Bioresource Technology 127 (2013) 242–247

Contents lists available at SciVerse ScienceDirect

Bioresource Technology

journal homepage: www.elsevier.com/locate/biortech

Biogas production from pear residues using sludge from a wastewater treatment plant digester. Influence of the feed delivery procedure

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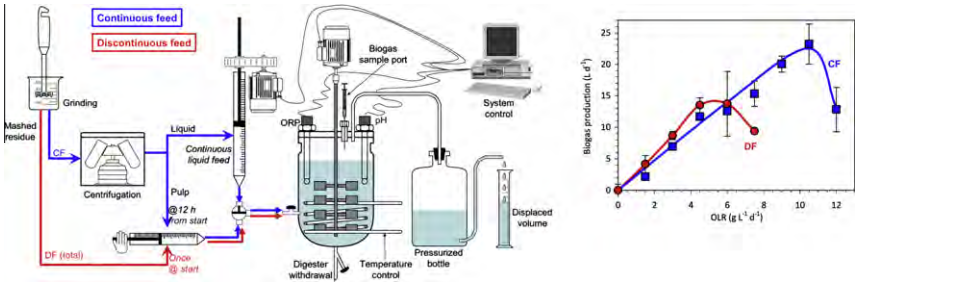
HIGHLIGHTS

- Digestion of pear residues at wastewater treatment plant digesters is feasible.
- The organic loading rate (OLR) is the critical parameter for the biogas production.
- Important differences are obtained from the two feed delivery procedures tested.
- Monitoring of pH and redox potential values allows the prediction of failures.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:
Received 6 July 2012
Received in revised form 17 September 2012
Accepted 22 September 2012
Available online 29 Septembe 2012

Keywords:
Fruit and vegetable wastes
Organic loading rate
Codigestion
Methanization
Feed delivery

ABSTRACT

Clear economic advantages may be obtained from the management of seasonal fruit wastes by codigestion at existing facilities which are working throughout the year with other residues.

We have explored the biomethanization of pear residues in a 5 L stirred reactor loaded with sludge from the anaerobic digester of a municipal wastewater treatment plant. Different organic loading rates (OLRs) of fruit waste were tested with two delivery procedures: a discontinuous one (fed once a day) and a pseudocontinuous one. For both procedures, as the OLR increases the pH of the digester drops to acidic values and large OLRs may cause the reactor failure. Nevertheless, the pseudocontinuous delivery allows the treatment of more residue, (10.5 versus 6.0 g of volatile solids per litre of reactor and day), maintaining the specific biogas production (0.44 L of biogas per gram of volatile solids), with some improvement in methane concentration (44% vs 39%).

1. Introduction

A highly productive agriculture can be found in many regions of the Mediterranean Sea. As a consequence important amounts of fruit and vegetable solid wastes (FVW) that require a sound management (Gomez-Lahoz et al., 2007) are also produced.

The easily biodegradable organic matter content of FVW (about 75%, w/w) and high moisture facilitates their biological treatment. Among these treatments, an increasing trend for the use of anaerobic digestion is observed (Mata-Alvarez et al., 1992; Bouallagui et al., 2003, 2005, 2009; Namsree et al., 2012). The main advantage of these processes is the production of biogas, which can be used for the production of renewable energy. Besides, the digestat can be applied as an organic amendment to replace carbon content and some nutrients to the soil (Converti et al., 1999; García-Delgado et al., 1994; Gomez-Lahoz et al., 2007). Bouallagui et al. (2005) reviewed

Abbreviations: BMP, biochemical methane potential; CF, *pseudo*continuous feed; COD, chemical oxygen demand, in dry basis (g O_2/kg TS); DF, discontinuous feed; FVW, fruit and vegetable wastes; MWTP, municipal wastewater treatment plant; NVS, non volatile solids (% w/w); OLR, organic loading rate (g L^{-1} d^{-1}); ORP, oxidation reduction potential (mV), given as standard reduction potential; TS, total solids (% w/w); VFA, volatile fatty acids; VS, volatile solids (% w/w).

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http://dx.doi.org/10.1016/j.biortech.2012.09.075