Abstract

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Title of diploma thesis: Optimization of extraction of phenolic substances using carbon dioxide

This diploma thesis deals with the optimization of extraction of phenolic substances by supercritical fluid extraction, using carbon dioxide, from a sample of homogenized dried apple chips. To quantify and identify the analytes contained in the extract, 14 standards were analysed using a separation method in a UHPLC system with a diode array detector. In the identification of the extracts´ components, 13 analytes were identified and after their quantification, 6 analytes were found to have major content. The difference in the sum of the concentrations of the 6 and 13 analytes was small, and therefore, optimization was carried out for these 6 majorly represented analytes, which are chlorogenic acid, epicatechin, catechin, phloridzin, quercitrin, and guaiaverin.

The extraction optimization was carried out in 4 successive steps. The first step of the optimization was to determine the influence and significance of CO_2 content in the extraction medium, H_2O content in the ethanolic cosolvent, pressure and temperature on the extraction yield. The most significant factor was determined to be the CO_2 content of the extraction medium. The extraction yield of polar phenolic compounds was greatly enhanced when a high concentration of polar solvent and a low concentration of CO_2, which is non-polar in nature, were used. By using high concentration of cosolvent, not supercritical but subcritical state of the extraction medium was achieved. The next step was to determine the effect of extraction medium flow rate and extraction time (extraction medium volume) on the extraction yield. The third step was to determine the influence of glass beads size on the yield. Glass beads fill a large part of the extraction cell and affect the flow of the extraction medium in the cell. It was found that there is no significant difference in yield between 2 and 3 mm glass beads. However, the use of 3 mm glass beads achieved better repeatability.

After optimization, the resulting extraction conditions were: 10% CO_2 content in the extraction medium, 20% H_2O content in the ethanolic cosolvent, pressure 300 bar, temperature 59 °C, flow rate 3 ml/min with extraction time 30 min (90 ml of extraction medium), 3 mm glass beads. The inter-day precision of the extraction method obtained was 11.66 %, expressed as RSD.