Camelina sativa meal hydrolysate as sustainable biomass for the production of carotenoids by *Rhodosporidium toruloides*

Stefano Bertacchi[1] and Paola Branduardi[1]

[1]Department of Biotechnology and Biosciences, University of Milano-Bicocca, Milano, Italy
E-mail: stefano.bertacchi@unimib.it

Keywords: bio-based process; carotenoids; residual biomasses; *Rhodosporidium toruloides*; fermentation; biorefinery; Camelina meal; enzymatic hydrolysis

Abstract:
Biorefineries are key players in bioeconomy scenario, but their sustainability is strongly related to the origin of the feedstock. Therefore, biorefineries based on residual biomasses are increasingly of industrial interest, to overcome drawbacks of the use of edible resources. To unlock the nutrients (*i.e.* sugars) present in lignocellulosic biomasses the use of enzymes is becoming pivotal, due to their low environmental impact, available portfolio and applicability in different processes [1]. We focused our work on the exploitation of leftovers from *Camelina sativa* oil extraction, called *Camelina* meal, mainly used as animal feed, to produce carotenoids by fermentation of *Camelina* meal-derived sugars with the yeast *Rhodosporidium toruloides*, a natural producer of these high-value products. In fact, since most of the market of carotenoids is covered by petrochemical synthesis, there is an increasing quest for molecules of natural origin, considering their applications in the food, feed and cosmetic sectors.
In order to exploit Camelina meal for this purpose, the biomass was saccharified by enzymatic hydrolysis to obtain a sugar mixture then converted by R. toruloides into the carotenoids in both Separated Hydrolysis and Fermentation (SHF) or Simultaneous Saccharification and Fermentation processes (SSF) [2]. The possible outcomes of the process are therefore pure carotenoids or Camelina meal enriched in carotenoids, to be use in the feed sector. In addition, the loading of enzymatic cocktail was reduced to increase economic appeal to the proposed processes. Initial content of total solid was also modulated, in order to improve carotenoids productivity. The process was further tested at the bioreactor level in order to assess the reliability of data from shake flasks fermentations [3]. This work paves the way to the use of an underrated biomass to produce a relevant commodity for several sectors in the light of cascading principles of bioeconomy.

1. Bertacchi S, Jayaprakash P, Morrissey JP, Branduardi P. *Interdependence between lignocellulosic biomasses, enzymatic hydrolysis and yeast cell factories in biorefineries*. Microb. Biotechnol. Wiley; 2021.
2. Bertacchi S, Bettiga M, Porro D, Branduardi P. *Camelina sativa meal hydrolysate as sustainable biomass for the production of carotenoids by Rhodosporidium toruloides*. Biotechnol Biofuels. BioMed Central; 2020;13:1–10.
3. Bertacchi S, Cantù C, Porro D, Branduardi P. *Optimization of carotenoids production from camelina sativa meal hydrolysate by rhodosporidium toruloides*. Fermentation. 2021;7:208.