Abstract

The research includes a series of calorimetric and spectroscopic measurements aimed at analyzing the processes of formation of cyclodextrin inclusion complexes with selected compounds, which are biologically active. The ligands chosen for the studies were drugs (ezetimibe and cilostazol) and flavanones (flavanone, 4'-methoxyflavanone, 4'chloroflavanone, and 7-methoxyflavanone), while the tested macrocycles were: α-cyclodextrin, β-cyclodextrin, hydroxypropyl-β-cyclodextrin, and sulfobutyl-β-cyclodextrin.

Two processes of complex formation have been incorporated into the analysis. The process of complex formation in solutions has been analyzed using isothermal titration calorimetry (ITC) and UV-Vis spectrophotometry methods, while the process of complex formation in the solid form has been analyzed using FT-IR spectroscopy and DSC differential scanning calorimetry.

Spectrophotometric measurements:

• Spectrophotometric calibrations of tested ligands were undertaken using the standard curve method. The molar extinction coefficients of the selected compounds were determined. Additionally, the solubilities of all of the ligands in the water were determined experimentally.

• The increase of tested ligands' solubility in water under the influence of an increasing concentration of cyclodextrins has been determined using the Higuchi-Connors phase solubility method. The analysis of the dissolution diagrams allowed for the initial determination of the stoichiometry and the stability constants (K) of the obtained complexes.

Calorimetric titration measurements:

- A series of calorimetric titrations of tested ligands with α cyclodextrin, β-cyclodextrin, and hydroxypropyl-β-cyclodextrin in water or dimethyl sulfoxide were performed. The titration isotherms of the direct thermal effects, which are accompanied by discussed titration processes, were determined.
- Based on the 'one site of sites' model, the thermodynamic parameters of the processes, characterizing the formation of inclusion complexes (molar enthalpy ΔH, molar entropy ΔS, molar free enthalpy ΔG, and the equilibrium constant K), were determined. The exact stoichiometric ratio of the formed complexes was also determined.
- All analyzed complexing processes were spontaneous and exothermic.