Solubility and Thermodynamic Analysis of Ketoprofen in Isopropanol-water Mixture [†]

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Abstract: Ketoprofen (KTP) is a potent nonsteroidal anti-inflammatory and analgesic drug commonly used in human and veterinary medicine. It represents one of the most common drugs for chronic painful conditions. However, its potential is limited due to low water solubility. This study aims to determine the KTP solubility (S_{KTP}) in isopropanol (IP)-water (w) systems determining the preferential solvation and dissolution thermodynamic parameters by a modified van't Hoff analysis. For that, in the experimental work, enough drug was added to achieve its saturation in each one of the IP-w mixtures, prepared in the whole range of the molar fraction. The experimental S_{KTP} was carried out in the T=288.15 to 308.15K range and spectrophotometrically determined in the saturated system. The results show that S_{KTP} in the binary system is highly enhanced compared to those measured in pure solvents, higher in the $0.1<X_w<0.7$ range and when the temperature rises. The observed deviation from ideality is corroborated by δ (preferential solvation parameter), which is negative for all mixtures. The thermodynamic analysis demonstrates that in the process of KTP solubilization, Gibbs energy, enthalpy, and entropy are positive. Additionally, the enthalpic and entropic contributions to Gibbs energy change are, on average, 52% and 48%, respectively.

Keywords: ketoprofen; solubility; isopropanol-water mixture.

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Conflicts of Interest

The authors declare no conflict of interest.