

Synthesis and characterization of polydimethylsiloxane-cyanopropyltriethoxysilane-derived hybrid coating for stir bar sorptive extraction

Abstract:

New inorganic-organic hybrid materials were synthesized by hydrolysis and condensation of cyanopropyltriethoxysilane (CNPrTEOS) and polydimethylsiloxane (PDMS) in the presence of hydrochloric acid, HCl catalyst and methyl trimethylmethoxysilane as precursor via sol-gel method and coated on glass encased stir bar for use in stir bar sorptive extraction (SBSE). The cyano part provides polar moiety, which may improve the extraction of polar analytes. The physico-chemical properties and extraction ability of PDMS-CNPrTEOS-derived hybrid coatings can be fine tuned via manipulation of solvents (tetrahydrofuran (THF)-based and dichloromethane (DCM)-based) and PDMS-CNPrTEOS molar concentrations during the sol synthesis. Clear, homogeneous PDMS-CNPrTEOS-derived hybrid sols were obtained using THF and DCM at optimized molar ratios. The optimized molar ratios of THF:CNPrTEOS and THF:PDMS were 5:1 and 25:1, respectively. The optimized molar ratios of DCM:CNPrTEOS and DCM:PDMS were 10:1 and 70:1, respectively. FTIR spectrum showed that the intensity of the CN peak increased with increasing content of CNPrTEOS in the PDMS;CNPrTEOS-derived hybrid. The Field Emission Scanning Electron micrographs of prepared coatings revealed smooth, homogenous surfaces and crack-free coatings with film thickness of 200 nm to 2.5 μ m attributing to different solvent types. All coatings prepared were thermally stable at temperature higher than 200 $^{\circ}$ C. The DCM-based PDMS-CNPrTEOS-derived coating shows more advantages in terms of physical characteristics and extraction ability compared to THF-based PDMS-CNPrTEOS-derived coatings due to higher cyano part content and its thicker coating. The PDMS-CNPrTEOS-derived hybrid coatings can be used as extraction sorbent for analysis of non steroidal anti-inflammatory drugs namely ketoprofen and diclofenac sodium in SBSE.