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Green technology for obtaining bioactive substances from far eastern Panax ginseng C.A. Meyer, using technology of supercritical CO_2 extraction

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Far Eastern ginseng *Panax ginseng C.A. Meyer* is a perennial plant that has been used for thousands of years in traditional oriental medicine. The most widely studied active ingredients of ginseng, known as ginsenosides, have various positive medicinal effects, antitumor, chemo-preventive, immuno-modulatory and anti-diabetic. The authors investigated, for the first time, the extraction of the root of Far Eastern wild-growing ginseng using supercritical fluid CO_2-extraction at varying temperatures and pressures. The aim of the work was the development of a new method of extraction of biomaterials using the method of supercritical fluid CO_2-extraction. The object studied was the root of wild Far Eastern ginseng *Panax ginseng C.A. Meyer*. CO_2 extraction was performed using a supercritical fluid extraction system. Carbon dioxide was compressed to the desired pressure using a supercritical extraction compressor (Thar SFC, S.N. 3526551, CIIIA). The extraction tank was heated with a hot jacket; the temperature was controlled by a thermostat (±1 °C); the pressure was controlled by a metering valve. Crushed ginseng roots (9.5 g) were loaded into a 1 L extractor and extracted with supercritical fluid CO_2 at a flow rate of 250 g/min. Six SFE extracts were obtained under various conditions of carbon dioxide pressure (200, 300 and 400 bar) and temperature (31-70 °C). Ethanol was selected as a modifier in minimal doses. The extracts were collected in a separator attached to the metering valve and kept in a circulation bath at 0 °C. Supercritical carbon dioxide extraction of ginseng was studied in this research. The extract which was obtained can be used as a food, medical supplement or for weight control. The pressure and temperature of carbon dioxide supercritical fluid extraction was optimized to achieve the maximum yield of the product during extraction. The content of ginsenosides in supercritical CO_2 extracts was analyzed using high performance liquid chromatography HPLC. We used a liquid phase-shift chromatograph Shimadzu LC-20 Prominence UFLC with an LCMS-2020 quadruple LCMA-spectrometer (Japan) equipped with an ultraviolet sensor and a Shodex ODP-40 4E reverse phase column (250 mm × 4.6 mm, particle size 4, the number of theoretical plates >17.000, Shodex, Japan) to analyze the compounds; the control was at 230 nm and 330 nm. The injection volume was 20 µL, the temperature of the thermostat was 17 °C and the flow rate of the liquid was 0.4 ml/minute. The sample was analyzed by an isocratic solvation system, the mobile phase of which was in a 25: 75 ratio of aqueous and acetonitrile. Increasing the concentration of the modifier can have a large effect on the amount of extraction yield for effective supercritical extraction. Supercritical extraction using CO_2 and EtOH as a modifier is an effective method of extracting biologically active substances, in particular ginsenosides, from ginseng.

Biography

Wojciech Piekoszewski is a Professor of Medical Sciences with second degree of specialization in Toxicology. He is the Head of the Toxicological and Pharmaceutical Analysis Group and the Head of the Laboratory of High-Resolution Mass Spectrometry, of the Faculty of Chemistry, Jagiellonian University, Krakow, Poland. He is also the Chief Researcher of the Laboratory of Food Biotechnology and Pharmaconutriology. His research and scientific interests are in the application of metabolomics, proteomics and lipidomics as tools for diagnosis (biomarkers) of mental and neurodegenerative disorders, food safety, security, analysis of drugs and medicaments in biological materials.