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Characterization of nanomaterials in liquid phase using particle tracking analysis method

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Recently, there has been an unprecedented increase in the number of studies related to nanomaterials technologies and nanomedicine area. Accurate determination of nanomaterial/nanomedicine size is crucial for developing such nanoscale technologies, because size governs many of the physical and chemical properties of these materials. In addition, focused on the regulation, the European Commission has declared that a nanomaterial is a natural, incidental or manufactured material containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for 50% or more of the particles in the number size distribution, one or more external dimensions is in the size range 1 nm–100 nm. According to this definition, accurate size determination of nanomaterials in a liquid phase is an important factor for nanomedicine/nanotoxicity fields. In order to characterize size of nanomaterials in liquid phase, diffusion phenomena are used to determine the sizes of particles in the liquid phase by particle tracking analysis (PTA), pulsed field gradient nuclear magnetic resonance (PFG-NMR), and dynamic light scattering (DLS). In PTA, the sizes of particles in a suspension are determined by measuring the diffusion coefficients, and then calculating the sizes of the particles from these diffusion coefficients by the stokes-Einstein relation as well as the PFG-NMR and DLS methods. Since the PTA, PFG-NMR, and DLS methods are based on the observation of diffusion phenomena of particles in liquid phase, the particle interactions are mediated by the solvent and measured as the configurationally dependence of the system friction, thus; this effect should increase at higher particle concentrations. Accurate size determination of PS-latex particles in aqueous solution was performed after reduction of the electrostatic interaction between particles by varying both the concentrations of the nanomaterials and the electrolyte in aqueous solution. Zeta potential measurement and Derjaguin, Landau, Verwey, and Overbeek assessment gave a good indicator to reduce the electrostatic interactions between the particles for determination of accurate size of particle by diffusion based characterization method.

Biography

Haruhisa Kato has his expertise in characterization of polymer and nanomaterials. He has been investigating novel characterization instrument and method. He is also concerned with the international standardization work in ISO/TC24, TC229, and TC256.

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