

Carbon nanotubes as sorbents for the gas phase preconcentration of semivolatile organics in a microtrap

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Abstract:

In this paper we present the application of carbon nanotubes as unique sorbents for the fabrication of microtraps for the nanoscale adsorption/desorption of relatively large semivolatile organic molecules. The microtrap application requires high adsorption capacity as well as easy desorbability; the latter being critical for semivolatile compounds. The sorbent characteristics of single and multiwalled carbon nanotubes for gas phase adsorption/desorption of several compounds has been studied. The nonporous nature of carbon nanotubes (CNTs) eliminates the mass transfer resistance related to diffusion into pore structures, thus allowing easy desorbability. At the same time, their high aspect ratios lead to large breakthrough volumes. As compared to a commercial sorbent Carboxen(TM), the breakthrough volume was as much as an order of magnitude higher in the CNTs, while the rate of desorption measured as the peak width at half height of the desorption band was eight times lower. The trapping and desorption characteristics of single and multi walled nanotubes were found to be comparable. We also found that the presence of disordered carbon impurities, which could be removed by controlled oxidative annealing could greatly degrade the performance of CNTs.

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