Retention behavior of gold nanoparticles in on-line flow field-flow fractionation with inductively coupled plasma mass spectrometer
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Abstract: On-line flow field-flow fractionation (FIFFF) with inductively coupled plasma mass spectrometer (ICP-MS) was applied for characterization of gold nanoparticles (AuNPs). During the characterization, the different retention behavior of AuNPs with different types of stabilizing agent occurred leading to the incorrect particle size information. The FIFFF conditions used were as follows: channel flow rate 1 mL/min; cross flow rate 2 mL/min; 1 kDa regenerated cellulose membrane and 1 kDa polyethersulfone membrane; and DI water, 0.02% FL-70, 0.05% SDS, and 30 mM TRIS-buffer as a carrier liquid. Electrostatically stabilized AuNPs such as tannic acid and citrate; and sterically stabilized AuNPs such as polyethylene glycol, polyvinylpyrrolidone, and branched polyethylene imine were examined for their retention behavior in FIFFF-ICP-MS system. Furthermore, the fractionation of AuNPs in FIFFF does not depend only on particle size but also on interactions inside the FIFFF channel. Therefore, zeta potential, retention time and fractionation recovery of AuNPs were monitored for evaluation and prediction of retention behavior, separation efficiency and interactions in FIFFF channel. Various conditions of FIFFF provided the difference in retention time and separation efficiency. The best condition for characterization of AuNPs in FIFFF-ICP-MS was the use of regenerated cellulose membrane with 0.02% FL-70 (anionic surfactant).

Keywords: Flow field-flow fractionation; Gold nanoparticles; Retention behavior; Stabilizing agent