ANALYSIS OF UV-FILTERS IN WATER SAMPLES BY SOLID PHASE MICROEXTRACTION WITH COATED-MAGNETIC NANOPARTICLES

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In recent years, nanomatirials have become in fashionable promising materials, gathering bulk physico-chemicals properties together with nanoscale structure properties such as magnetic catalytic, optical, sorption and other properties. Spinel ferrite nanoparticals may exhibit the so-called supermagnetic properties when the particle size is of a definite size.

Sample preparation is usually a laborious and time/reagent-consuming step with mainly extraction and preconcentration purposes leading to major sources of error. In the last few years, a considerable scientific interest is focussed on developing miniaturized extraction techniques to avoid these drawbacks. Recently, mixed hemimicelles SPE-based on Fe_3O_4 nanoparticles are proposed to favour mass transfer from sample to the solid extractant phase. The solid phase miniaturized technique reduces considerably the extraction time due to the high surface area/mass ratio and, in addition the strong magnetism of magnetite nanoparticles allows a fast separation from the water sample using a very strong Nd-Fe-B magnet. Afterwards, the particles are chemically desorbed with an appropriate solvent. Coated magnetic nanoparticles were synthesized by Hatton and coworkers for water treatment plant purposes [1]. Basically, $FeCl_2$ and $FeCl_3$ were mixed with polyacrylic acid, random copolymer of amino-terminated polyethylene oxide and amino-termined polypropylene oxide in a hydrothermal media, and then NH_3 was added to leading a Fe_3O_4 coated nanoparticles. Oleic acid coated magnetic nanoparticles were synthesized with oleic acid by aqueous coprecipitation of $CoCl_2$ and $FeCl_3$ in basic media at 80 ºC. Alternatively, the former copolymer graft was employed for coating $CoFe_2O_4$ [2].

Nanometer-size particles were measured by high resolution transmission electron microscopy, observing the coating and the stoichiometric ratio was verified by energy dispersive X-ray spectrometry. Nanoparticle surface were characterized by X-ray photoelectron apectrometry (Co, Fe, C and O). Olecic-coated-$CoFe_2O_4$ exhibits clearly a Type IV sorption N_2-isotherm characteristic of mesoporous materials with a hysteresis type H1. The mesoporous area was 103 m^2/g determined by BET plot (r = 99996). Magnetic nanoparticles were characterized by thermogravimetric analysis.

Extraction-preconcentration with surface-modified magnetic nanoparticles for miniaturized SPE are the aims of this work. The magnetic fluid is presented as an interesting and promising alternative to miniaturize solid phase extraction. The nanoparticles were used to extract and preconcentrate UV filters from water samples. High extraction efficiencies and enrichment factors were attained.

Keywords: magnetic nanoparticles, solid phase microextraction, UV-filters, water analysis.

References:

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