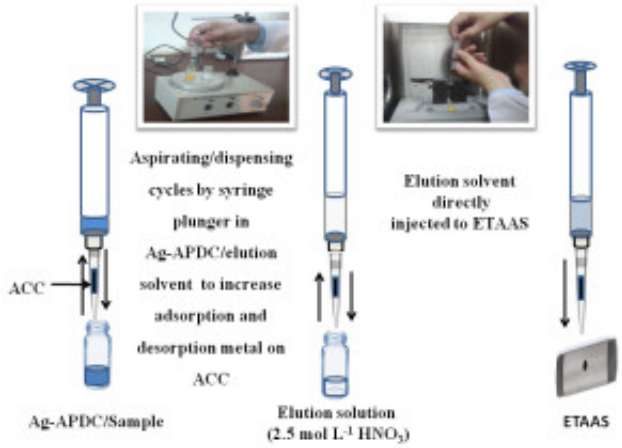
A new portable miniaturize solid phase microextraction using micropipette tip in-syringe system

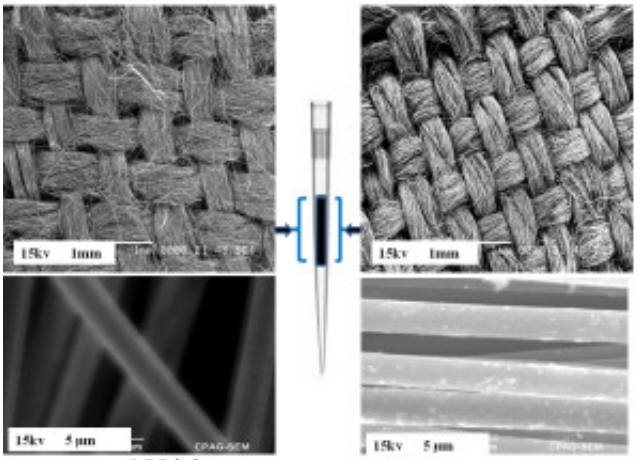
An innovative and simple miniaturized solid phase microextraction (M - SPME) method, using micropipette tip packed with activated carbon cloth (ACC) in a syringe system was developed for preconcentration and determination of silver (I) in the fresh and waste water samples. The ACC was packed as sorbent in a 100 µL micropipette tip. The retention of the metal ions in the form of complexes on ACC in a micropipette tip couple with syringe system was achieved by using ammonium pyrrolidine dithiocarbamate (APDC) as the complexing agent by 2 to 10 aspirating/dispensing cycle. The analyte retained on an ACC micropipette tip syringe system was quantitatively eluted by drawing and dispensing of different concentrations of acids from 2 to 5 aspirating/dispensing cycles, and then injected directly into the electrothermal atomic absorption spectrometry (ETAAS) for analysis. The influence of different variables on the extraction efficiency, including the concentration of ligand, pH, sample volume, eluent type, concentration and volume, and interfering ions was investigated. In order to validate the developed method, a standard addition method was used. The proposed method was successfully applied for the determination of trace levels of silver ions in real water samples.



Graphical Abstract of the (M-SPME)

The solid-phase extraction has been widely used because of its simplicity, low cost, and ability to combine with different detection techniques in both online and off-line mode. The conventional SPE method is laborious, and time-consuming. Recently, new efforts have been placed on miniaturizing SPE extraction procedure by reducing the extraction to aqueous phase ratio, leading to the development of solid phase microextraction (SPME). The SPME provides very efficient sample cleanup method, due to the use of very small samples and also reduces the consumption of organic solvents, which makes it more environmentally friendly, and it also simplifies the overall sample preparation procedure by minimizing the number of steps required. The activated carbons (ACC) adsorbents have the advantage of a higher specific surface area, mechanical strength and possibility of regeneration over the others. These advantages have led to the broad use of ACC as

an adsorbent in adsorption studies. For these reasons, the activated carbons have received considerable attention, in recent years, as a potential adsorbent for removal of organic and inorganic compounds.



The use of miniaturize solid-phase microextraction (M-SPME) using very cheap micropipette tip coupled with the syringe system is an ideal sample preparation technique because of the simple and high-throughput extraction, and the minimization of the sample and solvent requirements. The micropipette tip solid-phase microextraction method was successfully applied for pre concentration of silver(I) in real water samples. An advantage of using the micropipette tip for sample preparation is that extraction is simpler and faster than that with conventional SPE. We believe that this method will provide a useful tool for the screening and quantitative determination of other metal ions in and expect that it will become more popular as a pretreatment of method for different environmental samples. The method is practically more useful than a conventional column and batch techniques, also reduce the risk of contamination or sample loss and much cheaper than the use of on-line methods. The resulted data indicated that the levels of silver(I) was sufficiently lower than the maximum contaminant level for silver in water, which varies from 0.05 to 0.10 mg/L in different countries. In developing country including Pakistan, the waste water mostly drained into main water stream, which was used for agricultural as well as drinking purposes. Due to toxicity of silver to many aquatic organisms even at low concentrations, the serious environmental problems may occur.

Naeemullah

aNational Centre of Excellence in Analytical Chemistry, University of Sindh,Jamshoro, Pakistan

Publication

Development of new portable miniaturize solid phase microextraction of silver-APDC complex using micropipette tip in-syringe system couple with electrothermal atomic absorption spectrometry.
Naeemullah, Kazi TG, Afridi HI, Shah F, Arain SS, Arain SA, Panhwar AH, Arain MS, Samoon MK
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