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Comparative analysis of the influence of pressure and temperature on the process of supercritical CO_2-extraction of plant raw materials

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Abstract

The experimental data obtained as a result of extraction of various grape seed, melon seeds, pumpkin, watermelon and licorice roots by the supercritical carbon dioxide (SC-CO_2) extraction and their comparative analysis at various thermodynamic parameters – temperature and pressure are given in the article. It turned out that in each case the conditions of SC-CO_2 extraction differed from each other, and the corresponding extracts - in terms of their chemical composition. For example, CO_2 – an extract of various grape seed varieties is characterized by an elevated level of non-saponifiable fraction – carotenoids and tocopherols, the same trend is observed in pumpkin seeds. The similarity of the other indicators indicates the possibility of using SC-CO_2 as an alternative extractant in the industrial production of grape seed oil.

Next, SK-CO_2 fractions from ground melon seeds, pumpkin and watermelon, as well as licorice roots, are promising raw materials for the production of oil and polyphenol complex, which serve as ingredients for the production of cosmetology, are introduced into medical practice and serve as biologically active additives.

The basic fatty acids of grape oil are myristic, linolenic, arachidonic, oleic (50-70%), linoleic (20-40%) acids, as well as phospholipids and tocopherols.

The most important constituent of the licorice root is glycyrrhizin, or licorice sugar, which is mainly in the form of a potassium or calcium salt. Its content in extracts of licorice varies from 5 to 18%.

Processing regimes have been developed that determine the maximum yield of extractive substances of various types of plant raw materials. So, for example, for licorice roots, the maximum yield of extractive substances in the treatment regime is T = 393 K, τ = 15 min, at an excess pressure of P = 8 KPa.

It turned out that the disadvantage for most SC-CO_2 extracts is their high acid numbers. It is possible that the SC-CO_2 vaporization is not completely removed from the extract. A significant portion of CO_2 remains in the extract as a carbonic or carbonic acid (H_2CO_3).

A comparative study of the process of SC-CO_2 extraction of ingredients from various plant species showed a change in the critical parameters of SC-CO_2, as a result of which a high yield of the extract comes at the expense of high fluid solubility at parameters much higher than those for SC-CO_2. In this case, some components can both worsen and improve the extraction process. Humidity, which is typical even for dry raw materials (8-12%) can also increase the critical parameters of SC-CO_2, thereby increasing the effective parameters of the extraction process.

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