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ORIGINAL PAPER

Anaerobic treatment of rapeseed meal

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Rapeseed meal is a solid by-product obtained from rapeseed after oil extraction. This contribution summarises experiences from batch experiments as well as the long-term processing of this substrate in a laboratory stirred anaerobic reactor (continuous stirred-tank reactor). On the basis of the batch tests of hydrolysis, acidogenesis, and methanogenic activity, it was concluded that the anaerobic degradation of rapeseed meal can be performed using a one-step system and it is not necessary to include a hydrolytic-acidogenic step prior to the methanogenic step. Although the methanogenic potential of rapeseed meal appears to be very promising, the long-term processing as a single substrate led to serious problems arising from the inhibitory effects. It was, therefore, co-fermented with crude glycerol from biodiesel production. From the long-term operation of the laboratory model, it may be stated that, due to the co-fermentation of by-products from biodiesel production, the individual inhibition effects can be suppressed to a large extent and biogas production can be stabilised. The maximum organic loading rate in the continuous stirred reactor achieved 2.42 kg m^{-3} d^{-1} of volatile solids (15 g of rapeseed meal and 20 mL of gas-phase), which was 3.13 kg m^{-3} d^{-1} of chemical oxygen demand.
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Introduction

Biodiesel is a liquid fuel based on the methyl esters of long-chain fatty acids and is a prominent candidate to replace diesel fuel in transportation in the near future (Janaun & Ellis, 2010). It is usually produced by the base-catalysed transesterification of vegetable oils, animal fats, or waste oils with methanol (Leung et al., 2010). The most important by-products of biodiesel production usually are pressed cakes or meal from oil extraction and crude glycerol. The composition and characteristics of the by-products depend on the source of the oil used for the production of biodiesel and on the processing technology (Thompson & He, 2006; Ramachandran et al., 2007). Use of these by-products for biogas production provides a prospect of further energy generation, which could be used on-site or redistributed. Proper valorisation of by-products can have a strong influence on the economic and environmental status of the biofuel itself (Lora et al., 2011).

Rapeseed meal or cake is a solid by-product obtained after oil extraction from oilseed rape. In the EU, rapeseed oil is used predominantly as a substrate for the production of biodiesel (Malça & Freire, 2011). This material contains, depending on the method of oil extraction, approximately 2–25 % of oil. Oil cakes are produced when a simple oil pressing system is used. In the event that pressing is followed by advanced extraction techniques, residues are usually referred to as oil meals (Ramachandran et al., 2007). Besides oil, this substrate also contains proteins and fibres and quite a large portion (about 35–40 mass %) consists of nitrogen-rich substances. Rapeseed meal is currently mainly used in feed applications in the poultry and swine industries, although its use as an energy source has also been developing rapidly.

Rapeseed cake and meal contain a high portion

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