

DESCRIPTION FOR THE GENERAL PUBLIC

The research proposed in the project is aimed at determining the relation between the oil extraction method applied and the content of bioactive components and oxidative stability of the obtained oils. The objective is to maximise the concentration of lipophilic phytochemicals such as sterols, squalene, tocopherols, polyphenols and carotenoids and provide satisfactory oxidative stability of oils. One of the main criteria taken into consideration while selecting raw materials was their percentage content of polyunsaturated fatty acids (PUFA) and the n-6 to n-3 fatty acid ratio. On this basis, chia, flax, hemp and poppy seeds were selected for analyses. All of these raw materials contain fat with a high percentage of polyunsaturated fatty acids, which makes it a desirable component of a diet and results in its low resistance to oxidation.

The research described in the project will help to determine the effect of the oil extraction method on the release of lipophilic phytochemicals from biopolymer matrices. Particular attention at this point should be given to phenolic compounds demonstrating amphiphilic properties, which allows to modify, to certain extent, their transfer between the hydrophilic and lipid structures of seeds.

The research will involve obtaining oils from chia, flax, hemp and poppy seeds using three main methods: expeller pressing and extraction using a Soxhlet apparatus and supercritical carbon dioxide extraction. Pressing is a traditional method of vegetable oil obtaining. It will be carried out in two variants: "cold" and "hot". The "hot" variant will correspond to the pressing method that is most often applied at present, since it covers the stage of seed roasting for 1 h at 110°C, which permits to increase the oil yield, but also increases the content of accompanying substances, which refers both to compounds increasing oil durability, as well as those that reduce it. Extraction with the Soxhlet method will be carried out with two main solvents: hexane and acetone and their mixes. Hexane and extraction petroleum are the most often used solvents in industrial extraction methods. Because of their low polarity, they are good extractors for hydrophobic components. Acetone, with much higher polarity, can be of key importance as regards increasing the share of oil compounds making up an amphiphilic fraction, such as phenolic acids and their derivatives, i.e. antioxidants increasing oxidative stability of oils. The current knowledge concerning the effect of extraction solvents applied on the content and composition of bioactive components in oils is incomplete and often contradictory.

In order to achieve a supercritical solvent, appropriately high values of pressure and temperature must be set in the SFE process. Supercritical solvent has properties midway between liquids and gases, which results in a very good penetration of the raw material structure which, in turn, makes it possible to significantly increase the extraction rate. Through appropriate modification of temperature and pressure settings, various substances can be extracted from the same material. The great advantage of SFE is that chemical solvents are not used in this method, which results in the absence of their residues in oil. The extraction is conducted in an air-free environment, which prevents oxidation of labile components. Optimization of process conditions (temperature, pressure and solvent flow rate) can result in obtaining oil with a desirable composition of bioactive fraction and durability.

In oils obtained with the above-described methods, all of the most important bioactive components will be determined: phytosterols, tocopherols, carotenoids, phenolic compounds and squalene. Additionally, accelerated oxidation tests will be conducted to describe their durability. Statistical analyses will be used to describe the differences between various methods and the relations between stability and the content of individual components.

Knowledge related to chia, hemp and poppy seed oil is uncertain, since literature sources provide contradictory data in many cases. Those discrepancies can result from the application of various methods for obtaining oils analysed in the study. For this reason, it is necessary to examine the relation between the extracting technology and oil composition and durability. Ensuring a high content of bioactive compounds is a crucial aspect also in terms of social health. In recent years, an increase in the number of incidences of chronic non-infectious diseases has been recorded (diabetes, atherosclerosis, cancers, neurodegenerative diseases), which are a frequent cause of death. The research proves that a high share of polyphenols, phytosterols, squalene and carotenoids in the diet helps to significantly reduce the frequency of those diseases.