

Intensive development of civilization and science with particular emphasizing pharmaceutical, medical and food research requires the evaluation of new analytical materials. Peptide-silica stationary phases comprise a group of chromatographic packings with high potential for application in separation methods. Additionally, the diversity and multiplicity of chemically bonded ligands structures allow the preparation of so-called dedicated stationary phases. Published applications of peptide-bonded materials include high performance liquid chromatography (RP LC, HILIC), two-dimensional liquid chromatography (2D-LC), and ion chromatography (IC). However, the current preparative and application approach is based on a prediction instead of a concrete information, which poses a mainstay of designing of chemically bonded ligands.

Therefore, the aim of our project will be the creation of a kind of “library” data, which will contain the information necessary for the preparation of new analytical methods for specific groups of analytes using a peptide-silica stationary phases. This objective will be achieved by carrying out a systematic characterization of peptide-packings, which take into consideration the preparation, analysis, and application approach. The stage of characterization of synthesized adsorbents will include the application of chromatographic techniques and other physico-chemical methods. This approach will expand our knowledge of the nature and the surface chemistry of peptide-materials.

In addition, measurements of zeta potential allow describing the actual distribution of the charge on the surface of stationary phases. The measurement of solvation processes will be also carried out. The description of the retention mechanism of biologically significant analytes with various structure and properties using retention – structure relationship (QSRR) and utilization of automatic software programming HPLC method - ChromSword and DryLab will be an essential complement to the research. This approach will also include the preparation of stationary phases containing in the structure specific functional groups characteristics for biological membrane (peptide chains). The characterization of this type of stationary phases allows modeling the transfer process of drugs and consequently their metabolites. Thus, developed results and prepared materials may find a wide range of application in the “omics” analysis.

Systematic analytical approach, in the area which is the subject of the research, will contribute to deepening understanding of the physico-chemical and chromatographic properties of peptide-bonded stationary phases. Accordingly, the description of the retention mechanism of biologically significant compounds will be evaluated. As a consequence of the research, the step of the prediction of processes occurring in the chromatographic systems will be eliminated. This knowledge may be used e.g. in the pharmaceutical and medical laboratories as well as other analytical institution to develop analytical methods for identification and quantitation the desired analytes groups, and in the research of metabolism and the quality and purity of drugs. In addition, this approach takes into account the principle of “Quality by Design” (QbD), which is a trend in analytical methods.