

KINETICS AND THERMODYNAMICS OF OIL EXTRACTION FROM WATER-MELON SEEDS

M. S. OLAKUNLE, M. J. ABDULHAMID & A. C. NEBO

Department of Chemical Engineering, Ahmadu Bello University, Zaria, Nigeria

ABSTRACT

The kinetics of oil extraction is dependent on a number of factors, among which are temperature, duration of the extraction as well as the polarity of the solvent used. The solvent extraction of watermelon seed oil as reported in this paper was carried out between 313.15–343.15K in order to determine the kinetic and thermodynamic parameters of the extraction process. Three particle sizes of 500 μm , 1180 μm and 1700 μm were used to determine the optimum particle size for the process, which was found to be 1180 μm . The moisture content of the sample seed was 8.73% while the optimal n-hexane volume of 300ml was used to determine the percent oil yield at varying temperatures. The extraction process was found to obey first order kinetics. The activation energy, E_a , for the oil extraction kinetics of watermelon seeds with n- hexane was found to be 13.92kJ/mol, and the activation thermodynamic parameters at 343.15K which was the optimum temperature were $\Delta H^\ddagger = 11.065 \text{ kJmol}^{-1}$, $\Delta S^\ddagger = -254.736 \text{ Jmol}^{-1}\text{K}^{-1}$ and $\Delta G^\ddagger = 98.48 \text{ kJmol}^{-1}$. The enthalpy value was $\Delta H = 7.83 \text{ kJmol}^{-1}$, and the other thermodynamic parameters at 343.15K were $\Delta S = 26.62 \text{ Jmol}^{-1}\text{K}^{-1}$ and $\Delta G = -1.305 \text{ kJmol}^{-1}$. Thus, the optimal extraction of watermelon seed oil is favoured at a temperature of 343.15K, a particle size of 1180 μm and an optimal n-hexane volume of 15ml/g sample.

KEYWORDS: Solvent Extraction, Watermelon Seed, Thermodynamic Parameters, Kinetics, Activation Energy, Enthalpy