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Polymer coatings for sensitive analysis of colloidal nanoparticles in water

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A new analytical approach has been developed for the sensitive detection of colloidal nanoparticles in water, based on coating of the nanoparticles with a polymer to render them larger in size for better UV light absorption. These polymer-coated nanoparticles can be separated from the monomer and polymer by capillary electrophoresis due to differences in their ionic charge, size, and surface functionality. Using silica as model inorganic nanoparticles, controlled polymerization of 2-hydroxypropyl methacrylate increases their UV detection sensitivity by 5-7 folds. A second coating with polydopamine produces an extra 2-fold increase of the UV detection sensitivity. With both polyhydroxypropyl methacrylate and polydopamine coatings, a significant total enhancement of 10-14 folds in detection sensitivity is attained. Alternatively, addition of bisphenol A or polyvinyl alcohol to the polymerization mixture can result in 9-10 fold increase of detection sensitivity due to additional absorption of the UV detector light. Polystyrene is another coating material being assessed, for silica and other kinds of nanoparticles. Investigation will soon be underway to determine whether 2.5% ammonium molybdate solution can react with colloidal silica to form molybdosilicic acid for better CE-UV analysis, in terms of detection sensitivity and separation efficiency. Thermogravimetric analysis will also be conducted to study the degradation kinetics of various polymer coatings to help characterize the core nanoparticles.

Biography

Edward P C Lai completed his PhD at the University of Florida in 1982. After teaching at Bowling Green State University for two years, he joined the faculty at Carleton University and promoted to full professor in 1999. He is currently the Associate Dean of Science (Undergraduate Affairs). He has published 120 papers and 8 editorials in scientific journals.

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