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Mini Review

Mini Review of New Sorbents in Solid-Phase Extraction for Environmental Samples

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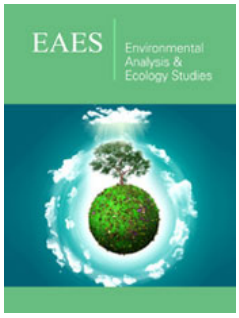

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Introduction

Emerging Contaminants (EC) are found to exert significant impacts on the human ecosystem, at low or trace-level concentrations. To meet the demand for their quantitation in diverse environmental media, the use of preconcentration approaches (such as solid phase extraction) can help significantly upgrade both procedural efficiency and sensitivity. Bio Adsorbents (BA) are realized as excellent candidates for proper sorbents because of their porous structural and surface properties with noticeably enhanced sorption capability towards contaminants. This mini review explores the use of various bio adsorbents [1] (Clay, Pine bark and cuttle bone), as potential sorbents for analytical applications. In this mini review, the distinctive features of BA-based sorptive extraction techniques are examined comprehensively.

Several groups of organic compounds, i.e., new brominated flame retardants, drugs of abuse and their metabolites, disinfection by-products, perfluoroalkyl substances, hormones, pharmaceuticals and siloxanes, are now considered to be emergent organic contaminants based on the risk they pose to human health and entire ecosystems, even at low or trace concentration levels. Worldwide administrations, organizations and environmental protection agencies have recommended maximum permissible levels of pollutants in environmental samples. For instance, the US Environmental Protection Agency (US EPA) has organized several environmental awareness programs over the years to monitor and identify organic pollutants in various environmental samples, including the effects of different levels on the local ecology [2]. Similarly, the European Parliament and the Council of the European Union have specified the regulative systems for dangerous particles, volatile organic compounds, and greenhouse gases into indoor or outdoor air" [3]. Organic contaminants can disturb the biochemical pathways of various living systems even at ultra-trace concentration levels. Therefore, the need is urgent to develop sensitive analytical techniques to monitor the levels of these low-concentration organic contaminants in environmental media, including water, air, soil, and living organisms. Sample preparation techniques such as preconcentration could concentrate the target organic contaminants, significantly lowering the limit of detection available using conventional analytical instruments (chromatography or chromatography with a mass detector). Therefore, there is an essential need to integrate sample preparation or treatment into analytical approaches for ultra-trace quantitation of chemicals in complex environmental samples.

SPE is one of the simplest sample preparation techniques for extracting and preconcentrating trace level organic contaminants from environmental matrices. It was first introduced in 1970 and has had a great impact in the field of analytical sciences. several bio adsorbents have all been used for trace-level analysis of various targets (e.g., pharmaceuticals, PAHs, pesticides, carbamate, bisphenols, phenols, phthalate acid esters, phenylurea herbicides

and hormones,) prior to their identification by chromatographic and spectrometric techniques. The extraction efficiency of SPE has been greatly enhanced by the integration of bio adsorbents, which provide more trapping sites than previous sorbents. Compared with other liquid extraction techniques for organic pollutants, bio adsorbents based SPE provides lower detection limits for a wide variety of organic pollutants with minimal sample and solvent volumes. The progress of sorbent techniques has been achieved by the plethora of research efforts. However, still many efforts are needed to expand their practical applications for the isolation and enrichment of target pollutants. Notably, universal protocols should be developed for the synthesis of bio adsorbent with same size, morphology, and surface chemistry to help extend their practical applications in the identification and quantification of diverse pollutants in various samples.

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