An efficient biosorption-based dispersive liquid-liquid microextraction with extractant removal by magnetic nanoparticles for quantification of bisphenol A in water samples by gas chromatography-mass spectrometry detection

ABSTRACT

In this work, a simple, fast, sensitive, and environmentally friendly method was developed for preconcentration and quantitative measurement of bisphenol A in water samples using gas chromatography with mass spectrometry. The preconcentration approach, namely biosorption-based dispersive liquid-liquid microextraction with extractant removal by magnetic nanoparticles was performed based on the formation of microdroplet of rhamnolipid biosurfactant throughout the aqueous samples, which accelerates the mass transfer process between the extraction solvent and sample solution. The process is then followed by the application of magnetic nanoparticles for easy retrieval of the analyte-containing extraction solvent. Several important variables were optimized comprehensively including type of disperser solvent and desorption solvent, rhamnolipid concentration, volume of disperser solvent, amount of magnetic nanoparticles, extraction time, desorption time, ionic strength, and sample pH. Under the optimized microextraction and gas chromatography with mass spectrometry conditions, the method demonstrated good linearity over the range of 0.5-500 µg/L with a coefficient of determination of R2 = 0.9904, low limit of detection (0.15 µg/L) and limit of quantification (0.50 µg/L) of bisphenol A, good analyte recoveries (84-120%) and acceptable relative standard deviation (1.8-14.9%, n = 6). The proposed method was successfully applied to three environmental water samples, and bisphenol A was detected in all samples.

Keyword: Biosorption; Bisphenol A; Dispersive liquid-liquid microextraction; Gas chromatography; Magnetic nanoparticles