Boosters for anaerobic co-digestion of sewage sludge

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Anaerobic co-digestion of sewage sludge and other organic wastes at a wastewater treatment plant (WWTP) is a promising method for both energy and material recovery. Some agro-industries such as olive oil mills and cheese factories represent a considerable share of the Mediterranean countries economy. The by-products of olive oil production such as olive mill wastewaters (OMW) pose a serious environmental risk. Cheese whey (CW) is a by-product during cheese manufacturing. This article focuses on a thermal pre-treatment mixture of food waste and two representatives, seasonally produced agro-industrial wastes, for Greece: olive mill waste water and cheese whey.

Optimization of biogas production from sewage sludge (SS) was attempted by co-digesting with a mixture of food waste, cheese whey and olive mill wastewater (FCO). A series of laboratory experiments were performed in continuously-operating reactors at 37 ^{o}C, fed with thermal pre-treated mixtures of FCO at various concentrations 3%, 5% and 7%. FCO addition can boost biogas yields, if the mixture exceeds 3% (v/v) concentration in the feed. Any further increase of 5% FCO causes a small incensement in biogas production. The reactor treating the sewage sludge produced 287 ml $CH_4/L_{reactor}$/d before the addition of FCO and 815 ml $CH_4/L_{reactor}$/d (5% v/v in the feed). The extra FCO-COD added (7% FCO v/v) to the feed did not have a negative effect on reactor performance, but seemed to have the same results (fig.1). In all cases, biodegradability of mixtures estimated to be higher than 80%, while the VS removal was 22% for the maximum biomethane production (5% v/v). Moreover, co-digestion improved biogas production by 1.2-2.7 times. The best d-COD removal efficiency of approximately 84% was achieved for 5% and & 7% FCO substrates (fig.2).

The concept of co-digestion a mixture of pre-treated food waste, cheese whey and olive mill wastewater could be a promising perspective at wastewater treatment plants as it increases methane production significantly. Results show a great ascendancy of 5% and 7% FCO mixtures with sludge, as they improve significantly the biogas production rate.

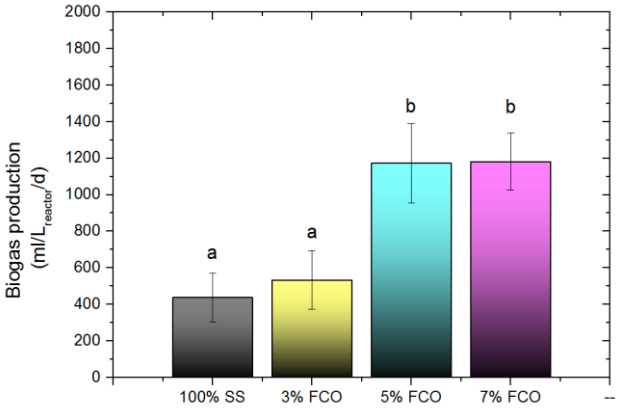

Figure 1. Biogas production (ml/$L_{reactor}$/d) for different concentrations of substrates. Different letters indicate significant differences with $p<0.05$. Error bars indicate standard deviation of the biogas production.

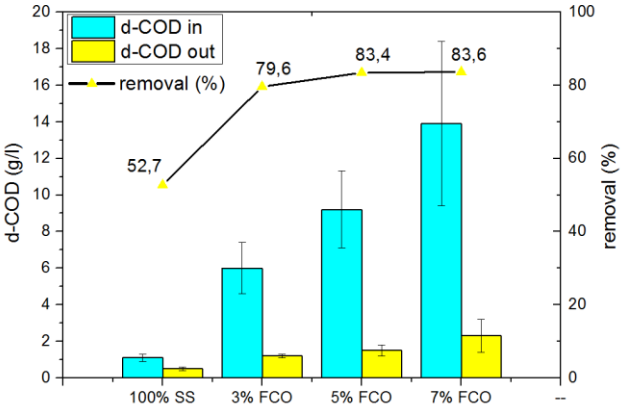

Figure 2. D-COD removal and d-COD concentrations in the influent (in) and effluent stage (out). Error bars indicate standard deviation.

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