Facile detection of polycyclic aromatic hydrocarbons from complex samples using Surface-Enhanced Raman spectroscopy coupled with thin layer chromatography on photonic biosilica

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Background
The combination of thin layer chromatography (TLC) and Surface-enhanced Raman scattering (SERS) has good potential for direct separate and analysis of complex samples. Diatomite is a kind of nature siliceous mineral from geological deposits, which has a variety of unique properties including highly porous structure, excellent absorption capacity, and low cost. The periodic pores on the surface enable diatomite to possess optical properties like photonic crystals. We developed a simple, fast and low-cost route for separating and detecting polycyclic aromatic hydrocarbons (pyrene) from mixed samples by TLC-SERS using diatomite as stationary phase.

Experiments
Fabricate diatomite base TLC plate through spin coating

Objectives

Results and Discussion

SERS spectra of mixture (pyrene/MBA, I/1) separated by diatomite earth (a, b) and silica gel (c, d) TLC plates

Images of mixtures (1: PY and MBA, 2: PY and R6G, 3: PY and nile blue) after separation

SERS spectra after separation

Conclusion: We have developed a simple, rapid and cost-effective route for separating and detecting PAHs (pyrene) from mixture samples (MBA and pyrene) by TLC-SERS using diatomite as the stationary phase. The experimental results demonstrate more than 10 times improvement of sensitivities, down to 2 ppm to detect pyrene from complex samples using the diatomite-based TLC plate compared to the commercial silica-gel TLC plate. These results prove the potential of the TLC-SERS sensing using diatomite as a facile technology for emergency and routine monitoring pollutant and toxics in environment.