Determinations of analytes present at trace and ultra-trace levels in samples with complex matrix composition (e.g., biological or contaminated samples, etc.) are quite often an integral part of the environmental assessment and monitoring. A limited number of analytical techniques that are sensitive enough for the direct determination of trace components in samples made it necessary to perform a preliminary step of the analyte isolation/enrichment. This step is crucial concerning the accuracy and reliability of the results, and it strongly influences on obtained results. Therefore, choosing the sample preparation technique is a very important step. Among the presence of a significant amount of sample preparation techniques, the Solid-phase microextraction (SPME) technique deserves particular attention. This technique base on the use of a small amount of sorption material applied as a thin layer to the surface of the fiber. The extraction process used in the SPME technique is performed by placing the fiber covered with a sorption material on the analyzed sample. The efficiency of the SPME technique is directly related to the availability and the ability to the appropriate fiber coverage selection. Several commercially available types of SPME fibers are currently on the market, but coatings of these fibers mainly include polymer-based sorption materials. Besides, the vast majority of commercial coatings used in the SPME technique operate based on the adsorption mechanism. The mechanism of adsorption limits the extraction efficiency due to the risk of occurring some undesirable processes, i.e., the competitive adsorption of residual components in complex samples, narrowing of the linearity of the extraction process. The above limitations do not occur when liquid or "pseudo-liquids" materials are used, where the isolation of the components takes place under the absorption (dissolution) mechanism. One of the groups of substances that refers to perfect materials as absorbents in the SPME technique is ionic liquids. Due to their ionic structure, these substances are characterized by negligible low vapor pressure, high thermal stability, occurrence in the liquid phase in a wide range of temperatures, and affinity to organic or inorganic compounds. There is one crucial problem in the use of ionic liquids in the SPME technique - a low stability and low reproducibility of the ionic liquid layer on the surface of the fiber.

This project offers a universal porous solid network on the surface of the SPME fiber. The porous material film will allow for the nano-confining, in its pores, of any ionic liquid. At the same time, the ionic liquid will be immobilized on the SPME fiber surface in the form of a stable layer. With a developed method, the porous structure of a solid network with identical parameters as the pore size, their volume will be obtained.

The undeniable advantage of this solution is the opportunity to study the extraction properties of various ionic liquids. Obtained fibers will be tested in the extraction of the analytes from different groups of analytes in model samples. Obtained results allow for the estimation of the extraction power of ionic liquids. The project includes evaluation of the influence of ionic liquid structure on its extraction properties, i.e., the type of cation and anion.