integration into existing wastewater treatment or anaerobic digestion plants, with reference to clusters and for different production size. Each clusters has an experimental platform that is being operated by using a representative “cocktail” of urban bio-waste for the respective cluster.

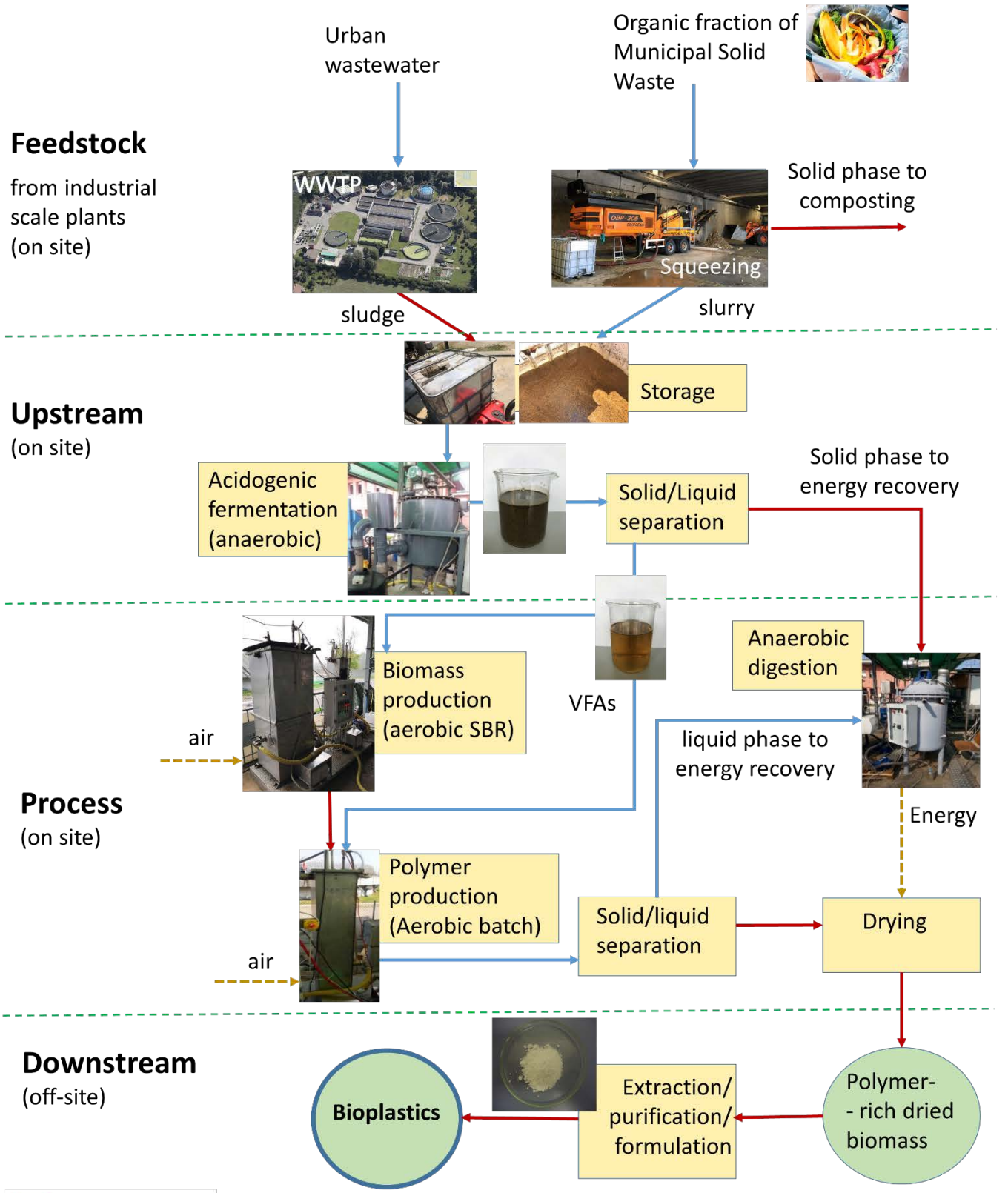
The economic analysis will be based on a portfolio of PHA-based bioplastics, which will be produced at pilot scale and tested for applications, such as a) biodegradable commodity film, b) packaging interlayer film, c) speciality durables (such as electronics), d) biocomposites with lignocellosic fibers, and e) premium slow C-release material for ground water remediation.

Present achievements

The talk will briefly report on 1st year of activity, especially focusing on the pilot-scale investigation of the PHA production process, which has been performed at the experimental platform in Treviso (Italy).

According to the process flowsheet summarized in Figure 1, different mixtures of OFMSW and WWS have been used to feed an acidogenic fermentation step (reactor volume 380 L), under different operating conditions (OLR and T), to obtain a VFA mixture no less than 19 gCOD/L. Then, after solid/liquid separation, the VFA-RICH, effluent has been used to feed both the biomass selection reactor and the PHA accumulation reactor. The PHA content in the biomass usually ranged between 40 and 50% (w/w). Simple extraction tests allowed to reach PHA with a purity of at least 85% (lab scale).

Figure 1 Flow-sheet of biopolymer production from urban biowaste (pilot scale plant in Treviso, Italy)



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