

Production of extracts which are rich in biologically active compounds and which are solvents free from chemical impurities is widely known due to the possibility of their further application. These are products which have both the nutritional values and pharmaceutical properties. Their biologically active compounds including metabolites called phytochemicals have health promoting effect. In food industry, over the last years, a new concept of “functional food” was introduced which refers to food enriched with selected groups of functional compounds responsible for particular health-promoting effect i.e. lowering cholesterol level or supporting digestive system via restoring the microbiological balance. Biologically active compounds have ability to reduce the amount of free radicals which contributes to health improvement and to decrease the likelihood of morbidity. Compared to artificially synthesized anti-oxidants, antioxidants of natural origin will be always more valuable as their use does not cause any adverse effects.

The CO₂ supercritical extraction as separation technique is very popular which is confirmed by numerous national and international papers. Its popularity is connected with the nature of solvent and specificity of the obtained product. Carbon dioxide is formed as by-product in many industrial processes and it can be easily returned to other production cycle. It has a lot of advantages i.e. it is inexpensive, easily available and *GRAS - Generally Regarded As Safe*. It has interesting physicochemical properties: it is an inert gas, non-polar, tasteless, and odorless and therefore, it does not contaminate the final product. There is also no need to evaporate the solvent as after the end of process it changes into gaseous state and leaves the process environment itself. Carbon dioxide reaches critical parameters at 31,1 °C and the pressure of 73,8 bar. Its low critical temperature allows extraction of thermolabile compounds without their prior thermal decomposition.

In order to understand the process of extraction and in order to be able to plan it more effectively, it is necessary to understand dominant mechanism which controls the process that is mass transfer. The success of the extraction and obtaining of the product reached in desired group of compounds is influenced by many physicochemical variables such as the solubility of the solute in the solvent, the viscosity or solvent density, or the surface tension at the interface. These phenomena depend on the basic process parameters such as temperature, pressure or solvent flow rate. At laboratory scale only the analysis of the final result of the extraction is carried out. However, with upscaling, weight of feedstock and amount of solvent increases proportionally and hence, all the phenomena contribute synergistically to the final effect of the process. While analyzing the obtained results, it is possible to specify the effect of variables determining the process.

Goldenrod (*Solidago*) and alfalfa (*Medicago sativa*) are the plant raw material used for studying the extraction process. Both of them are very popular plant in Poland. Goldenrod is rich in biologically active compounds such as mono- and sesquiterpenes, diterpenes containing furans, phenol or saponins. Numerous studies prove that biologically active compounds contained in leaves, stems and flowers of *Solidago* have antioxidant, antimicrobial, antifungal, anti-inflammatory, antihypertensive, antitumor, anti-adipogenic effect and they also have cardioprotective, spasmolytic and diuretic effects. *Medicago sativa* (also known as Lucerne or alfalfa) is a plant which is regarded as an inexpensive source of protein. Besides protein, the extract of alfalfa is rich in secondary metabolites such as flavonoids, including medikarpin, genistein or daidzein and saponins such as hederagenin and soyasapogenol. Also in the extract are other groups of bioactive compounds: chlorophylls, vitamins (C, E, B1, B2, B6 and B12) or β -carotene. Because of the content of these substances, lucerne extracts have antifungal, antibacterial, anti-bacterial, insecticidal and nematocidal properties.