NIMBIN EXTRACTION FROM NEEM SEEDS USING SUPERCritical CO2 AND A SUPercritical CO2- METHANOL MIXTURE

Authors : Pathumthip Tonthubthimthong, Peter Douglas, Supaporn Douglas, Suvassa Phongamphai, Wittaya Teppaitoon, La-eid Pengsopa


The supercritical fluid extraction of nimbin from neem seeds, using CO2 as a solvent and methanol as a co-solvent is presented in this study. Nimbin was extracted from neem seeds using a supercritical CO2 flow rate of 0.24 to 1.24 cm³/min, a pressure 10 to 26 MPa, a temperature of 308 to 333 K, a neem sample weight of 1 to 2.5 g and an average particle size of 575 to 1850 µm. The effect of CO2 flow rate, pressure, temperature, weight of neem sample and average particle size of nimbin extraction were studied. In addition, the effects of the methanol to carbon dioxide ratio and temperature on the extraction were investigated. The co-solvent experiments were performed at a pressure of 20 MPa and a methanol to carbon dioxide ratio ranging from 8 to 10% v/v and over a temperature range of 303 to 328 K.

Experimental, nimbin extraction results using supercritical carbon dioxide yields of approximately 68%; the extraction yield of 0.18 mg nimbin per gram of neem kernel powder (neem kernel powder are known to contain about 0.2646 mg nimbin per gram of neem kernel powder). The best extraction conditions from each experiment were found to be; 308 K, 23 MPa and a supercritical CO2 flow rate of 1.24 cm³/min for a 2 gram sample of neem. An optimum pressure of extraction appears to exist at about 23 MPa at a temperature of 328 K. The specific extraction rate was not found to be a function of sample weight in bed for the range of sample studied. Although extraction using a methanol modifier did improve the extraction somewhat, methanol was not found to be an effective modifier for extracting nimbin.

Extraction curves were evaluated using three empirical models and a theoretical model. The first empirical model was based on Langmuir gas adsorption. The second was first order plus dead time, FOPDT model. The third was a so-called t^n model used to incorporate sigmoidal curves. The parameters in the empirical model were fitted using experimental data. The theoretical model also fits experimental results well. The theoretical model shows that the extraction rate depends strongly on the solvent flow rate. That is external mass transfer or equilibrium is the controlling step of this process.