

Proteins and carotenoids- innovative CO₂-extracts

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1 Introduction

Food with higher protein content is more and more common: Bodybuilders, vegetarian, vegans just as many people with usual diets are looking for protein-concentrates. A high protein level can be gained by removing the oils and fats from edibles using supercritical CO₂ extraction. Another innovative example is the production of carotenoid-extracts as additive for nutraceuticals applying compressed CO₂ as effective solvent.

The CO₂ extraction technology is the basis for both applications, whereas the extraction parameters differ completely. The lecture presents new products for the food industry generated by usual extraction pressures as well as by ultra-high-pressure extraction.

2 Proteins

Important factors for the human consumption are proteins. General animal proteins are considered as more high-grade nutrition than plant derived-proteins. But for economic and ecological reasons, the high energy costs of producing animal proteins have to be considered. Additionally, the amount of essential amino acids in animal proteins is lower than in vegetable proteins. Above all health awareness is increasing and therefore vegetable proteins become more and more important for consumers.

The protein content in kernels and seeds is almost high as well as the fat content.

Raw material	Protein content [% by weight]	Fat content (% by weight)
Sun flower kernels	22	49
Hemp seeds	22	35 - 50

To enrich the protein concentration the high fat content of the raw materials should be reduced by cold pressing down to 10 – 15 % (w/w), e.g..

Subsequently by CO₂ extraction the fat concentration can be decreased below 2% and so the protein content goes up to 55%. Additionally the process enables to preserve organic, kosher or halal status of all fractions. Extraction at usual pressures of around 300 bars and 50 °C is sufficient and highly economic.

3 Carotenoids

Carotenoids are the most common natural colorants. Most carotenoids are C₄₀-compounds and belong to the group of tetraterpenes. Compounds with oxygen are called xanthophylls, like lutein and zeaxanthin and compounds without oxygen bounds are carotenes like β -carotene and lycopene. Carotenoids are unpolar, fat-soluble substances and therefore perfectly soluble in CO₂.

Carotenes are mostly present in yellow to red vegetables and fruits and xanthophylls in green vegetables. For example, photosynthesis wouldn't be possible without carotenoids, because carotenoids protect the chlorophyll against oxidation.

Carotenoids have major importance in food, pharma and cosmetic industry and are well known as dietary supplements.

At NATECO₂ varying raw materials are treated with supercritical CO₂ to produce carotenoid-extracts. For instance the dried biomass of the algae *Haematococcus pluvialis* comprises 2-4 % of the carotenoid astaxanthin. By optimized preparation of the raw material and ideal adjustment of the extraction parameters more than 95 % of the astaxanthin is transferred to the separators and extracts with 10-14 % of carotenoids in the first separation step are attained. Pressures of around 1.000 bars are required to assure an effective process.

4 Summary

The CO₂ extraction enables to produce defatted material as additive in cereals or shakes, as well as the concentration of carotenoids in the extracts. This specific extraction technology offers the possibility to use all fractions: The extracted oils or spent materials with high protein contents and the carotenoid extracts.