INSTITUTE OF FOOD TECHNOLOGY

Hempseed meal protein isolates prepared by different isolation techniques. Part I. physicochemical properties. Food Hydrocolloids, 79, 526-533, 2018, M21a, IF= 5.839 (Food Science & Technology 5/139, authors: Hadnađev, M., Dapčević-Hadnađev, T., Lazaridou, A., Moschakis, T., Michaelidou, A. M., Popović, S., & Biliaderis, C. G.

Scientific paper

Miroslav Hadnađev, PhD

Protein isolates from hemp seed meal were prepared using alkaline extraction/isoelectric precipitation (HPI) and micellization (HMI) procedures and compared in terms of their physicochemical properties and functionality. The micellization technique resulted in lower protein recovery than the isoelectric precipitation technique. Both HPI and HMI proteins had protein contents higher than 90%. The HMI protein powders were lighter in colour than the corresponding HPI isolates due to higher content of coextracted polyphenols for the latter. The electrophoretic mobility and subunit composition, as well as amino acid composition of the isolates were not affected by the extraction procedure, indicative of similar protein composition. The HPI exhibited minimum protein solubility at pH 5.0, while for HMI it was shifted to pH 6.0. Differential scanning calorimetry indicated that highly alkaline conditions during HPI extraction led to partial protein denaturation which is reflected in lower transition enthalpy of HPI than HMI. FTIR spectra have also confirmed changes in HPI protein secondary structure, i.e. lower intensity of the peak (1634 cm-1) corresponding to native protein structural elements such as intramolecular β-sheets and higher intensities of peaks (1618 cm-1, 1683 cm-1 and 1694 cm-1) indicating enhanced protein aggregation compared to HMI. Protein conformational changes during alkali extraction resulted in higher water retention capacities of HPI in comparison to HMI.

Description

This article represents the first in a series of author's research papers in the field of isolation and characterization of proteins obtained from industrial hemp meal (Cannabis sativa L.) - a by-product generated in the production of cold-pressed hemp seed oil. The results presented in the paper were obtained during the postdoctoral study of the first author at the Department of Food Science and Technology, Aristotle University of Thessaloniki under the supervision of professor Costas G. Biliaderis and represent a part of the project funded by Provincial Secretariat for Higher Education and Scientific Research (project cycle 2016 - 2019), entitled "Techno-functionality of proteins isolated from alternative plant-based raw materials produced in the Province of Vojvodina". Developed methods for

hemp proteins isolation and a detailed presentation of the influence of the isolation procedure on their amino acid composition, structural features and physicochemical properties served as a basis for further investigation of the functionality of hemp proteins in various food systems: from emulsifying agents, water binders and thickeners to nutrient in high-protein food.

Results

The results obtained in this study have revealed that method of protein extraction from hempseed meal influenced both the functional and conformational properties of protein isolates. Although both micelle protein isolate (HMI) extracted using 0.8 M NaCl and alkali extracted/isoelectric point precipitated protein isolate (HPI) had similar electrophoretic and amino acid patterns, they exhibited different protein yield, colour, solubility profiles, thermal characteristics, and water retention capacity. Highly alkaline conditions during HPI extraction led to partial protein denaturation and exposure of polar amino acid side chains which influenced higher water retention capacities. On the contrary, the micellization procedure, which favoured exclusion of non-proteinaceous materials, resulted in protein isolates of higher purity, lower total phenolics content, lighter colour, preservation of native state and higher solubility at pH values lower than 6.0. Due to distinctly different functional properties, it could be expected that the two hemp protein isolates could be used in different food systems. Lighter colour and blander taste of HMI make it more suitable for incorporation into high-protein food products, such as the food intended for sport active people. On the contrary, higher product recoveries and ability to retain higher amount of water, make HPI desirable for industrial food applications as "clean label" replacement for additives used as thickeners, emulsifiers and gelling agents.