

Anaerobic Co-digestion of Coffee Wastes with Other Organic Substrates: A Mixture Experimental Design

¹Anastasia Kampioti and ²Dimitrios Komilis

¹*Environmental Engineer*

²*Professor*

Abstract

This study investigated the viability of the anaerobic co-digestion of coffee wastes (CFW) with other organic wastes (cow manure-CM, food wastes - FW, anaerobic sludge - AS), to determine the biogas production, derived from coffee residues. Four different mixtures were tested anaerobically at 37 °C using 1 L reaction vessels that were filled with each co-substrate and 150mL of a liquid mixture of nutrients. Anaerobic sludge was used in some mixtures as an inoculum. The biogas was collected using a syringe of 60mL volume and carbon dioxide was absorbed by an alkaline solution. The co-digestion of coffee wastes with anaerobic sludge appeared to have a positive effect on biogas production. On the other hand, the co-digestion of coffee wastes with cow manure and coffee wastes with food wastes, had a negative effect. The results were analyzed using two statistical models for experiments with mixtures. Model [1] calculated the effects of co-digestion among coffee wastes, anaerobic sludge and cow manure. Model [2] evaluated the effect of co-digestion of coffee wastes with food wastes. The results were represented using the equations listed below: Biogas = 179 AS - 99 CFW + 144 CM + 482 AS CFW (1) Biogas = 7.0 FW (2) Biogas: mL/g VS of mixture The positive coefficients reveal the positive interactions between the substrates in the mixture. The negative coefficient of the term coffee wastes in Eq. 1 indicates that coffee waste inhibits biogas production when present in a mixture, due to the presence of toxic substances. By co-digesting coffee wastes with anaerobic sludge a substantial amount of biogas is produced by the CFW. On the contrary, the co-digestion of coffee wastes with food wastes revealed that coffee waste does not contribute to the total biogas generation and only food waste actually generated biogas.

Keywords: Anaerobic co-digestion, coffee wastes, organic wastes, biogas production