

Extraction of carotenoids with supercritical CO₂

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1 Introduction

"We live in a world of mixtures - the air we breathe, the food we eat, the gasoline in our automobiles ..." [1]. Therefore raw materials as well as synthetic products have to be separated into desired and undesired components for further use. Since 1979 CO₂ as solvent for the separation of high-graded products at moderate conditions is used at NATECO₂.

Most of the commercial CO₂- extraction-plants work at pressures lower than 300 bars. With ascending pressure the solubility for different substances is rising. Consequently also the extraction of carotenoids with CO₂ in an effective and economical way is possible through higher pressures.

Carotenoids have many physiological functions. They are efficient free-radical scavengers and enhance the vertebrate immune system.

2 Summery

The paper presents the applications and possibilities of supercritical CO₂ for the production of extracts with high concentrations of carotenoids out of different raw materials:

Raw Material	Carotinoids
Marigold	Lutein
Red Algae	Astaxanthin
Tomato Skins	Lycopene
Carrots	α/β -Carotene

For the test series a CO₂-plant with a design pressure of 1000 bars and a volume of the extraction basket of 2 l was used. To reach a high yield, extraction pressures varied from 500 to 800 bars and temperatures from 40 to 80 °C. The extracts have been analyzed with HPLC.

With the applied parameters the recovery of valuable, red carotenoid-extracts is possible. Due to the absence of oxygen the extracts are highly stable.

3 Conclusions

With higher pressures the extraction of carotenoids with supercritical CO₂ becomes effective and economic. The resulting products are mostly applied as additives in functional food. Up-scaling to small-scale-productions have been already performed successfully at NATECO₂. For this purpose a plant with an extraction volume of 50 l and pressures up to 1000 bars exists in the facility. Two separators allow the manufacturing of two extracts with different carotenoid contents in one extraction step. Also construction work for an additional plant with bigger extraction volume is running at the moment.

[1] Prausnitz, J.M. Molecular Thermodynamics of Fluid-Phase Equilibria. Prentice-Hall, Engelwood Cliffs, N.J. Library of Congress Catalog Card NO. 69-16866