

DETERMINATION OF SELECTIVE SEROTONIN RECAPTURE INHIBITORS IN ENVIRONMENTAL EFFLUENT SAMPLES USING MAGNETIC BIOSORBENT FOLLOWED BY ANALYSIS BY MASS SPECTROMETRY WITH SPRAY IONIZATION FROM MAGNETIC PARTICLES

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ABSTRACT

INTRODUCTION: Selective serotonin reuptake inhibitors (SSRIs) have emerged as contaminants of growing concern in aquatic effluents, due to their persistence and ecotoxicological potential even at trace levels. Given the lack of regulatory measures and the limited efficiency of conventional wastewater treatment processes, the development of innovative techniques for the detection and removal of these pharmaceuticals at ultra-trace levels is essential. In this context, the present study introduces, for the first time, the use of a magnetic biosorbent derived from orange peel powder (M-OPP) for the pre-concentration of SSRIs, followed by analysis via magnetic particle spray mass spectrometry (MPS-MS), a technique recently developed by our research group.

OBJECTIVE: Development of a new sensitive and selective method for the determination of citalopram, duloxetine, fluoxetine, sertraline, venlafaxine, and paroxetine in environmental samples using M-OPP as sorbent for dispersive solid phase extraction followed by MPS-MS analyses.

MATERIAL AND METHODS: The adsorption process was initially investigated, including the influence of pH, adsorption kinetics, and isotherms. Next, the MPS-MS method was optimized, and the process was validated according to the acceptance criteria proposed in the national validation guideline Inmetro, ensuring its reliability with current analytical standards.

Calibration curves were constructed in the linear range of 0.1 to 10 ng mL⁻¹, while the precision and accuracy were assessed based on relative standard deviation and recovery, respectively.

RESULTS AND CONCLUSION: The developed method proved highly effective for the analysis of SSRIs in aquatic effluents, showcasing the remarkable efficiency of M-OPP in the extraction of antidepressants from environmental matrices. The adsorption process between the biosorbent and analytes was notably rapid, reaching equilibrium in approximately five minutes, and followed a cooperative adsorption model with a maximum capacity of 237.89 mg. In addition to its analytical performance, which presented determination coefficients (R^2) greater than 0.99, limit of quantification 0.1 ng mL⁻¹ and limit of determination 0.03 ng mL⁻¹. Therefore, the method offers significant advantages in terms of sensitivity and selectivity, enabling the detection of trace-level analytes using low sample volumes and minimal solvent consumption, thereby aligning well with the principles of green chemistry.

Keywords: Antidepressants, emerging contaminants; magnetic biosorbent; MDSPE; MPS-MS.

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