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RESEARCH ARTICLE

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Dispersive magnetic solid-phase extraction of phthalate esters from water samples and human plasma based on a nanosorbent composed of MIL-101(Cr) metal–organic framework and magnetite nanoparticles before their determination by GC–MS

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In this study, a magnetic metal–organic framework was synthesized simply and utilized in the dispersive magnetic solid-phase extraction of five phthalate esters followed by their determination by gas chromatography with mass spectrometry. First, MIL-101(Cr) was prepared hydrothermally in water medium without using highly corrosive hydrofluoric acid, utilizing an autoclave oven heat supply. Afterward, Fe_3O_4 nanoparticles were decorated into the matrix of MIL-101(Cr) to fabricate magnetic MIL-101 nanocomposite. The nanocomposite was characterized by various techniques. The parameters affecting dispersive magnetic solid-phase extraction efficiency were optimized and obtained as: a sorbent amount of 15 mg; a sorption time of 20 min; an elution time of 5 min; NaCl concentration, 10% w/v; type and volume of the eluent 1 mL *n*-hexane/acetone (1:1 v/v). Under the optimum conditions detection limits and linear dynamic ranges were achieved in the range of 0.08–0.15 and 0.5–200 μg/L, respectively. The intra- and interday RSD% values were obtained in the range of 2.5–9.5 and 4.6–10.4, respectively. Ultimately, the applicability of the method was successfully confirmed by the extraction and determination of the model analytes in water samples, and human plasma in the range of microgram per liter and satisfactory results were obtained.

KEYWORDS
dispersive magnetic solid-phase extraction, magnetite nanoparticles, metal-organic frameworks, phthalate esters

1 | INTRODUCTION

Sample preparation methods play a very important role in chemical analyses. A sample cleanup procedure is commonly required to decrease the matrix effect and remove the matrix components which can act as interfering during the analysis. In this regards, SPE is one of the most popular sample preparation methods owing to its significant advantages such as simplicity, rapidity, improvements in automation, various sorbent usage, reproducibility, and high-throughput capability [1–4]. Besides, the numerous advantages of SPE and its wide application, it has some disadvantages such as solvent loss, large secondary wastes, time-consuming procedure, tedious operations, and need for complex equipment. Dispersive solid-phase extraction (DSPE) is categorized as an SPE technique.

Abbreviations: DMSPE, dispersive magnetic solid phase extraction; MOF, metal–organic framework; MNP, magnetic nanoparticle; PE, phthalate ester; TGA, thermogravimetric analysis; XRD, X-ray diffraction

Conflict of interest: The authors declare no conflict of interest.

