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Simultaneous Determination of Ten Endocrine Hormone Disrupters in Water Using SPE/LC-(ESI)MS-MS

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ABSTRACT

The aim of this study was developed and validated an analytical method based on liquid chromatography and tandem mass spectrometry after solid phase extraction to monitorizing ten endocrine hormone disrupters in Lisbon drinking water system. Natural and synthetic hormones (17-β-estradiol, ethinylestradiol, estriol, estrone, progesterone, mestranol and diethylstilbestrol) and some industrial products (4-n-nonylphenol, 4-tert-octylphenol and bisphenol A) were studied. Mass spectrometer detection parameters were optimized, such as the best conditions for the precursor ion formation, namely cone voltage, when applying negative and positive electrospray ionization, and also collision energy for MRM1 and MRM2 transitions. The best conditions of the solid phase extraction (SPE) using Waters Oasis HLB (6 mL, 200 mg) and Isolute C18 (EC) (6 ml, 1000 mg) were also optimized. The method was validated through the application of several statistical tests and the uncertainty estimation of the analytical assay. This method showed a very good linear range for all the studied analytes with determination coefficients (r2) between 0.9962 and 0.9999 and coefficients of variation lower than 4%. There were no significant differences between recoveries obtained with the studied matrices, like groundwater, surface water and water for human consumption. In these matrices, the recovery values varied between 32 and 95%. The limits of method detection were between 0.28 and 22 ng/L. The validated method was applied for the analysis of water samples from the EPAL (Empresa Portuguesa das Águas Livres, S.A.) water supply system including tap water, spring water, groundwater, and river water. Some target compounds (bisphenol A, progesterone, 4-tert-octylphenol, and 4-n-nonylphenol) were found in trace amounts in analysed waters.

KEYWORDS

Water Analysis, Endocrine Disruptors, Tandem Mass Spectrometry, Solid-phase Extraction, Uncertainty Evaluation

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