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Valorisation of digestate from biowaste through solid-state fermentation to obtain value added bioproducts: A first approach

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Abstract

Digestate from biowaste was assessed as a potential source of bioproducts of commercial and industrial interest through solid-state fermentation. The targeted bioproducts were hydrolytic enzymes (cellulases and proteases from autochthonous microbiome), biosurfactants (sophorolipids produced from *Starmella bombicola*) and biopesticides (produced from *Bacillus thuringiensis*). Low cellulase production was observed within the range of 0.5-1.5 FPU g⁻¹DM while protease production showed two discrete peaks of 66±8 and 65±3 U g⁻¹DM at 3.5 and 48h, respectively. Low sophorolipids production was also obtained, with a maximum yield of 0.02 g g⁻¹DM using hygienised digestate supplemented with external sugar and fat sources. Biopesticides produced by *B.thuringiensis* were successfully at 72h of operation, reaching a maximum spore production of 8.15±0.04 (10⁷) CFU g⁻¹ DM and 2.85±0.22(10⁷) CFU g⁻¹ DM using sterile and hygienised digestate, respectively. These biopesticides could contribute to the substitution of chemically produced pesticides, moving towards a sustainable digestate management in a circular economy scheme.

Keywords: solid state fermentation, digestate, valorisation, bioproducts, biopesticide.

1. Introduction

In the last years, the EU has developed legislation that affected the waste management of organic materials. The Landfill Directive 199/31/EC aims to divert waste disposal from landfills and the Waste Directive 2008/98/EC aims to develop a new waste management hierarchy that promotes the use of wastes as secondary raw materials. In this context, anaerobic digestion (AD) is a widely used technology that can produce biogas, which contributes to the substitution of fossil fuels, providing a highly efficient method for resource recycling that allows to close the production cycle. However, the sustainability of AD processes will depend on the ability of the plant operator to properly manage the digestate remaining after the AD process (Dahlin et al., 2015).

Digestate is a heterogeneous material produced in large amounts during the anaerobic digestion process (Dahlin et al., 2017; Monlau et al., 2015). Nearly 95% of the digestate produced in Europe

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