

Synthesis, characterization and application of dendritic PAMAM-functionalized silica as nano-hybrid scavenger for clean-up in multi-residue analysis

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Background and Aims: Clean-up is the most critical step for multi-residue pesticides analysis in foodstuff. Aminopropyl and primary secondary amine (PSA) are two famous SPE that used in the removal of sugars, fatty acids, organic acids, lipids and some pigments. In this study, a novel SPE was synthesized by grafting of polyamidoamine (PAMAM) dendrimer generation 2 (G=2) onto ultrafine silica for increasing of sorbent efficiency, for clean-up in multiresidue analysis.

Methods: PAMAM dendrimer G=2 functionalized silica as organic-inorganic nano-hybrid scavenger was synthesized in three steps. At the first, 3-aminopropyltrimethoxysilane (APTMS) was grafted on PAMAM dendrimer G=2 in the presence of methyl acrylate and absolute methanol by Michael addition with purge dry nitrogen inert gas for 4h at 30°C. In the second step, tetraethyl orthosilicate (TEOS) was added to the solution and PAMAM-functionalized silica was prepared by sol-gel processing of methoxy and ethoxy groups on APTMS and TEOS. Finally, PAMAM-functionalized silica was dried in a vacuum oven for 2h at 80°C.

Results: The completion of the grafting reaction in each step was clearly confirmed by using FT-IR analysis. The scanning electron microscopy (SEM) images of PAMAM-functionalized silica nanoparticles showed the presence of silica nanoparticles in resultant PAMAM dendrimer-functionalized silica. The influence of elution protocols on the sorbent efficiency of resultant PAMAM-functionalized silica was compared with conventional PSA for removal of interferences. With increasing of amine groups in sorbent by grafting of PAMAM G=2 on silica, it seems that the potency of silica enhanced for removing of sugars, fatty acids, organic acids, lipids and pigments.

Conclusions: A novel SPE was synthesized by grafting of polyamidoamine (PAMAM) dendrimer G=2 on silica. The Michael addition reaction and sol-gel processing were used for preparation of PAMAM-functionalized silica. The efficiency of resultant PAMAM-functionalized silica was better of conventional PSA for removing of interferences in multiresidue analysis.

Keywords: Synthesis; PAMAM; SPE; Clean up; Pesticides residue