Solubility of Beta-Carotene in Binary Mixed Solvents

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The experimental results of beta-carotene solubilities in binary mixed solvents formed by cyclohexane, n-hexane, 1-hexene and toluene with 2,5,8-trioxanonane, acetone, and cyclohexanone are reported. The solubility of beta-carotene in pure solvents increases in the order: 2,5,8-trioxanonane < acetone < n-hexane <1-hexene < cyclohexanone < cyclohexane < toluene. In the mixed solvents studied a maximum of beta-carotene solubility is observed, except for the mixed solvents containing toluene. The reported solubility data for binary solvents were smoothed by means of Myers and Scott rational type equation. These results together with our previous results for hydrocarbon polar non-associating component are interpreted in terms of various models of mixtures. For this purpose models based on the Flory and Huggins non-athermal mixture theory, such as Acree and Rytting (AR), and the authors (TT) model, are tested. Both models predict qualitatively size and shape of the beta-carotene solubility curves, including the maximum solubility and asymmetry, in contrary to UNIFAC model. The analysis of the TT and AR models indicate an important role of value and asymmetry of the excess Gibbs energy of the mixtures of solvents as a source-increased solubility. The difference between the solubility of beta-carotene in pure solvents and value of the excess Gibbs energy are responsible for the appearance, position and shift of the maximum solubility.