Circular Economy in Food Industry Waste Management (BIVALIA Workshop2 - 2026)

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P.I.1 — Thermal hydrolysis pretreatment to enhance anaerobic digestion performance of the organic fraction from municipal solid waste

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Anaerobic degradability; Biochemical methane potential; Biogas yield; Substrate improvement; Waste degradation

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Poster Presentations #18

P.I.1 — Thermal hydrolysis pretreatment to enhance anaerobic digestion performance of the organic fraction from municipal solid waste

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Keywords: *Anaerobic degradability; Biochemical methane potential; Biogas yield; Substrate improvement; Waste degradation*

Municipal solid waste generation is increasing worldwide, while source separation remains limited and landfilling continues despite European circular-economy targets. Mechanical biological treatment enables the recovery of materials and energy from unsorted municipal solid waste, producing a mechanically separated organic fraction (MS-OFMSW) that can be valorized through anaerobic digestion. However, its low biodegradability often limits methane production and overall digestion performance. This study evaluates the application of Econward's BIOMAK® thermal hydrolysis technology as a pretreatment strategy to improve the anaerobic digestion of MS-OFMSW [2].

MS-OFMSW, from a mechanical biological treatment (Madrid), was thermally hydrolyzed at 152 °C - 4 barG for 20 min. The thermally hydrolyzed organic fraction (THOF) was screened through 40 mm sieve and subsequently cleaned using a pulper-hydrocyclone-rejector system to produce a diluted Biopulp. The BIOMAK® outflow mix (BO-Mix) was prepared by combining THOF with the condensate and the process water generated during the process (96:16:1, mass balance ratio). Biochemical methane potential tests were conducted at 36 °C for 29 days, using anaerobic digestate sourced from a mesophilic anaerobic reactor as inoculum with an inoculum-to-substrate ratio of 2 on a volatile solids (VS) basis [2]. Total solids (TS), VS, soluble chemical oxygen demand (SCOD), alkalinity, pH, ammonia nitrogen, and volatile fatty acids (VFA) were monitored, as well as biogas generation and composition,

Thermal hydrolysis modified the substrate characteristics by lowering pH and improving C:N and VS/TS ratios, indicating enhanced biodegradability. During assays, pH remained within the optimal range, with enough alkalinity and non-inhibitory ammonia concentrations. Pretreated substrates showed higher solubilization and VFA formation during the first days, followed by efficient conversion during methanogenesis stage (Figure 1a). Figure 1b shows the cumulative specific methane production. The highest methane yields were obtained for Biopulp and THOF, reaching 346 and 332 mL STP CH_4/g VS_{added}, respectively, compared with 275 mL STP CH_4/g VS_{added} for untreated MS-OFMSW. In contrast, BO-Mix presented limited improvement, likely due to inhibitory aromatic compounds present in the condensate.

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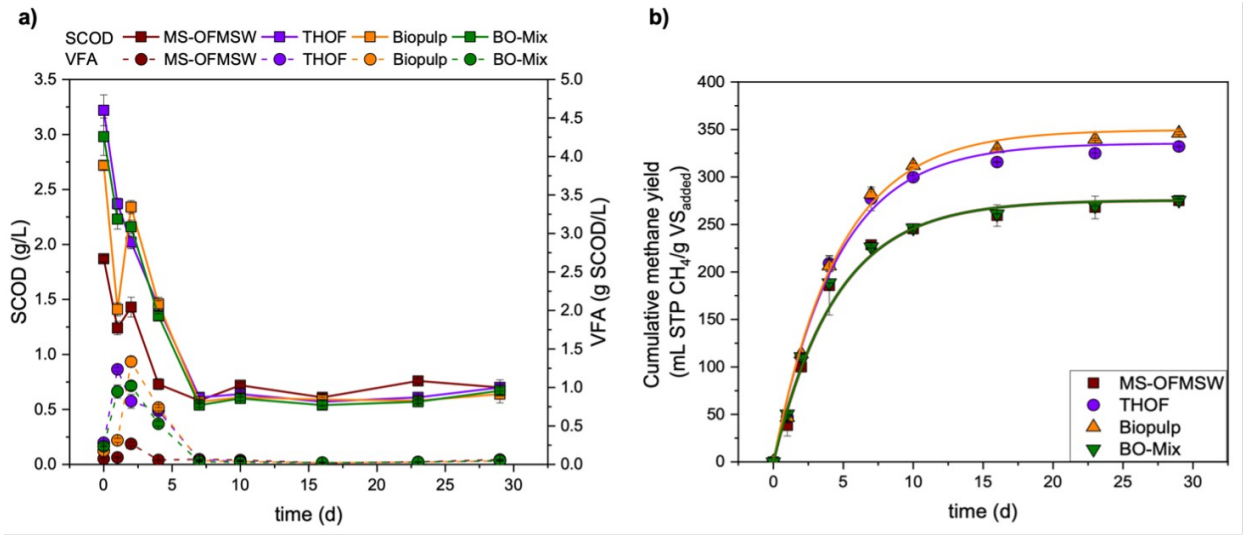


Figure 1. SCOD and VFA evolution (a); Cumulative methane yield per g VSadded (b)

BIOMAK® thermal hydrolysis enhanced MS-OFMSW biodegradability and anaerobic digestion performance, supporting its potential for biowaste valorization within circular-economy strategies.

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