

Dye-ing to Discover: Investigating the Production of BETA-Carotene in the Yeast *Rhodotorula mucilaginosa* as Natural Pigments

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Beta-carotene is found in most living organisms and contributes to the red, orange, and yellow coloration in various life forms. In humans, beta-carotene is converted into vitamin A, which promotes vision and eye health and supports a strong immune system. Additionally, due to its antioxidant properties, beta-carotene prevents milk oxidation, reduces the onset of mastitis in dairy cattle, and aids in the survival of salmon. Furthermore, the global carotenoid market is estimated at \$2.5 billion and is projected to grow in the coming years. In light of the recent ban on Red No. 3 by the FDA, there is a pressing need to develop sustainable and safe alternatives to synthetic red dyes used in human food, animal feeds, cosmetics, and pharmaceuticals. This research explores the use of the yeast *Rhodotorula mucilaginosa* for producing beta-carotene as a potential replacement for synthetic pigments. This study utilizes sugar beet molasses (SBM), an inexpensive and abundant resource, as the carbon source for beta-carotene production in yeasts. Several tests on yeast extracts were performed to identify the most effective one. Preliminary findings show that after 7 days of fermentation, an average of 13.7µg/g of beta-carotene was achieved in 100 mL of SBM media with 1% cell biomass, resulting in total carotenoid levels of up to 216.5µg/g. Future research will involve scaling up the experiment to benchtop bioreactors and purification studies of the product.

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