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Green synthesis of carbon dots functionalized silver nanoparticles for the colorimetric detection of phoxim

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ABSTRACT

In this work, Lycii Fructus as raw materials for green synthesis of fluorescent carbon dots (CDs) reduce $AgNO_3$. The CDs-AgNPs were synthesized by one-step method. CDs were applied to stabilize AgNPs due to abundant functional groups on the surface of CDs. In presence of phoxim, the dispersed CDs-AgNPs get aggregated and the absorption peak with red shift from 400nm to 525nm, resulting in the color changed from yellow to red. Under optimized conditions, the absorbance ratio at $A_{525\ nm}/A_{400\ nm}$ was related linearly to the concentrations of phoxim in the range of 0.1-100 μM. The detection limit was calculated to 0.04 μM, which is lower than maximum residue limits of phoxim in samples in China. The colorimetric sensor was successfully utilized to monitoring phoxim in environmental and fruit samples with good recoveries ranges from 87% to 110.0%. These results showed the sensor had a promising application prospect in real samples.

Keywords: Lycii Fructus CDs-AgNPs Phoxim Colorimetric sensor

Introduction

Organophosphate pesticides (OPs) belong to one branch of organic pesticides [1-2]. OPs are the most widely used in both agricultural and domestic gardens, especially in developing countries [3]. Phoxim (O,O-Diethyl-O-α-Oximinophenyl cyanophosphorothioate), a broad spectrum antiparasite, is an effective insecticide for the control of pests [4-6]. However, excessive residues of phoxim not only can pose threat to the environment and human health, leading to the contamination of lakes and rivers but also affect the food consumption, growth and reproduction [7-8]. Meanwhile, phoxim also inhibits acetylcholinesterase activity and oxidative stress of *B. mori* [9]. To realize a simple, selective and on-situ detection, a variety of methods have been developed for the detection of phoxim. Such as high-performance liquid chromatography (HPLC) [10-11], liquid chromatography-mass spectrometry (LC-MS) [12], enzymatic kinetic method [13], amperometric biosensor, and electrochemical analysis