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# Magnetic graphene solid-phase extraction for the determination of carbamate pesticides in tomatoes coupled with high performance liquid chromatography

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## Abstract

Graphene-based magnetic nanoparticles, comprising zero-valent iron, iron oxide-oxyhydroxide and graphene, were prepared through a simple one-step synthesis method, and subsequently applied to magnetic solid-phase extraction for the determination of trace carbamate pesticides in tomatoes coupled with high performance liquid chromatography. The properties of the nanocomposites were confirmed by using Fourier transform infrared spectroscopy, X-ray photoelectron spectroscopy, and vibrating sample magnetometer. The components within the nanocomposites endowed the material with high extraction performance and manipulative convenience. Compared with reduced graphene oxide, the as-prepared G-MNPs showed the better extraction efficiencies for the carbamate pesticides thanks to the contribution of the iron-containing magnetic nanoparticles to the adsorption capacity of the nanocomposites. Various experimental parameters affecting the extraction efficiency had been investigated in detail. Under the optimal conditions, the method provided high enrichment factors ranging from 364 to 434, good linearities ranging from 5 to 200 ng g<sup>-1</sup> for metolcarb, baygon and methiocarb and 10 to 200 ng g<sup>-1</sup> for carbofuran and isoprocarb, low limits of detection ranging from 0.58 to 2.06 ng g<sup>-1</sup>, and satisfactory spiked recoveries (between 90.34% and 101.98% with the relative standard deviation values from 1.21% to 5.93%). It was confirmed that this novel method was an efficient pretreatment and enrichment procedure and could be successfully applied for extraction and determination of trace carbamate pesticides in

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