

Anaerobic co-digestion of pear residues and sewage sludge using a CSTR digester. Influence of the feed procedure

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HIGHLIGHTS

- Anaerobic co-digestion of pear residues with sewage sludge is feasible.
- Important differences are obtained from the two feed regimes tested, with better results for the so-called continuous feed.
- The organic loading rate (OLR) is the important parameter for the methane production.

Keywords

Fruit and vegetable wastes; organic loading rate; methane; co-digestion; feeding regimes

INTRODUCTION

Fruit and vegetable wastes are generated in large quantities around the world. This kind of residue constitutes a source of nuisance in municipal landfills because of its high biodegradability. Their high moisture and large biodegradable organic matter content facilitates their treatment by biological techniques among which the anaerobic digestion presents increasing attention (Bouallagui et al., 2005).

FVW production is frequently concentrated in only several weeks each year. The anaerobic digesters should be designed to treat very large amounts for only the few weeks of production, which implies a serious economic disadvantage. Co-digestion with other residues, produced continuously throughout the entire year, could be an interesting way to overcome these difficulties. Therefore, the analysis of the optimal introduction of the FVW into the anaerobic digester of the municipal wastewater treatment plant (MWTP) is a very interesting approach with clear economic advantages.

METHODS

The aim of this work was to investigate the digestion of pear residues using the anaerobic sludge obtained from a MWTP digester under mesophilic conditions and to explore the influence of the feed operating conditions using a continuously stirred tank reactor (CSTR) digester, which has a total capacity of 6.4 L and a working volume of 5 L.

Two different ways of feeding the FVSWs were tested: in the first one, denominated discontinuous feed, the residue is fed once a day. In the second one, denominated continuous feed, a liquid and a pulp fraction are separated immediately before use by centrifugation and then the liquid fraction is continuously fed for the first 12 h after which the pulp is injected.

RESULTS AND DISCUSSION

Under discontinuous operation conditions, the results, presented on Figure 1, showed that stable operation was achieved with organic loading rates (OLR) of 1.5-6.0 g L⁻¹ d⁻¹ with a methane

production of 2.0–5.33 L d⁻¹. A maximum methane production was achieved at OLR 4.5 g L⁻¹ d⁻¹ with value of 5.59 L d⁻¹. On the other hand, for the continuous feed the OLRs were varied between 1.5 and 10.5 g L⁻¹ d⁻¹, with a methane production of 1.0 to 10.16 L d⁻¹, with the latter value obtained for a OLR of 10.5 g L⁻¹ d⁻¹. The differences observed between the two feeding procedures investigated indicate that the continuous feed allows the treatment of almost twice as much residue (10.5 vs 6.0 g L⁻¹ d⁻¹). System instabilities are observed at larger OLRs.

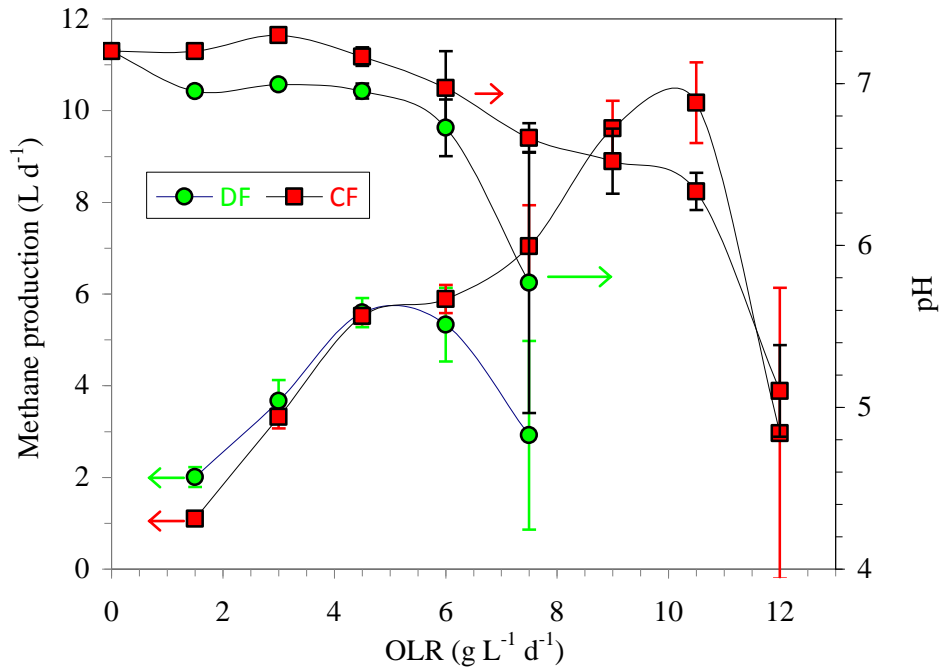


Figure 1. Methane production and pH value versus organic loading rate (mass of volatile solids), for discontinuous (DF) and continuous (CF) feed.

ACKNOWLEDGEMENTS

The authors acknowledge the economic support from the Agencia Española de Cooperación Internacional para el Desarrollo (AECID), through the Project: "Aprovechamiento de residuos vegetales generados en invernaderos de la zona de Tanger A/023239/09"

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