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Solubility of naproxen in polyethylene glycol 200 and water mixtures at various temperatures

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Background and Aims: Solubility alteration of drugs is required in many pharmaceutical applications, including crystallization, separation, decontamination, liquid extraction and drug formulation. Solvent mixing or cosolvency is one of the most frequent and feasible methods used in the industry and it is important to determine the solubility of pharmaceutical compounds in mixed solvent systems. Besides, temperature-solubility dependence allows us to carry out the respective thermodynamic analysis, which also permits inside the molecular mechanisms, involved toward the solution processes.
Methods: The solubilities of naproxen in binary mixtures of polyethylene glycol 200 and water (PEG 200 + W) at the temperature range from 298.0 K to 318.0 K are reported. The solubility data as a function of temperature were used to determine the thermodynamic properties.
Results: Combination of the Jouyban-Acree model with Van' Hoff equation and partial solubility parameters can be used to predict solubility in PEG 200 + W with only four solubility data points in mono-solvents. Non-linear enthalpy-entropy compensation was found for naproxen in the investigated solvent system and the Jouyban-Acree model provides a reasonably accurate mathematical description of the thermodynamic data of naproxen in the investigated binary solvent systems.
Conclusions: The combinations of Jouyban-Acree model and Van't Hoff or the Jouyban-Acree model and partial solubility parameters were used to predict the solubility and thermodynamic properties of naproxen in PEG 200 + W mixtures at different temperatures.

Keywords: Thermodynamic analysis; Solubility; Naproxen; Jouyban-Acree model