ABSTRACT (EN)

The aim of the dissertation thesis is characterization of modern HPLC columns from the point of their interaction possibilities and demonstration of their application potential.

The first part of the thesis is focused on alternative reversed-phase HPLC columns based on zirconium dioxide. These packings offer excellent chemical stability and additional interactions that can be helpful in the development of analytical methods. A detailed study of the chromatographic behaviour of biologically active nonapeptides as model analytes confirmed the substantial effect of mobile phase composition on retention mechanism. Consequently, HPLC separation systems with zirconia-based polystyrene column were characterized by distinct approaches that allowed recognition of the interactions participating in the separation process. Empirically based chromatographic tests evaluated the fundamental properties of the system – hydrophobicity and polarity. The complex model of linear free energy relationship described the prevailing interactions in different separation systems. Application of a set of basic compounds revealed the contribution of ion-exchange interactions participating in the separation systems with zirconia-based column.

The second part of the thesis is devoted to new cyclofructan-based chiral stationary phases. Structurally different chiral compounds (binaphthyl derivatives and certain chiral pharmaceuticals) served for evaluation and comparison of the interaction and enantioseparation capabilities of three different cyclofructan-based chiral stationary phases. Some excellent enantioseparations were achieved. Furthermore, the linear free energy relationship model was used to reveal the dominant interactions affecting the retention and separation process on the cyclofructan-based columns in normal separation mode. Finally, two chiral stationary phases, i.e. cyclofructan- and cyclodextrin-based columns with the same substituent, were compared by the linear free energy relationship approach. The results showed the differences in the interaction mechanism on the two columns derived from their different basic structure.