# The role of hydrothermal treatment on the production of VFAs for bioplastics: Assessment of extraction methods

A. Kalampokidis [a], S. Vakalis [b], D. Liakos [b], Eleftheria Klontza [a] and D.F. Lekkas [a]

[a] *Waste Management Laboratory, Department of Environment, University of the Aegean, University Hill – 81100 Mytilene Greece.*

[b] *Energy Management Laboratory, Department of Environment, University of the Aegean, University Hill – 81100 Mytilene Greece.*

Conventionally, the production of bioplastics incorporates the utilization of biomass that has the capacity for PHA production. Feast and Famine cycles exerted on Mixed Microbial Cultures (MMCs) can result in improved production of PHAs bioplastics. In principle, volatile fatty acids (VFAs) are produced during the anaerobic digestion (AD) of biomass and are utilized for feeding the MMCs. In the framework of this study two novelties are presented. Hydrothermal treatment is utilized as an alternative - and in this case thermochemical- pathway to AD for faster production of VFAs. In addition, two different extraction techniques were applied for transferring the VFAs from an aqueous to a polar medium. Cheese whey wastewater was treated in a 4570A Parr hydrothermal reactor in temperature ranges between 120 – 180 °C and evolved autogenous pressures. The hydrothermal products were sampled in 30, 60 and 120 minutes respectively. Extraction of the VFAs from an aqueous to a polar medium was performed by shaking and ultrasonic extraction, while the selected polar medium was Diethyl Ether. The identification of the produced VFAs/ VFAs extracts was implemented in an Agilent 6891 GC-FID instrument with a wax column DB-WAXETR 30m x 0.53mm x 1μm. Hydrothermal treatment produced primarily butyric acid, followed by isovaleric, acetic and propionic acids. Butyric acid concentration increased with increased residence time in the hydrothermal reactor and ranged between 3200 and 4000 ppm. On the other hand, the concentration of isovaleric acid fluctuated between 500 and 1000 ppm but the concentration profile was affected significantly by the temperature of hydrothermal treatment. Overall, ultrasonic extraction by shaking was identified as the optimal extraction method, with 90% recovery of the VFAs.

**Keywords:** bioplastics, hydrothermal treatment, volatile fatty acids, extraction, PHA