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Incorporation of micro and nanoparticles in porous polymer monolithic columns for capillary liquid chromatography application

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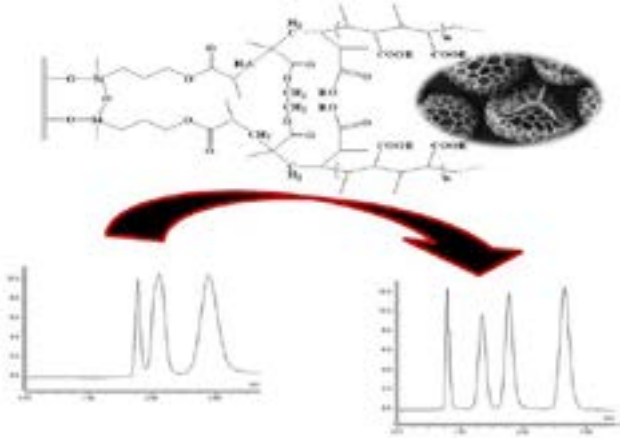
Capillary liquid chromatography has become one of the most important developments in separation technology. According to the literature, it's widely accepted that capillary liquid chromatography performed using columns with an internal diameter less than 500 µm. This technique carried out using fused silica capillary columns and prepared with a variety of different stationary phases. However, the successful development of this technique is closely related to the technical challenges associated with the columns manufacturing. Monolithic media have rapidly become popular and attracted increasing interest as separation phases. They consist of a single rigid piece of porous material that possesses a unique bimodal pore structure distribution with micrometer sized macropores and nanometer sized mesopores. Unfortunately, unmodified monolith is lake of small mesopores that comes at the cost of surface area. The better specific surface area for methacrylate polymers is within 10 m2/g. Although, the large macropores provides advantages in the separations of large molecules such as proteins, it does not provide the sufficient interaction sites for separation of small molecules especially with isocratic modes. However, several approaches have been proposed to enhance the separation efficiency of the monolithic columns. In this work, small amounts of micro/nanoparticles such as carbon nanotubes, metal organic frameworks and sporopollenin have been incorporated into the porous polymer monolithic capillary columns under specific conditions to enhance the separation efficiency of small molecules. Porous and hydrodynamic properties and the morphology of the prepared columns were thoroughly characterized. The columns were evaluated by separation mixtures of different compounds such as phenols, aromatics, ketones and drugs. The combination of both monoliths and capillary liquid chromatography systems offer several advantages that include fast and sensitive analysis, in addition to the consumption of much smaller amounts of solvents, samples and stationary phase materials, which will reflect positively on the environment and cost.



Biography

Ahmad Aqel received his BSc and MSc degrees in 2005 and 2008, respectively, from Hashemite University, Jordan, and received his PhD degree in 2012 from King Saud University, KSA. Currently, he is an Assistant Professor of Analytical Chemistry at King Saud University. He has worked as a Researcher at King Abdullah Institute for Nanotechnology (2008-2013), Assistant Researcher at Hashemite University (2008), and as a Teaching Assistant at Hashemite University (2005-2007). Currently, he is working on a variety of separation and chromatographic topics ranging from preparation and development of packing materials for chromatographic columns to extraction and pre-concentration of various organic and inorganic samples. He is the co-author of more than 50 scientific contributions; 21 original papers, 2 review articles, 1 patent, 2 book chapters and 27 presentations in local and international conference proceedings.

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