A 3D gelatin aerogel sorbent for the extraction of polycyclic aromatic hydrocarbons in tea drinks

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INTRODUCTION:
Tea leaves could be contaminated by polycyclic aromatic hydrocarbons (PAHs), a well-known class of carcinogens commonly generated from incomplete combustion of gases during the drying process. Therefore, as a consumer safety precaution, it is important to determine the concentrations of PAHs in tea. The most potent PAHs, which are benzo(a)anthracene (BaA), benzo(b)fluoranthene (BaF) and benzo(a)pyrene (BaP) were selected as target PAHs in this study. However, the contamination level is very low, therefore an extraction before the analysis was required. Gelatin aerogel sorbent was prepared and used as a 3D-porous sorbent for the extraction of PAHs in tea samples. The aerogel was rich in carbonyl (C=O) groups that can adsorb PAHs through carbonyl-π or π-π interactions. After extraction, the extractant was analyzed by a high-performance liquid chromatography with diode array detector (HPLC-DAD).

OBJECTIVES:
To develop a simple, affordable and effective extraction method for the analysis of PAHs in tea samples

METHOD / DESIGN:
15% gelatin was added in water before a crosslinking agent (25% glutaraldehyde) was added. Then the mixture was transferred into a template and kept at -20℃ for 16 h. The gelatin cryogels were removed from the template and lyophilized at -60℃ for 12 h to obtain the gelatin aerogel and used for the extraction of PAHs by the vortex-assisted solid phase extraction.

RESULTS:
Under the optimum conditions, the method provided a good linearity in the concentration range of 0.005-0.2 μg L^{-1} with low limits of detection for all three PAHs. Good reproducibility and reusability were achieved over 40 extraction cycles. BaA was detected in six different tea samples at concentrations ranging from 1.02±0.02 to 5.0±0.2 μg L^{-1}. BbF was found in four tea samples at a concentration rage of 0.32±0.03 to 2.50±0.02 μg L^{-1}. Recoveries in the range of 89.4±1.3% to 100.0±7.0% for BaA, 82.3±0.9% to 100.1±5.0% for BbF and 83.4±1.5% to 100.2±4.3% for BaP, respectively.

CONCLUSIONS:
The 3D-gelatin aerogel sorbent exhibited excellent adsorption and desorption towards target analytes. The sorbent is more cost effective than commercial ones. The PAHs analysis with the developed gelatin aerogel sorbent showed good accuracy, reproducibility and reusability with acceptable RSDs and recoveries. Finally, the developed method was successfully applied for the determination of the polycyclic aromatic hydrocarbons in tea samples.

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