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Spectroscopic characterization of digestates obtained from sludge mixed to increasing amounts of fruit and vegetable wastes

Maria Rosaria Provenzano (1), Ornella Cavallo (1), Anna Daniela Malerba (1), Francesco Di Maria (2), Anna Ricci (3), and Giovanni Gigliotti (3)

(1) Dipartimento di Scienze del Suolo, della Pianta e degli Alimenti, University of Bari, Bari, Italy (mariarosaria.provenzano@uniba.it), (2) LAR – Dipartimento di Ingegneria, University of Perugia, Perugia, Italy, (3) Dipartimento di Ingegneria Civile e Ambientale, University of Perugia, Perugia, Italy

Anaerobic digestion (AD) represents an efficient waste-treatment technology during which microorganisms break down biodegradable material in absence of oxygen yielding a biogas containing methane.
The aim of this work was to investigate the transformations occurring in the organic matter during the co-digestion of waste mixed sludge (WMS) with an increasing amount of fruit and vegetable wastes (FVW) in a pilot scale apparatus reproducing a full-scale digester in an existing wastewater treatment plant.
Samples comprised: sludge, FVW, sludge mixed with 10-20-30-40% FVW. Ingestates and digestates were analyzed by means of emission fluorescence spectroscopy and FTIR associated to Fourier self deconvolution (FSD) of spectra.
With increasing the amount of FVW from 10% to 20% at which percentage biogas production reached the maximum value, FTIR spectra and FSD traces of digestates exhibited a decrease of intensity of peaks assigned to polysaccharides and aliphatics and an increase of peak assigned to aromatics as a result of the biodegradation of rapidly degradable materials and concentration of aromatic recalcitrant compounds.
Digestates with 30 and 40% FVW exhibited a relative increase of intensity of peaks assigned to aliphatics likely as a result of the increasing amount of rapidly degradable materials and the consequent reduction of the hydraulic retention time. This may cause inhibition of methanogenesis and accumulation of volatile fatty acids.
The highest emission fluorescence intensity was observed for the digestate with 20% FVW confirming the concentration of aromatic recalcitrant compounds in the substrate obtained at the highest biogas production.