

Abstract

The submitted thesis is focused on the development, optimization, testing and practical application of the new microextraction method called Bell Shaped Extraction Device assisted Liquid-Liquid Microextraction (BSED-LLME).

The method is based on the application of a miniature bell-shaped extraction tool in which the extraction takes place, so that only minimal solvent losses can occur, and which allows a reproducible dosing and collection of a small volume of the extraction solvent. The BSED-LLME method was used to preconcentrate selected volatile and less volatile analytes from aqueous samples into organic solvents of a density lower than water. After the extraction, the analytes were determined by fast gas chromatography with flame ionization detection and gas chromatography with mass spectrometry.

The statistical methods known as Design of Experiment (DOE) were used for determination of the optimal extraction conditions for BSED-LLME procedure. DOE is based on a mathematical description of the system and the prediction of the optimal setting of experimental parameters that may influence extraction efficiency. Factors such as extraction time, volume of extraction solvent, addition of sodium chloride (ionic strength), stirring rate and the diameter of the extraction vessel ect., have been tested. The statistical significant factors have been optimized.

Enriched Factors (EF), instrumental limits of quantification (ILOQ) and method limits of quantification (MLOQ) were determined for a set of selected analytes. EF values ranged from 5 to 138 with a repeatability of up to 15%, and Method limits of quantification (MLOQ) were found in range from 0.3 to 11.0 ng ml⁻¹. The BSED-LLME technique has been tested on river and mineral water samples.

The new BSED-LLME microextraction method has proven to be a simpler, faster, more environmentally friendly and cheaper alternative to extraction methods, such as solid phase extraction (SPE), liquid-liquid microextraction (LLME) or solid phase microextraction (SPME) for extraction of organic compounds from aqueous samples. Industrial Property Office in Czech Republic has patented BSED-LLME method for commercial applications (Patent n. 302841) in 2011.