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Polydimethylsiloxane/metal-organic frameworks coated stir bar sorptive extraction coupled to gas chromatography-flame photometric detection for the determination of organophosphorus pesticides in environmental water samples

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Abstract

In this work, the metal-organic frameworks (MOFs), MIL-101-Cr-NH_2 was synthesized via a direct hydrothermal method, and a polydimethylsiloxane (PDMS)/MIL-101-Cr-NH_2 coated stir bar was prepared by sol-gel technique. Good reproducibility was obtained for the preparation of PDMS/MIL-101-Cr-NH_2 coated stir bar with the relative standard deviations (RSDs) ranging from 3.7 to 5.2% (n=7) in one batch, and from 5.4 to 9.2% (n=7) among different batches. With the high surface area and rich benzene ring structure of MIL-101-Cr-NH_2, the prepared PDMS/MIL-101-Cr-NH_2 coated stir bar presented higher extraction efficiency for target organophosphorus pesticides (OPPs, including phorate, diazinon, malathion, fenthion, quinalphos and ethion) over PDMS coated stir bar. Based on it, a new method of PDMS/MIL-101-Cr-NH_2 coated stir bar sorptive extraction (SBSE) coupled to gas chromatography-flame photometric detection (GC-FPD) was proposed for the determination of six OPPs in environmental water samples. The operation parameters affecting the extraction efficiency of SBSE, including extraction time, stirring rate, desorption time and ionic strength, were investigated. Under the optimal conditions, the limits of detection (S/N=3) were found to be in the range of 0.043-0.085 μg L^{-1} for the six target OPPs, and the linear range was 0.5-100 μg L^{-1} for malathion and 0.2-100 μg L^{-1} for other five OPPs. The RSDs of the proposed method evaluated at 1 μg L^{-1} for each OPP were in the range of 5.9-8.7% (intra-day, n=7) and 6.1-10.7% (inter-day, n=5), respectively. The enrichment factors were varied from 110 to 151-fold (theoretical enrichment factor was 200-fold). The proposed method was

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