Sustainable carotenoid synthesis from cheese whey: evaluation of key fermentation parameters and carotenoid profile using two novel *Rhodosporidium kratochvilovae* strains

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Abstract

The transition to circular economy requires the development of sustainable processes for the production of value-added compounds, currently derived from petroleum oil. Renewable resources, such as waste and by-product streams generated from the agro-food sector, constitute suitable candidates for the development of efficient bioprocesses for the production of high value commodities. To this end, cheese whey, a high lactose waste stream generated from the dairy industry, was evaluated as a low-cost substrate for carotenoids production from red yeasts. Despite the fact that is produced in vast amounts, cheese whey remains unexploited, presenting a huge environmental burden.

In this study, cheese whey was employed as substrate for the production of carotenoids and lipids from yeasts belonging to *Rhodosporidium* sp. Cheese whey was hydrolyzed prior to fermentation to the respective monosaccharides (glucose and galactose), due to the inability of the red yeasts to directly assimilate lactose. Subsequently, two isolated *Rhodosporidium kratochvilovae* strains (FMCC Y-42 & Y-43) were evaluated at various carbon to free amino nitrogen (C/FAN) ratios and incubation temperatures, in terms of both carotenoid and lipid production. Incubation temperature significantly influenced carotenoid production for both studied strains. More specifically, the maximum carotenoid production was observed at low C/FAN ratios, while the preferred incubation temperature was strain-dependent. Likewise, lipid accumulation was not favored using cheese whey as substrate. HPLC-DAD analysis of the produced carotenoids revealed that their profile was independent of culture conditions. In particular, the prevailed carotenoid was lycopene (98% of total carotenoids), followed by torularhodin, torulene and γ-carotene in lower amounts. This is the first study indicating the potential of *R. kratochvilovae* strains to produce carotenoids valorizing cheese whey as substrate.

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