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Temat pracy doktorskiej:

„The Extraction of Carotenoids from Paprika Using Supercritical Carbon Dioxide”

SUMMARY

In the commercially available dyes used in the food, cosmetic and the pharmaceuticals industry still dominate the synthetic or natural products produced by liquid extraction methods. They are often acceptable due to the lack of alternative products. Acquiring natural pigments from plant raw materials that can compete with currently used products requires the development of an effective and a selective extraction technique ensuring safety for human health.

The main purpose of this thesis was to develop the basics of carotenoids extraction technology from paprika using supercritical carbon dioxide. The applied technology eliminates the drawbacks of a traditional extraction with organic solvents and it ensures the high quality and purity of the obtained extracts containing high concentration of carotenoids.

During the work realization, the effect of physicochemical properties of the raw material as well as process parameters on extraction of carotenoids from paprika was studied. Moreover, the separation conditions were investigated for the fractionation process. The range of significant extraction and separation parameters were determined based on the paprika extract solubility tests carried out in the supercritical carbon dioxide.

Design of experiments (DOE) and surface response method (RSM) were used for the studies of the extraction and separation parameters effect on process yield as well as the quality of extracts. The obtained results allowed to specify correlation between particular process parameters and their influence on output variables. The obtained mathematical models were used to optimize the extraction and fractionation processes of carotenoids from paprika using supercritical carbon dioxide. In the next step the results of the mathematical modeling were verified experimentally.

The developed fractionation method of paprika extract allows to obtain, in one production cycle, extracts with high carotenoid concentration neglecting the quality of raw

material composition used for the extraction. The stability of carotenoids in the obtained extracts was examined to determine the appropriate storage conditions. It is a very important aspect for the commercial natural products.

This dissertation also consists the investigation on the scaling-up. The optimized process parameters based on laboratory tests were successfully verified during the supercritical fluid extraction on pilot plants. The obtained results allowed to prepare detailed technology description of reach in carotenoids extract production using supercritical carbon dioxide. Moreover, the economic analysis of industrial process indicates that supercritical paprika extracts produced with developed and optimized technology could successfully compete with typically, commercially available extracts based on organic solvents.