# Production of polyhydroxyalkanoates from anaerobically digested sewage sludge: the B-PLAS proof of concept.

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Nearly 40% of chemical energy of food ends up in wastes or in wastewater, wastewater organics are typically concentrated through aerobic wastewater treatment plant (WWT) yielding biosolids, mainly formed by bacteria and insoluble residues, with an overall European production equal to 20 Mton/y in the EU area (Eurostat, 2017). This material can be subjected to anaerobic digestion (AD), allowing valorization of about one third of its chemical energy and producing a scarcely biodegradable digestate, thereafter called WWT sludge. WWT sludge is actually disposed through land application (56%), incineration (27%) or landfilling (17%), with greenhouse gas emissions, potential biohazard (e.g. residual spores and aflatoxins) and variable disposal cost (depending on the source of sludge and/or its chemical properties) between 5 and 120 euro per wet ton. The idea of B-PLAS DEMO project (funded by EIT-climate KIC) is to demonstrate the exploitation of a large portion of the chemical potential of WWT sludge by a hydrothermal pre-treatment (150-180°C) followed by a sequence of biological processes, namely acidogenic fermentation and aerobic microbial mixed cultures (MMC) which end up with Polyhydroxyalkanoates (PHA). PHA is a biodegradable polymer with a market price between 4,000 and 6,000 €/ton. This contribution reports the preliminary evaluation of the process that will be scaled to 1 kton/y scale in the B-PLAS DEMO project. Hydrothermal carbonization increases by 10-times the soluble chemical oxygen demand (COD) of WWT, allowing to split 44-54% of its COD into an aqueous phase ($HTC_{aq}$) enriched in small fermentable organic molecules; the coupling of acidogenic fermentation and aerobic fermentation converted these substrates firstly into volatile fatty acids (40-60% of $COD_{HTCaq}$) and then into PHA (about 20% of $COD_{VFA}$). The extraction of microbial biomass with pressurized dimethyl carbonate (DMC) allowed to produce high quality PHA, with a high molecular weight (0.9 MDa) and a percentage of medium chain monomers (hydroxyvalerate and hydrohexanoate) close to 12%.