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Optimization of the ar-Turmerone Extraction from Turmeric (*Curcuma longa L.*) Using Supercritical Carbon Dioxide

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Extraction of volatile compounds using supercritical carbon dioxide is one of the most interesting applications of supercritical technology. Some important aspects are the high solubility of the volatile substances in supercritical CO_2 medium and the facility to change the selectivity of target compounds by changing the process variables. For this reason, this technology was applied for optimizing the extraction of the sesquiterpenoid ar-turmerone. This compound has been reported in the scientific literature as a beneficial substance by presenting some bioactive properties, such as: anti-inflammatory, antimicrobial, antioxidant and anticarcinogenic activity. Turmeric (*Curcuma longa L.*) rhizomes were milled and sieved, and the ar-turmerone was extracted with 8.5 g/min of supercritical CO_2 in laboratorial scale equipment. A full factorial design composed of six levels of pressure (10, 15, 20, 25, 30 and 35 MPa) and three levels of temperature (313, 323 and 333 K) was used to evaluate the global and the ar-turmerone yields. For these runs the solvent (S) to feed (F) mass ratio was maintained constant at 10.5. The highest ar-turmerone yields were found at 20, 25 and 35 MPa for all temperature levels. From these results, kinetic assays were performed to understand the extraction curves taking into account kinetic parameters obtained from spline method. High extraction rates and yields in the constant extraction rate period were obtained for 333 K and pressures of 20 and 25 MPa. In these conditions, a range of S/F ratio of only 0.7-0.95 was required to extract approximately 94% of ar-turmerone contained in the raw material. The extracts obtained using supercritical CO_2 extraction were also compared with those obtained using conventional technique (hydrodistillation). The compounds present in the extracts were identified and quantified by gas chromatography, and the major compounds in the extracts were alpha-turmerone, ar-turmerone and beta-turmerone.