

Rhodobacter and pigments in anaerobic digestion of brewery effluent

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ABSTRACT: Brewery wastewater (BWW) was digested anaerobically in mesophilic conditions and batch mode. The presence of a reddish pigmentation associated to the better removal capacity of the BWW digestion (64%), indicates that the treatment and energetic valorisation of an organic effluent can occur at the same time and inside the same unit as the production of a photosynthetic pigment. The reddish pigmentation found in this experiment was mainly attributed to bacteriochlorophyll *a*, and to carotenoids pigments of the spirilloxanthin series (characteristics of purple non-sulfur bacteria). Microbial identification through Next-generation sequencing of 16S rRNA genes showed the presence of bacterial genus *Rhodobacter* in the inoculum and in anaerobic digestion of BWW.

1 INTRODUCTION

The brewing sector has an important impact on the Portuguese economy, with beer production increasing by 11% in 2017 (EUROSTAT 2018). However, for each liter of beer produced, 3–10 liters of highly polluted wastewater are generated (Simate et al. 2011). Due to their organic load (sugars, soluble starch, ethanol and volatile fatty acids), suspended solids content and the presence of phosphorus and nitrogen (ammonia and/or nitrate) (Raposo et al. 2010), they have to be treated before being thrown into the environment.

Anaerobic digestion (AD) has been used as a sustainable and environmentally friendly method for converting organic content wastes into a renewable energy and a flow for agricultural use. Moreover, it was found the presence of a ubiquitous group of anoxyphototroph microorganisms – the purple non-sulfur bacteria (PNSB) – which can produce photosynthetic pigments in anaerobic conditions, like carotenoids and bacteriochlorophyll *a* (Zhang et al. 2002, Soto-Feliciano et al. 2010), which gave them a reddish pigmentation. The members of this group belongs to α and β -Proteobacteria and are photoautotrophic, photoheterotrophic, and chemoheterotrophic (Soon et al. 2014). They show an important role in wastewater treatment processes loaded with high concentrations of acetate and lower fatty acids (Okubo et al. 2005).

The objective of this work is to characterize a pigmented population detected in the liquid medium during the anaerobic digestion process of BWW and evaluate possible conjugation of the effluent treatment and the simultaneous production of the pigment during the same process.

2 MATERIAL AND METHODS

2.1 Substrate and inoculum

Brewery wastewater (BWW) was collected from the Sociedade Central de Cervejas e Bebidas brewery (SCC, Vialonga, Portugal) after a primary treatment stage. Biological solids, collected from an anaerobic digester plant (SIMLIS, Leiria, Portugal), were used as inoculum (I).