Analysis of the Degradation and Biogas Yield of Anaerobic Digestion of PHBV, PLA, Cellulose, and PBT Bioplastics with Wastewater Sludge Inoculum and Food Waste

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In recent years, bioplastics have emerged as a viable alternative to traditional petroleum-based plastics (PE, PBT, etc.). Three of the most common bioplastic polymers are Polyhydroxybutyrate- valerate (PHBV), Polylactide (PLA), and Cellulose-based bioplastics. Due to the energy and greenhouse gas emissions associated with the production of these plastics, it is important that we understand how to effectively dispose of them and maximize the energy return during the disposal process. Anaerobic digestion of bioplastic has the potential to reduce plastic waste and increase the efficiency of our energy use and emissions involved with the use of plastics in all applications. The purpose of this project was to assess the biodegradability and productivity of various bioplastics and plastics under anaerobic conditions. The CO2 and CH4 yields were analyzed through Biochemical Methane Potential (BMP) protocol and a Gas Chromatography machine. The four bioplastics, PHBV, PHB, PLA, and PBT were digested in pellet form and treated under anaerobic conditions at 35°Cand 55°C in the presence of food waste along with PHBV without food waste in triplicate. The bioplastics were analyzed by L CH4 / kg Volatile Solids. The most productive treatments were PHBV 35 and PHBV 35 with food waste. The PLA-FW treatment was a little less productive while the next treatments, Cellulose-FW and PBT-FW were significantly less productive. Scanning electron microscopy revealed almost full degradation of the PHBV plastic and partial degradation of the PLA. The high productivity of the PHBV 35 treatments with and without food waste is promising in supporting the transition from petroleum-based plastics to safer and highly biodegradable polymers like PHBV.