Latin American Journal of Pharmacy
(formerly *Acta Farmacéutica Bonaerense)*
Lat. Am. J. Pharm. **31** (3): 427-36 (2012)

Regular Article
Received: April 10, 2012
Revised version: April 21, 2012
Accepted: April 22, 2012

Solution Thermodynamics of Sodium Diclofenac in Ethanol + Water Mixtures and Correlation with the Jouyban-Acree Model

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***SUMMARY*. The solubility of sodium diclofenac (NaDIC) in several ethanol + water mixtures was determined at 293.15 K to 313.15 K. The thermodynamic functions Gibbs energy, enthalpy, and entropy of solution were obtained from these solubility data by using the van't Hoff and Gibbs equations. Thermodynamic quantities of mixing were also obtained by means of the drug properties of fusion. In contrast to other electrolyte drugs, NaDIC exhibits low solubility and the greatest value was obtained in the mixture 0.80 in mass fraction of ethanol. A non-linear enthalpy–entropy relationship was observed from a plot of enthalpy vs. Gibbs energy of solution. Accordingly, the driving mechanism for NaDIC solubility in water-rich and ethanol-rich mixtures is the entropy, probably due to water-structure losing around the drug non-polar moieties by ethanol or increased ionic solvation; whereas, in the medium composition mixtures the driving mechanism is the enthalpy, probably due to NaDIC solvation increase by the co-solvent molecules. The generated solubility data is mathematically represented by using the Jouyban-Acree model and also predicted employing previously trained versions of the model in which both fitting and prediction errors are within acceptable ranges. The computed thermodynamic properties are accurately represented using adapted versions of the Jouyban-Acree model.**

KEY WORDS: Cosolvency, Ethanol, Sodium diclofenac, Solubility, Solution thermodynamics.

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