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Simultaneous determination of torulene, torularhodin and β-carotene in *Rhodotorula mucilaginosa* using UV-Vis spectroscopy and chemometric approaches

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Abstract

Carotenoids are pigments of biotechnological importance, with antioxidant and radical-scavenging properties, confered by their extensive system of conjugated double bonds. They are synthesized via the mevalonate pathway in red yeasts, such as those belonging to the genus *Rhodotorula,* which have been explored as natural pigment-producing living factories, a safer and more consumer-friendly alternative than chemically synthesized carotenoids.

The aim of this work was to develop a method for the simultaneous, non-destructive determination of the main carotenoids produced by *Rhodotorula mucilaginosa* (β-carotene, torulene and torularhodin), using Principal Component Regression (PCR), a multivariate chemometric technique.

The fungal pigments were purified after chemical cell wall disruption via normal-phase column chromatography. PCR was used to obtain multiple regression equations for the determination of each carotenoid, using the UV-Vis spectra of carotenoid mixtures as input data. The method was validated on samples of known pigment concentration and tested on real samples, prepared by subjecting yeast cells to sodium selenate stress, to investigate the antifungal activity of selenocompounds.

An inverse correlation between total carotenoid content and seleno-compound concentration was observed. Intermediary selenate concentrations appear to shift the carbon flux in the biosynthetic pathway of carotenoids, favoring carotene synthesis in the detriment of xanthophylls.

To our knowledge, no previous method for the simultaneous determination of *Rhodotorula mucilaginosa* carotenoids using PCR has been developed.

The method could be used in industrial settings, when optimization of the culture media for the overproduction of a specific carotenoid is desired. It could also facilitate future studies regarding selenium-mediated fungal toxicity.

Keywords: carotenoids*, R. mucilaginosa*, simultaneous determination, selenocompounds.

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