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BIO-HYDROGEN AND BIO-METHANE CO-PRODUCTION BY SEQUENTIAL TWO-PHASES DARK FERMENTATION FROM AGRO-INDUSTRIAL WASTES (IMERA*)

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Abstract

Anaerobic digestion processes have often been applied for biological stabilization of solid and liquid wastes. These processes generate energy in the form of biogas. Recently, high-rate methane and hydrogen fermentation from renewable biomass has drawn much attention due to current environmental problems, particularly related to global warming.
The aim of this paper is to study new research activities covering production of methane and hydrogen via both conventional mono and high-rate two-phase anaerobic digestion processes from LDO waste vegetable residues. At first, in order to set up and optimize several parameters related to the increase both in bio-hydrogen and methane, several aspects were considered, under lab conditions (T, type of substrate, pre-treatments of solid wastes, type of microbial inocula, HRT, biofuels recovery). Two anaerobic reactors were connected in series for the experiment: a) a working volume of 1 L and 5 L for bio-hydrogen and methane, respectively. The system operated in semi-continuous flow, at pH 5.5 and a HRT of 4 day, while the methane stage at pH 6.5-7.5 and a HRT value of 16 day.
The results demonstrate the successful of an advanced biological approach to convert LDO residues (Large Distribution Organization) into renewable energy (IMERA project). The data obtained allowed to the set-up and the identification of the best conditions for fast treatment efficiency; more, permitted us the scale-up of the plant and co-production of hydrogen and methane, in a semi-pilot plant, with re-cycle between two-phases and with working volume of 300 and 1,000 l, respectively. Moreover, we proposed the use of low electric current treatment (LECT) of vegetables residues to control early stage fermentation and to improve bioH_2 production.
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Key words: anaerobic digestion, GDO residues, hydrogen, low electric current, two-phase anaerobic digestion