Production of Carotenoids in *Rhodosporidium toruloides* from Residual Lignocellulosic Biomasses

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Abstract:

Microbial diversity is a plentiful repository for the development of biorefineries based on residual biomasses. In this work we focus on the use of the yeast *Rhodosporidium toruloides*, known for the ability to consume pentose and exose sugars, and to withstand several inhibitory compounds that might arise from lignocellulosic biomasses. At the same time, it naturally produces valuable compounds (*e.g.* carotenoids); nevertheless, its potential is not yet fully exploited. To explore biodiversity in terms of raw material we the bark and wood of sessile oak and mulberry trees obtained from the maintenance of the Besozza Park (Pioltello, MI). Its lignocellulosic composition can provide both fermentable sugars released by enzymatic hydrolysis and lignin moiety, which can be valorised as biopolymer for the production of nanocapsules.
The first step of the process involves the hydrolysis of the residual biomasses to obtain growth media for the yeast. The concentration of sugars and nitrogen sources derived from mulberry and sessile oak wood and bark were analysed. These data, combined with the growth kinetics of *R. toruloides*, demonstrate that they are suitable substrates for growth and possibly for carotenoids production too, which were analysed and quantified by flow-injection analysis coupled with mass spectrometry (FIA-MS). To fully utilize the waste biomass, adhering to the principles of bioeconomy and circular economy, the residual lignin from enzymatic hydrolysis is used to produce nanocapsules, which can host yeast-derived carotenoids as cargo for several applications. Further investigations will evaluate gene modulation in the yeast during the fermentation of the different biomasses, in order to provide insights useful both for the improvement of the knowledge of metabolic pathways in *R. toruloides* and the optimization of carotenoids production from these woody biomasses.
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