Title: Metal-organic framework UiO-66 for rapid dispersive solid phase extraction of neonicotinoid insecticides in water samples

Authors: Xiaolin Cao, Zejun Jiang, Shanshan Wang, Sihui Hong, Hui Li, Chao Zhang, Yong Shao, Yongxin She, Fen Jin, Maojun Jin, Jing Wang

PII: S1570-0232(17)31397-1
DOI: https://doi.org/10.1016/j.jchromb.2017.11.034
Reference: CHROMB 20931

To appear in: *Journal of Chromatography B*

Received date: 13-8-2017
Revised date: 8-10-2017
Accepted date: 27-11-2017

Please cite this article as: Xiaolin Cao, Zejun Jiang, Shanshan Wang, Sihui Hong, Hui Li, Chao Zhang, Yong Shao, Yongxin She, Fen Jin, Maojun Jin, Jing Wang, Metal-organic framework UiO-66 for rapid dispersive solid phase extraction of neonicotinoid insecticides in water samples, Journal of Chromatography B https://doi.org/10.1016/j.jchromb.2017.11.034

Metal-organic framework UiO-66 for rapid dispersive solid phase extraction of neonicotinoid insecticides in water samples

Xiaolin Cao, Zejun Jiang, Shanshan Wang, Sihui Hong, Hui Li, Chao Zhang,Yong Shao,Yongxin She*, Fen Jin, Maojun Jin, Jing Wang*

* Corresponding author
E-mail address: w_jing2001@126.com; 0891syx@163.com
Key Laboratory of Agri-food Safety and Quality, Institute of Quality Standard and Testing Technology for Agro-Products, Chinese Academy of Agricultural Sciences, Ministry of Agriculture of China, Beijing, 100081, P.R. China

Abstract: UIO-66 crystals were explored for the first time to adsorb neonicotinoid insecticides in environmental water samples. HPLC coupled with tandem MS was used for quantification and determination of neonicotinoid insecticides. UiO-66 crystals was successfully synthesized by a simple constant-temperature bath method. Synthesized UiO-66 was characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), thermogravimetry and nitrogen adsorption porosimetry (NAP), which demonstrated a uniform particle size, a large Brunauer–Emmett–Teller (BET) surface area and high thermostability. The adsorbing results showed that UIO-66 crystals could be used as a promising adsorbents for rapid extraction of neonicotinoid insecticides and be reused at least 10 times. Under the optimized conditions, the limits of detection (LODs, S/N = 3) and limits of quantification (LOQs, S/N = 10) for the five insecticides were found to be 0.02-0.4 ng/mL and 0.05-1.0 ng/mL, respectively. This developed approach not only provided more simple and sensitive method, as well as possessing satisfactory recovery for neonicotinoid insecticides, but also for other traces in environmental samples.

Keywords: UiO-66; dispersive solid phase extraction (DSPE); neonicotinoid insecticides; water samples

1. Introduction

Neonicotinoid insecticides are a new group of insecticides functioning as acetylcholine receptor agonists. They fall into the fastest growing class of insecticides around the globe, which have been widely used in agricultural fields due to their excellent activity against pest insects.[1] But recent research has showed that these insecticides may be the main factor for pollinator decline (e.g. colony collapse disorder of honeybees) and also impose a serious risk to human health.[2] Therefore, many government agencies have controlled their use in the environment to protect beneficial insects and guarantee human health. To decrease the matrix effect and protect analytical instruments, conventional solid-phase extraction (SPE)[3,4] and liquid-liquid extraction (LLE)[5,6] have been employed for purification of neonicotinoid insecticides in different samples. However, these methods require a large amount of organic solvents and considerable time and usually have poor accuracy and low recovery. Therefore, an easy and fast extraction procedure and a highly sensitive multi-residue determination approach are highly demanded for effective monitoring of neonicotinoid insecticide residues in environmental samples.

Dispersive solid phase extraction (DSPE) involves a single extraction procedure with solid adsorbents and a rapid clean-up process, which is worth drawing more and more attention due to less consumption of organic solvents, simpler operations, shorter extraction time and higher efficiency.[7] Recently, metal organic frameworks (MOFs) have been employed as a class of hybrid