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Co-digestion of wastes and sewage sludge to boost biogas production

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Anaerobic co-digestion of sewage sludge and other organic wastes at a wastewater treatment plant 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 pose a serious environmental risk. Cheese whey 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 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 37oC, fed with thermal pre-treated mixtures of FCO at various concentrations 3%, 5% and 7% (v/v). FCO addition can boost biogas yields, if the mixture exceeds 3% 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 CH4/Lreactor/d before the addition of FCO and 815 ml CH4/Lreactor/d (5% in the feed). The extra FCO-COD added (7% FCO) to the feed showed no 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%). For 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.

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Hydrothermal liquefaction for bio-oil production: Opportunities and challenges

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Hydrothermal liquefaction (HTL) is one of the promising technologies for converting advanced biomass (wood, organic waste, algae, etc.) into biofuel. The bio-oil derived from HTL has lower oxygen content, higher stability and heating value. However, due to the presence of proteins in biomass, their degradation products are responsible for high nitrogen content in the bio-oil. Nitrogen containing compounds are highly problematic for conventional hydrotreatment catalysts and their presence in the bio-oil cause the NOx emissions. Therefore, it is essential to determine the reaction pathway of nitrogen containing compounds in order to minimize their formation and improve the performance of HTL. Doubtless, it can be very challenging to understand the chemistry of HTL, if starting directly from complex biomass. In this connection, the purpose of this study is to investigate the degradation route and the repartition of nitrogen during HTL of amino acids. The effect of different catalysts and solvents on nitrogen distribution into products of hydrothermal liquefaction of amino acids was investigated. The use of catalysts and co-solvents in the liquefaction process had different influence on the nitrogen content. The data obtained from this study can provide the knowledge about reaction pathways and mechanisms of nitrogen containing compounds at HTL, thus allowing improving the HTL performance in order to obtain high quality bio-oil.

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