Bioresource Technology 178 (2015) 247–253

Contents lists available at ScienceDirect

Bioresource Technology

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

Extraction of soluble substances from organic solid municipal waste to increase methane production

Rosalinda Campuzano *, Simón González-Martínez

Environmental Engineering Department, Institute of Engineering, National University of Mexico (Universidad Nacional Autónoma de México), 04510 Mexico DF, Mexico

HIGHLIGHTS

- Using water, consecutive volatile solids extractions from OFMSW were performed.
- Total and volatile solids and COD were evaluated as function of dilution and time.
- Extracts and bagasses were used for BMP tests at 35 °C during 21 days.
- Volatile solids and methane production increases with dilution rate.
- Extracting volatile solids, the methane production increases up to 47%.

ARTICLE INFO

Article history:
Received 30 June 2014
Received in revised form 7 August 2014
Accepted 8 August 2014
Available online 18 August 2014

Keywords:
Bagasse
Extractions
Methane production
OFMSW
Organic solid waste

ABSTRACT

This work deals with the analysis of the methane production from Mexico City's urban organic wastes after separating soluble from suspended substances. Water was used to extract soluble substances under three different water to waste ratios and after three extraction procedures. Methane production was measured at 35 °C during 21 days using a commercial methane potential testing device. Results indicate that volatile solids extraction increases with dilution rate to a maximum of 40% at 20 °C and to 43% at 93 °C. The extracts methane production increases with the dilution rate as a result of enhanced dissolved solids extraction. The combined (extract and bagasse) methane production reached, in 6 days, 66% of the total methane produced in 21 days. The highest methane production rates were measured during the first six days.

1. Introduction

As an alternative for organic solid waste treatment, anaerobic digestion is commonly used for energy recovery in the form of methane; it allows also the reduction of waste volume to be disposed in landfills and the destruction of pathogenic organisms (Sonakya et al., 2001). There are several commercial processes, such as BTA (BTA International GmbH, 85276 Pfaffenhofen, Germany), DRANCO (OWS nv, 9000 Gent, Belgium) and Valorga (Valorga International S.A.S., 34935 Montpellier, France), among others, for biogas generation from organic solid wastes and, in the last 20 years, more than 184 commercial plants have been installed (de Baere et al., 2010). According to solids content in the reactor, anaerobic digestion technologies can be classified as *dry* and *wet* processes (de Baere et al., 2010). Due to the complexity of the organic fraction of municipal solid waste (OFMSW), the reaction times range from 15 to 30 days. Shorter reaction times are common in wet digestion with solids content between 10% and 15%.

Biogas production potential largely depends on the substrate characteristics, its biodegradability and content of carbohydrates, proteins and lipids, as well as the fractions of cellulose, hemicellulose and lignin in its composition (Hartmann and Ahring, 2006). Lignin content in OFMSW is a negative indicator of degradation (Buffiere et al., 2006). Water leaching allows the extraction of soluble organic compounds from OFMSW which are, compared to the lignocellulosic substances, readily available for the microorganisms during anaerobic digestion.

Nayono et al. (2010) and Fantozzi and Buratti (2011), using a press to "squeeze" the fresh OFMSW. They used the leachate to produce biogas and conclude that the highest biogas production was obtained during the first 5 days of the test. Unfortunately, they do not present OFMSW characterization.

When the substrate is provided to the microorganisms in dissolved form, the time required for anaerobic degradation is 3 to

* Corresponding author. Tel.: +52 5556233670.
E-mail addresses: rcampuzanoa@iingen.unam.mx, sgm@pumas.ii.unam.mx (R. Campuzano).

http://dx.doi.org/10.1016/j.biortech.2014.08.042
0960-8524/