

The topic of a PhD dissertation was the application of carbon dioxide in a supercritical state for the separation of bioactive compounds from omega-3 rich materials.

The object of research carried out as a part of the doctoral dissertation was waste fish oil and one species of brown macroalgae: *Fucus vesiculosus* L. The most important stage of the research was demonstrating the correctness of the use of supercritical carbon dioxide for the isolation and fractionation of biologically active compounds from materials rich in omega-3 acids and the development of effective and efficient methods for the determination of bioactive compounds. In order to confirm the stated theses, Supercritical Fluid Extraction (SFE), Countercurrent Supercritical Fluid Extraction, and Supercritical Fluid Chromatography (SFC) were used. The starting point for the initiation of research in the framework of the doctoral dissertation was both the lack of research results on the chemical composition of the tested materials and the lack of innovative and effective separation methods for fat-soluble vitamins and fucosterol with the use of carbon dioxide in a supercritical state.

The implementation of the assumed goals was used to develop appropriate separation methods using supercritical carbon dioxide, as well as to learn about the chemical composition of the tested materials. Separation methods used so far have not focused on determining the composition of fish oil waste in terms of fat-soluble vitamins. This dissertation first

(1) developed a method for determining fat-soluble vitamins (A, D, E and K) in one experiment and determined their content in waste fish oil,

(2) the CC-SFE method was used to separate fatty acids in waste fish oil,

(3) a method for determining fucosterol was developed, and its content in a supercritical carbon dioxide extract of bladderwrack (*Fucus vesiculosus* L.) was determined,

(4) antifungal properties of the *F. vesiculosus* extract have been demonstrated.

The results obtained as a part of the doctoral thesis may allow for a wider use of *F. vesiculosus* L. extract to combat phytopathogens of the *Fusarium* spp genus as the antifungal activity of the extract was characterized by 100 % inhibition of macroconidia germination (mycostasis), as well as a complete degradation and lysis of macroconidia.

The presented doctoral dissertation presents a summary of research conducted as part of the doctoral dissertation in the period from 2018 to 2019. The results were presented in the form of four original scientific articles [**Appendices II–V**]. The dissertation also includes one review article [**Appendix I**] and one patent application [**Appendix VI**].

The presented research was partially implemented as part of two editions of the project for young scientists awarded by the Competition Commission at the Institute of New Chemical Syntheses, entitled: "Fractionation of omega-3 (DHA, EPA), omega-6 (DPA, linoleic acid) and phospholipids from fish oil by centrifugal field chromatography (CPC) and molecular distillation" (2017) and "Fractionation of compounds biologically active from fresh fish oil and other vegetable sources of phosphatidylcholine and omega-3 fatty acids by centrifugal field chromatography (CPC) and molecular distillation" (2018).