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Cellulose supported promising magnetic sorbents for magnetic solid-phase extraction: A review

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ABSTRACT

Cellulose with ample hydroxyl groups is considered as a promising supportive biopolymer for fabricating cellulose supported promising magnetic sorbents (CMS) for magnetic solid-phase extraction (MSPE). The easy recovery via external magnetic field, and recyclability of CMS, associated with different types and surface modifications of cellulose has made them a promising sorbent in the field of solid-phase extraction. CMS based sorbent can offer improved adsorption and absorption capabilities due to its high specific surface area, porous structure, and magnetic attraction feature. This review mainly focuses on the fabrication strategies of CMS using magnetic nanoparticles (MNPs) and various forms of cellulose as a heterogeneous and homogeneous solution either in alkaline mediated urea or Ionic liquids (ILs). Moreover, CMS will be elaborated based on their structures, synthesis, physical performance, and chemical attraction of MNPs and their MSPE in details. The advantages, challenges, and prospects of CMS in future applications are also presented.

1. Introduction

Magnetic solid-phase extraction (MSPE) is an attractive approach for the pre-concentration of target analytes from the bulk samples using magnetizable adsorbents. It happened because of the easiest way of solid-liquid phase separation through an external magnetic field (EMF) (Samadder et al., 2020; Yi et al., 2019; Yuan et al., 2020). Consequently, MSPE has widely been used for investigating both organic and inorganic residuals in water (Abujaber et al., 2018; Huang et al., 2020). In this regard, different types of magnetic adsorbent materials (MAM) such as three-dimensional (3D) ionic liquid functionalized magnetic graphene oxide nanocomposite (Li et al., 2017; Zhang, Luan et al., 2017; Zhang, Zhou et al., 2017), magnetic metal-organic framework (Ma et al., 2016; Maya et al., 2017) and toner powder (Farajzadeh & Mohebbi, 2018) have been developed for MSPE purposes. Among different types of MAM, the magnetic metal-cellulose framework is a greener, renewable and more sustainable material, and its synthesis is more straightforward, easier to obtain, cost-effective and efficient materials. Therefore, it has attracted the attention of many researchers and academics worldwide. In the recent years, active interfacial cellulose supported promising magnetic sorbents (CMS) have enabled oily wastewater treatment through MSPE as opposed to traditional techniques such as electrocoagulation (Fouad, 2014; Kobya, Soltani, Omwene, & Khataee, 2020), oil sorption (Kong et al., 2018; Tanvir, Ting, & Eichhorn, 2020), filtration (Luo & Liu, 2017; Yin, Zhang, Ma, Venkateswaran, & Hsiao, 2020), coalescers (Zhang, Huang et al., 2020; Zhang, Liu et al., 2020; Zhao & Li, 2011), and solvent extraction (Karatum et al., 2016) owing to the abundance of raw material, high efficiency, reusability, quick recovery, easy and quantitative separation of the targeted analyte by MSPE (He, Liang, Liu, & Xu, 2019; Xu, Jia, Ren, & Wang, 2018). A schematic diagram of the composite components of the CMS is shown in Fig. 1.

In a recent development, the authors have synthesized Fe_3O_4

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