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Effect of laser-induced shockwave on molecules and particles in solution

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Focusing of a nanosecond laser pulse (≈200 μJ) into aqueous solutions with an objective lens generates a high temperature plasma by dielectric breakdown, which induces generation of shockwave. Propagation of the shockwave with a high pressure causes linear and non-linear effects on the solute or dispersed particles. Time-resolved fluorescence spectroscopic observation under microscope has revealed that the shockwave affects local concentration of solutes due to a sub-mm movement of the molecules/particles with a near-sonic velocity in water. Combination of a ≈100μm capillary to confine the shockwave propagation into one-dimension and a collagen gel to control the holding and releasing of the loaded molecules/particles made their movement give a spot as if they were brought by a laminar flow. The distance travelled of a few tens to hundreds μm by the fluorescent-labeled proteins, DNAs, and polysaccharides or CdSe nanoparticles was found to be molecular type- and size-dependent. This technique (laser-induced shockwave chromatography) can avoid unwanted adhesion onto the solid stationary phase and will be applicable to prompt analysis to study aggregation/polymerization phenomena of biomolecules.

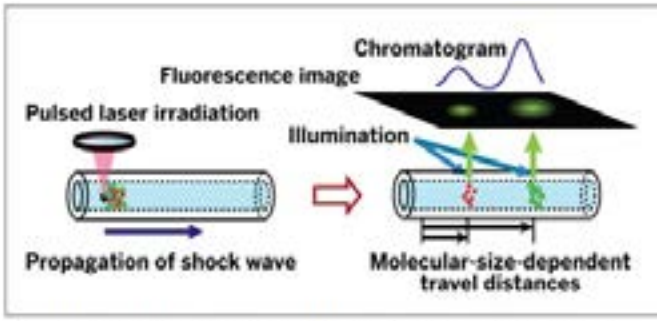

Figure 1: Schematic illustration of the laser-induced shockwave chromatography

Biography

Nobuyuki Ichinose received his PhD from Osaka Prefecture University, Japan. He is the professor of Kyoto Institute of Technology, Japan. He has over 60 publications in various fields in chemistry.

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