Abstract

A crucial step in the analysis and development of high-performance liquid chromatography is the selection of the proper stationary phase. The prevalence of RP LC, as well as the rapid development of HILIC observed in recent years, with the simultaneous pursuit of the principles of "Green Chromatography" in analytics, forces researchers to search for selective and specific stationary phases.

The main objective of the research undertaken in this work was to synthesize a group of new stationary phases with embedded polar group. The silica gel was modified with diol groups and then, in the esterification reaction, C10 and C18 alkyl chains of different lengths, a phenyl ring and a cholesterol molecule were attached, respectively. In this way, four different packing materials with an embedded ester group and a non-polar fragment were obtained. The correct synthesis was confirmed using methods. Such elemental analysis and spectroscopic methods of FT IR and NMR. The density of surface coverage with ligands was also calculated. The surface chemistry of the stationary phase in liquid chromatography is a key factor determining the retention of chemical compounds. The measured zeta potential values and calculated parameters for the LSER model were used to more precisely describe the interactions affecting retention in the RP LC system. Secondary interactions were also assessed in the Tanaka characterization test. Radar plots were drawn based on the data, and stationary phases with embedded ester or phosphoester group were classified appropriately. The description of solvatation processes on the surface of chemically bonded stationary phases with an embedded polar group was complemented by the determination of excess solvent adsorption isotherms. The shape of isotherms indicated the occurrence of competitiveness adsorption between the components of the mobile phase. The appropriate combination of functional groups both - polar and hydrophobic in the structure of the stationary phase and the appropriate selection of the mobile phase translates into the selectivity of the materials synthesized in this way in the RP LC and HILIC. Moreover, stationary phases with an ester or phosphoester group have been successfully applied in the analysis of substances of significant biological importance, i.e. nucleo bases, nucleosides or purine alkaloids, with pure water as the only component of the mobile phase. The obtained results constitute an important contribution to complementing the knowledge about surface chemistry, intermolecular interactions and selectivity of chemically bonded stationary phases with embedded ester or phosphoester group. The conclusions drawn allow for a more in-depth look at the mechanisms that govern the separation process in RP LC, HILIC systems or when pure water is used as the only component of the mobile phase.