Lipid and Carotenoid Production by a *Rhodosporidium toruloides* and *Tetradesmus obliquus* Mixed Culture Using Primary Brewery Wastewater Supplemented with Sugarcane Molasses and Urea

Carla Dias1 · Beatriz Nobre2 · José A. L. Santos3,4,5 · Alberto Reis1 · Teresa Lopes da Silva1

Accepted: 24 June 2022 © The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2022

Abstract

In this study, *Rhodosporidium toruloides* and *Tetradesmus obliquus* were used for lipid and carotenoid production in mixed cultures using primary brewery wastewater (PBWW) as a culture medium, supplemented with sugarcane molasses (SCM) as a carbon source and urea as a nitrogen source. To improve biomass, lipid, and carotenoid production by *R. toruloides* and *T. obliquus* mixed cultures, initial SCM concentrations ranging from 10 to 280 g L\(^{-1}\) were tested. The medium that allowed higher lipid content (26.2% w/w dry cell weight (DCW)) and higher carotenoid productivity (10.47 µg L\(^{-1}\) h\(^{-1}\)) was the PBWW medium supplemented with 100 g L\(^{-1}\) of SCM and 2 g L\(^{-1}\) of urea, which was further used in the fed-batch mixed cultivation performed in a 7-L bioreactor. A maximum biomass concentration of 58.6 g L\(^{-1}\) and maximum lipid content of 31.2% w/w DCW were obtained in the fed-batch cultivation. PBWW supplemented with SCM was successfully used as a low-cost medium to produce lipids and carotenoids in a *R. toruloides* and *T. obliquus* mixed culture, with higher productivities than in pure cultures, which can significantly reduce the cost of the biofuels obtained.

Keywords Mixed cultures · Primary brewery wastewater · Lipids · Carotenoids · *Tetradesmus obliquus* · *Rhodosporidium toruloides*