Environmental Engineering and Management Journal

March 2012, Vol.11, No. 3, Supplement, S70
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

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RECENT ADVANCES IN THE BIOREFINERY OF OLIVE MILL WASTEWATER

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Abstract

Resources availability at a reasonable price will be one of the main issue of the next years. Since biowastes have been employed as the renewable source for the obtainment of biological compounds, their extensive exploitation through multi-step integrated processes has been considered of upmost interest. In the present work, recent advances related to the case study of Olive Mill Wastewater (OMW) biorefinery are reported.

Polyphenols are natural antioxidant present in high amounts in OMWs. Their recover from synthetic, as well as actual site OMWs by means of solid phase extraction processes (using Amberlite XAD16 as the solid phase) was proved to be effective. Almost complete phenols removal from OMWs, along with their subsequent recover up to 60% of the concentration occurring in OMWs (using a biocompatible extraction solvent such as ethanol), were found attainable. Recent findings showed that sustained solid phase recycling can be carried out with no significant loss of efficiency. Furthermore, the alcoholic mixture of phenols was concentrated maintaining its antioxidant and antiradical activity while allowing theoretically infinite recover of the desorbing phase.

The aforementioned process produces a dephenolized OMW, whose organic matter could be employed for the production of biobased chemicals and biofuels. In particular, anaerobic acidogenic digestion could be carried out at high yields in order to produce an effluent enriched in Volatile Fatty Acids (VFAs). The importance of the latter relies on the fact that they can be used as the carbon source for polyhydroxyalkanoates (PHAs) synthesis. In this respect, it was found that by varying Hydraulic Retention Time (HRT) in continuously operated acidogenic Packed Bed Biofilm Reactors (PBBRs), biogas production and composition were found to change: in particular, a significant H_2 gas production was achieved, together with a reduction in VFAs accumulation. The possibility to physically separate the hydrolytic activity leading to H_2 production from the acidogenic one, thereby increasing VFAs amount in the effluent, is under way.

However, VFAs concentration was also increased by means of electrodialysis. This process produced two effluents: a first with a higher VFAs amount with respect to the inlet, and a second with a lower one. The latter could be used by some photosynthetic microorganisms in the typical two-stage process, while the former outlet could be finally fed to aerobic reactors for PHAs production. In this respect, utilization of anaerobically digested OMWs for PHAs production was successfully carried out.