Tubular-type carbon nanofibers used as probing materials for solid-phase extraction device

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Since the discovery of solid-phase microextraction (SPME) by Professor J. Pawliszyn in 1990, many researchers have devoted to investigating the development and improvement of SPME apparatus; for example, novel coating techniques, apparatus improvement, surface modification of adsorber, auto-sampling system, etc. Up to now, the SPME has been extensively applied to various application fields including bio-analytical chemistry, food industry, and environmental chemistry. Compared with traditional solid-phase extraction (SPE), SPME is a relatively effective and convenient analytical technique due to the following advantages; solvents are completely eliminated, blanks are greatly reduced, and extraction time can be reduced to a few minutes.

In the present work, a simple and novel method for extraction and concentration of volatile organic compounds (VOCs) in headspace using a new design of solid-phase nanoextraction (SPNE) has been developed. To avoid complex set-up and operations using commercial SPME device, one new type of SPNE was fabricated from mechanical assemblies and an adsorption probe, which was coated with highly-porous carbon nanofibers (CNFs) as adsorber. Our preliminary study has pointed out that our CNFs array prepared by template-based method has a higher *n*-hexane adsorption capacity and can rapidly achieve an equilibrium coverage. This result is beneficial for the open-tipped CNF array used as a solid media. By incorporating the unique CNFs with our simply SPNE apparatus, the formal equilibrium times were determined to be 1–20 min for eight VOCs (e.g. benzene, toluene, ethylbenzene, *p*-xylene, *o*-xylene, naphthalene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene), and the GC spectrum showed no significant matrix interference. Our findings also indicated accurate detection with low RSD % (< 6 %) during 10 cycling tests. In conclusion, advantages of the SPNE are easy to assembly, fast sampling/desorption, accurate detection, and durability.

Fig. 1 Morphology of the Newly-designated SPNE device.

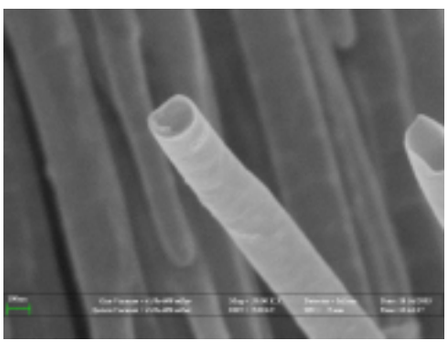

Fig. 2 FE-SEM image of the open-tipped CNF.

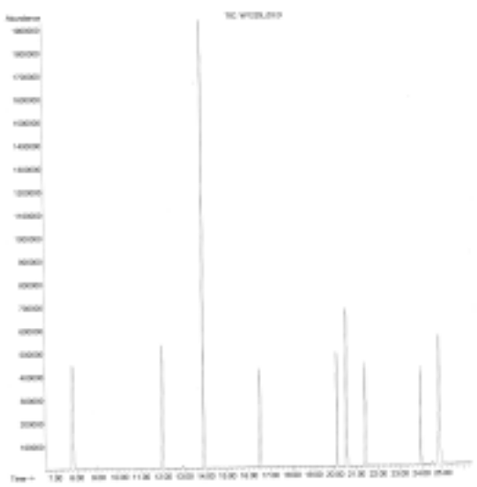

Fig. 3 Typical GC spectra for eight types of VOCs using the SPNE device.