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Supercritical [SC]-CO_2 extraction glycyrrhizic acid from licorice roots

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Abstract

This study used a supercritical (SK) of CO_2-extraction to extract glycyrrhizic acid (GA) from the licorice root. To do this, define the conditions (preliminary experiments) of the extraction process, namely, the temperature, pressure and fluid flow SK (CO_2). Given that this process is multifactorial, the method RSM-response surface methodology and CCRD-central composite rotatable design used to determine the optimum operating conditions of the process. The effectiveness of the established SC-CO_2 extraction conditions, expressed GA content in the extracts as compared with a yield of GA produced by the conventional extraction method, when applied SC-CO_2 modified polar co-solvent (ethanol).

In describing the GA yield predictions using appropriately combined with RSM CCRD, we found that the yield of GA mainly depends on the pressure and quantity of SC-CO_2 used for extraction. It turned out that there is a significant relationship for the linear and quadratic terms of the relationship between the output of the GA and these parameters. Noticeable interaction between the three process parameters (pressure, SC-CO_2 temperature and flow rate) was observed.

Licorice root is subjected to moisture-heat pre-treatment. Cooked thereafter pitch used as a raw material for the extraction of GA by SC-CO_2 extraction. Initial studies for a wide spectrum of SC-CO_2 density value (780-890 kg/m^3) indicates that it is possible to set optimum operating conditions for the GA separation.

According to RSM-analysis of the optimal process conditions: 14.6 KPa, 33.5 ^oC and 21.88 g CO_2/g.d.m. CO_2 consumption for the extraction of GA from licorice using SC-CO_2. SC-CO_2 density calculated for the optimum pressure and temperature equal to 885 kg/m^3, which was found as a result of a preliminary analysis of the correlation between the output of the GA and CO_2 density. The maximum yield of GA is equal to 0.158 g of 1 g of dried material (about 15% of extract) with SC-CO_2 density equal 863 kg/m^3.

Preliminary tests performed at condition resulting in SK-CO_2 density ranging from 780 to 890 kg/m^3 indicated that at some pressure, temperature as well as consumption of supercritical fluids the optimal working conditions for glycirhizin acid isolation could be determined. For thus purpose the following range of working conditions of SK-CO_2 were tested by using Central Composite Rotatable Design (CCRD) and Response Surface Methodology (RSM): pressure from 16 to 34 KPa, temperature from 20 ^oC to 40 ^oC and consumption of SK-CO_2 from 10 to 26 *g*CO_2/*g*d.m. The results of this investigation indicated that maximum yield G.A. 158 mg from 1 g materials on dry basis (about 15% of total extract) at 14.6 KPa, 33.5 ^oC and 21.88 *g*CO_2/*g*d.m. could be obtained.

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