

Solubility of atenolol in ethanol + water mixtures at different temperatures

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Background and Aims: Atenolol is a cardioselective β -blocker agent which is widely used in the management of hypertension and angina pectoris. Solubility of drug in solvent mixtures is frequently evaluated for purification, preformulation studies, and pharmaceutical dosage design. The solubility of atenolol in water is very low and water + co-solvent mixtures have been used to increase its solubility to develop liquid pharmaceutical dosage forms. In this study, solubility of atenolol in water + ethanol mixtures at several temperatures were investigated along with solubility data modeling using different cosolvency and thermodynamic models.

Methods: For measurements of solubility of atenolol, shake-flask method was used. The solubility of atenolol in water + ethanol mixtures was determined at 298.2, 303.2, 308.2 and 313.2 K. The saturated solutions were filtered after the appropriate equilibration time, then diluted and the samples were analyzed by a UV-Vis spectrophotometer. Data is used to calculate thermodynamic properties and prediction capability of different cosolvency models.

Results: Obtained results showed that the solubility of atenolol in water + ethanol mixtures at several temperatures is increased with addition of ethanol and reached the maximum solubility value and then decreased with further increase in ethanol concentration. The thermodynamic properties (Gibbs energy, enthalpy, and entropy) of solutions and dissolution mechanism of atenolol in ethanol + water mixtures were calculated from the solubility data. The solubility data can be predicted using different cosolvency models.

Conclusions: Solubility of atenolol was increased with addition of ethanol to the aqueous solutions. The derived thermodynamic data is useful tool to study dissolution mechanism in pharmaceutical engineering and industry. The findings of this work will facilitate the process design in the industry to solubilize/desolubilize atenolol.

Keywords: Atenolol; Solubility; Cosolvency; Thermodynamic