Supercritical Fractionation of Turmerones from Turmeric rhizomes by Sorption – Comparison of Different Types of Silica Gel.

Topiař, Martin
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Supercritical fractionation of turmerones from turmeric rhizomes by sorption – comparison of different types of silica gel

M. Topiar, M. Sajfrtova, H. Sovova
E. Hála Laboratory of Separation Processes, Institute of Chemical Process Fundamentals of the CAS, v.v.i., Rozvojova 135, 16500 Prague, Czech Republic;
tel. +420 220390241, e-mail: topiar@icpf.cas.cz;

In the recent years, natural products from plants became more often used in many fields. Supercritical fluid extraction with carbon dioxide (SFE) is considered as more selective method for obtaining plant isolates than traditional separation techniques, i.e. hydrodistillation or oxhlet extraction. Due to the nonpolar character of carbon dioxide, the SFE isolates mostly contain a mixture of volatile and non-volatile compounds such as terpenes and cuticular waxes. Fortunately, we can use several fractionation techniques by which we are able to separate the SFE isolate to several fractions and increase this way the concentration of desired compounds. Beside simple ones, more sophisticated techniques such as using several separators or fractionation of isolates with the help of sorbent can be applied.

The powder obtained from turmeric (*Curcuma longa* L.) rhizomes is commonly used as a natural dye or spice. The best known chemical components of turmeric are curcuminoids, with the most famous compound – curcumin. Other important compounds extractable by SFE are turmerones, β-sesquiphellandrene or zingiberene. According to the scientific studies, ar-turmerone shows hepatoprotective[1] and anticancer[2] effects, among others. Another study indicates that β-sesquiphellandrene has anticancer potential comparable with curcumin[3].

Our previous research was focused on the optimization of turmerones extraction using supercritical CO_2 (sc-CO_2) and their sorption on different sorbents with particular interest in determination of a suitable sorbent for their separation from the SFE isolate.[4] Eventually, silica gel was determined as the most appropriate sorbent for this purpose. Nevertheless, we can find on the market a large amount of silica gel types with different chemical and physical properties.

Aim of this study was to find the optimal type of silica gel for the separation of turmerones from the turmeric SFE isolate and their concentration in eluted fractions.

The chemical composition of isolates and their yields were determined by GC-MS and GC-FID. The sorption experiments were done with turmeric isolate obtained by SFE at optimal conditions for the extraction of turmerones – 9 MPa, 50 °C. Main components of the initial isolate were turmerone (22.7 wt.%), ar-turmerone (13.3 wt.%), curlone (13.8 wt.%) and (1.7 wt.%).

Several types of silica gels with different pore (Å) and particle (μm) size were used. The elution of the turmeric isolate from silica gel was performed with sc-CO_2 at 66 MPa and 50 °C. (Lower pressures were not sufficient to start elution because of the weak solvent power of sc-CO_2.) The flow rate of CO_2 was adjusted to 1.8 $g.min^{-1}$. Several fractions were collected during experimental run to determine the changes in the isolate composition. The concentration of β-sesquiphellandrene in isolate increased from 1.7 wt.% to 28.8 wt.% by using of supercritical sorption technique. The increase in concentration of turmerones, especially ar-turmerone in isolate was observed, when silica gel with smaller pore size and narrowed range of particles was used.

The type of silica gel showing the best results for the observed parameters was used in an experiment where the extraction from plant material and extract sorption on silica gel were integrated into one process.

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