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Kinetics and Thermodynamics of Oil Extraction from Sunflower Seeds in the Presence of Aqueous Acidic

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**Abstract:** Oil extraction was performed in aqueous HCl, H<sub>2</sub>SO<sub>4</sub> and H<sub>3</sub>PO<sub>4</sub> solutions with n-hexane (C<sub>6</sub>H<sub>14</sub>) at 30, 40, 50 and 60 °C using 10 gr of sunflower seeds over 1 h with 10-min. sampling intervals. The optimum acid concentration was wt. 10% for each acid, and the highest oil yield was obtained in the extraction procedure with n-hexane containing H<sub>2</sub>SO<sub>4</sub>. The extraction process was observed with regard to the percent oil yield versus time, and the reaction order was found to be first-order kinetics by the differential method. The activation energy for the oil extraction kinetics of sunflower seeds with 10% H<sub>2</sub>SO<sub>4</sub> was found to be E<sub>a</sub>=4.2 kJmol<sup>-1</sup>, and the activation thermodynamic parameters at 60 °C were ΔH<sup>°</sup> = 1.43 kJmol<sup>-1</sup>, ΔS<sup>°</sup> = -309.3 Jmol<sup>-1</sup>K<sup>-1</sup> and ΔG<sup>°</sup> = 104.4 kJmol<sup>-1</sup>. The enthalpy value was ΔH=11.2 kJmol<sup>-1</sup>, and the other thermodynamic parameters at 60 °C were ΔS=36.75 Jmol<sup>-1</sup>K<sup>-1</sup> and ΔG=-1.07 kJ mol<sup>-1</sup>.

**Key Words:** Hexane, kinetics, oil extraction, sulfuric acid, sunflower seed, thermodynamics.

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