

Membrane-assisted extraction of astaxanthin from the microalgae

Haematococcus pluvialis

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Astaxanthin is a red carotenoid used as a dye in the aquaculture industry. Due to its antioxidant properties, the demand for natural astaxanthin for use in the cosmetics and food industries has increased enormously. The best natural source of astaxanthin is the microalgae *Haematococcus pluvialis* (*H. pluvialis*), in which it can accumulate at up to 5wt%. The synthesis of astaxanthin in *H. pluvialis* is accompanied by the formation of a resistant cyst cell wall, which prevents direct astaxanthin extraction into a solvent. In the subsequent downstream process, the algal broth is harvested by centrifugation, mechanically disrupted, dried and finally astaxanthin is extracted with supercritical CO₂. In order to simplify the downstream process, it is of interest to establish a process that enables a direct extraction of astaxanthin from the algal broth into a solvent.

Membrane contactors are used for bubble-free aeration in the beverage industry, chiral separations, wastewater treatment and the extraction of natural products and proteins. In this work, a hydrophobic membrane was used. The membrane separates the fermentation broth from the solvent while its pores are filled with the solvent only. This enables dispersion-free contact of the two phases.

In order to enhance the solubility of the strongly hydrophobic astaxanthin in the aqueous phase, the influence of different surfactants on the formation of stable astaxanthin/water emulsion was first investigated. Finally, astaxanthin was successfully extracted from the aqueous solution (model fermentation broth) phase into n-heptane, using a membrane-assisted extraction unit. The initial astaxanthin concentration of the aqueous phase could be concentrated by a factor of three in the organic phase. Astaxanthin is obtained after evaporation of the solvent.