Abstract

The aim of the work was to develop a new way of managing waste generated in individual households. The proposed method consists of the preliminary treatment of green waste (grass and leaves) in hyperthermophilic conditions (70-80 ℃) followed by anaerobic digestion of these materials with kitchen waste in thermophilic or mesophilic conditions. It was shown that the initial hyperthermophilic treatment carried out at the temperature of 70 ℃ significantly increases the production of biogas in the second stage, especially in the range of thermophilic temperatures (55 ℃), both from green waste alone and its mixture with kitchen waste. The highest production of methane and hydrogen was obtained by co-digesting a mixture containing 75% of kitchen waste and 25% of green waste previously subjected to hyperthermophilic treatment. In particular, the co-digestion process enabled nearly 3 times higher hydrogen production compared to the grass mono-digestion process. In this work, bacterial strains of the genus *Coprothermobacter* were also isolated, which, when added to the process of thermophilic anaerobic digestion, enabled a 2-fold increase in hydrogen production, and an over 3-fold increase in methane production from green waste.

In the optimization studies of the two-stage process (70/55 ℃) operated in semi-continuously fed reactors, methane yield of an average of 300 $mlCH_4/g_{s.m.o}$. from a mixture of green waste and kitchen waste and only 131 $mlCH_4/g_{s.m.o}$. from green waste alone was recorded, which confirms the choice of the adopted technological concept . In turn, the two-stage digestion using mesophilic temperatures in the second stage stimulated the production of hydrogen from waste while inhibiting the production of methane.