BIOCHAR ADDITION IN THE ANAEROBIC DIGESTION OF THE ORGANIC FRACTION OF MUNICIPAL SOLID WASTE FOR BIOGAS PRODUCTION

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The continuous decline of fossil fuel availability and the ever increasing concern about environmental pollution, expressed by scientists, governments and public at large, are stimulating the research on renewable energy production. In this perspective, anaerobic digestion (AD) of the organic fraction of municipal solid waste (OFMSW) is recently meeting with increasing interest. It is a process viable both from an economic and technological standpoints, capable to combine the environmental friendly re-cycle of large amount of OFMSW combined to the production of methane, an excellent fossil-based fuels substitute (Chatterjee and Mazumder, 2016). Recent researches in this field are focused on the enhancement of AD performances in terms of biogas yield and methane concentration. Biochar is a by-product of thermal decomposition of organic matter characterized by high carbon content, high porosity and the presence of many functional groups. All these characteristics make biochar particularly useful in number of different use (soil amendments, bulking agent for composting, reduction of bioavailability and phytoavailability of organic contaminants in soil, etc.) (Qian et al., 2015). Laboratory trials showed that biogas production can be greatly improved by using biochar as additive during the AD (Meyer-Kohlstock et al., 2016). Nevertheless, the mechanism underpinning the improvement of methane yields through biochar addition is not yet fully understood. In this work, an attempt to correlate the effect of biochar on AD of OFMSW to its physico-chemical properties was made. Biochar was obtained from slow pyrolysis up to 873 K using *Populus nigra* as feedstock. Steam is used as pyrolyzing agent, as it positively affects the structural characteristics of char. AD of OFMSW was carried out in a batch reactor in mesophilic conditions (37 °C) using as inoculum a digestate deriving from an anaerobic treatment plant in which manure was used as feedstock. OFMSW was prepared in laboratory using food leftovers (fruits, cooked meat, vegetable and bread). Crimped pyrex bottles with perforable butyl rubber septa were used as batch bioreactor. Four percent of biochar (w/w) was added to the feedstock. The bottles were placed for 18 days in a tilting incubator. Both the liquid and the gas phase were analyzed during the AD process monitoring microbial growth (OD_{600}), pH, biogas volume and composition. During the early stages of the process, a strong acidogenesis with a marked pH decrease (around pH 4) occurs when biochar was not added to the reactor. On the contrary, the addition of biochar determined a fast stabilization of pH to mild acid values (around pH 6) more suitable for methanogenic activity. The total volume of biogas is not affected by the addition of biochar. Nevertheless, as showed in Figure 1, the methane yields and the methane concentration in the produced biogas were considerably higher when biochar was added to the feedstock.

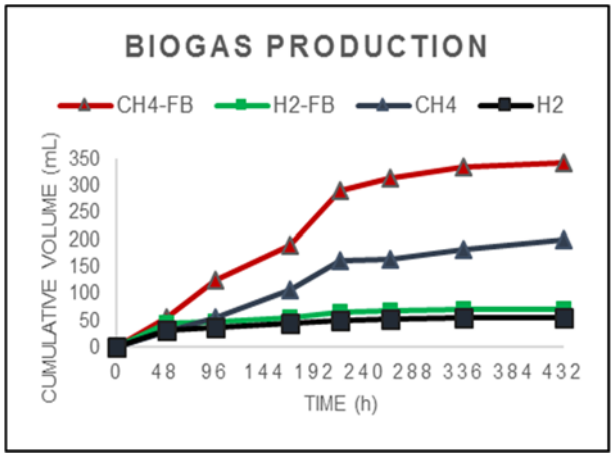

Figure 1 – CH_4 and H_2 cumulative production

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