

Treatment of agricultural waste with a combination of anaerobic, aerobic and adsorption processes

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Abstract

The efficient and integrated management of high organic content waste produced in agricultural and livestock industries constitutes a key factor for sustainability and environmental protection. This work investigates the remediation of mixtures of high organic load wastes (pig waste, cheese dairy and food residues) generated by farming industries in the Prefecture of Heraklion. A combinational remediation approach was evaluated, and in specific a sequential treatment process comprising anaerobic digestion, followed by activated sludge (aerobic-anoxic treatment) and finally natural zeolite adsorption, with the outflow of each system being used as the feed for the one following. Emphasis was given to the efficacy of zeolite and specifically two different granule sizes of Clinoptilolite, as a final treatment step of the agricultural waste mixture, as natural zeolite is considered a safe, abundant, thermally stable and economical adsorbent material. Two different adsorption approaches were evaluated; the magnetic agitation of the waste with the zeolite, as well as the channeling of the waste through zeolite packed columns. High adsorption capacities were achieved in both cases. In addition, a gradual decrease in adsorption efficiency, dependent of the granular size of the zeolite, was observed for the zeolite packed columns with increasing waste volumes treated, suggesting the need for the regeneration of the packing material to increase its lifetime. As a general conclusion, the proposed sequential approach constitutes a promising route towards the remediation of complex mixtures of wastes with high organic contents.

Keywords: Waste treatment; Adsorption processes; Natural zeolite; Integrated waste management, agroindustrial wastewaters

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