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Anaerobic biodegradability of Category 2 animal by-products: Methane potential and inoculum source

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HIGHLIGHTS

- ▶ Methane production from animal by-products is affected by the inoculum source.
- ▶ Landfill leachate and sludge from anaerobic lagooning are good inoculum sources.
- ▶ The maximum methane production rate is 35 mL CH_4 g^{-1} $VS_{substrate}$ d^{-1}.
- ▶ The biodegradability of Category 2 animal by-products is inhibited at 5% TS.

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ABSTRACT

Category 2 animal by-products that need to be sterilized with steam pressure according Regulation (EC) 1774/2002 are studied. In this work, 2 sets of experiments were performed in mesophilic conditions: (i) biomethane potential determination testing 0.5%, 2.0% and 5.0% total solids (TS), using sludge from the anaerobic digester of a wastewater treatment plant as inoculum; (ii) biodegradability tests at a constant TS concentration of 2.0% and different inoculum sources (digested sludge from a wastewater treatment plant; granular sludge from an upflow anaerobic sludge blanket reactor; leachate from a municipal solid waste landfill; and sludge from the slaughterhouse wastewater treatment anaerobic lagoon) to select the more adapted inoculum to the substrate in study. The higher specific methane production was of 317 mL CH_4 g^{-1} $VS_{substrate}$ for 2.0% TS. The digested sludge from the wastewater treatment plant led to the lowest lag-phase period and higher methane potential rate.

1. Introduction

The possible uses and processing rules of animal by-products not intended for human consumption were defined by the European Parliament and the Council in October 2002 (Regulation (EC)1774, 2002). There are 3 categories of animal by-products (ABP): Category 1 is a high risk material; Category 3 is low risk ABP that are not intended for human consumption but can be used as a raw matter for animal feeds; and Category 2 that comprises all ABP included neither in Category 1 nor in Category 3. Category 2 includes (Kirchmayr et al., 2003): manure and digestive tract content; all animal materials collected when treating wastewater from slaughterhouses; products of animal origin containing residues of veterinary drugs; products of animal origin imported from EU non-member countries that fail to comply with the veterinary requirements into the Community; killed or fallen animals and solid materials from slaughterhouses (particle size >6 mm), including animals killed to eradicate episodic diseases.

Currently, in Portugal, Category 2 ABP other than manure, digestive tract and milk are pre-cooked at around 100 °C (rendering process) and sterilized (designed as Category 2 ABP* hereafter) and then disposed in landfill. The sterilization of Category 2 ABP is based on the reduction of the residue fraction to the particles with size <50 mm, sterilization at temperatures higher than 133 °C, for at least 20 min without interruption, at 3 bar absolute pressure, and marking the transformed residue with odorous repellent (smell). Due to the high organic matter content of Category 2 ABP*, there is a great potential for the valorization of this residue through conversion into biogas by an anaerobic digestion process.

The use of different waste dilutions in determining the Biochemical Methane Potential (BMP) allows to check if the methane production is not underestimated (Angelidaki et al., 2009). According to these authors, when the maximum methane potential is the same in at least two consecutive dilutions of the dilution series, it can be assumed that the inoculum is neither overloaded nor

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