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

Hooda, Anika (School: Brookings High School)

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.

Awards Won: