Multi-laboratory study sizes up nanoparticle sizing

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As a result of a major inter-laboratory study, the standards body ASTM International has been able to update its guidelines for a commonly used technique for measuring the size of nanoparticles in solutions. The study, which was organized principally by researchers from the National Institute of Standards and Technology and the Nanotechnology Characterization Laboratory of the National Cancer Institute, enabled updated guidelines that now include statistically evaluated data on the measurement precisions achieved by a wide variety of laboratories applying the ASTM guide.

Data from the inter-laboratory comparison gathered from 26 different laboratories will provide a valuable benchmark for labs measuring the sizes and size distribution of nanoparticles suspended in fluids—one of the key measurements in nanotechnology research, especially for biological applications, according to materials researcher Vince Hackley, who led the NIST portion of the study.

Size is an important characteristic of nanoparticles in a variety of potential uses, but particularly in biotech applications where they are being studied for possible use in cancer therapies. The size of a nanoparticle can significantly affect how cells respond to it. (See, for example "Cells Selectively Absorb Short Nanotubes".)

One widely used method for rapidly measuring the size profile of nanoparticles in, say, a buffer solution, is photon correlation spectroscopy (PCS), sometimes called "dynamic light scattering." The technique is powerful but tricky. The basic idea is to pass a laser beam through the solution and then to measure how rapidly the scattered light is fluctuating—faster moving particles cause the light scattering to change more rapidly than slower moving particles. If you know that, plus several basic parameters such as the viscosity and temperature of the fluid, says Hackley, and you can control a number of potential sources of error, then you can calculate meaningful size values for the particles.

ASTM standard E2490 is a guide for doing just that. The goal of the ASTM-sponsored study was to evaluate just how well a typical lab could expect to measure particle size following the guide. "The study really assesses, in a sense, how well people can apply these techniques given a fairly well-defined protocol and a well-defined material," explains Hackley. Having a "well-defined material" was a key factor, and one thing that made the experiment possible was the release this past year of NIST's first nanoparticle reference standards for the biomedical research community—NIST-certified solutions of gold nanoparticles of three different diameters, a project also supported by NCL. (See "NIST Reference Materials Are 'Gold Standard' for Bio-Nanotech Research")

The inter-laboratory study required participating labs to measure particle size distribution in five samples—the three NIST reference materials and two solutions of dendrimers, a class of organic molecules that can be synthesized within a very narrow size range. The labs used not only PCS, but also electron and atomic force microscopy. The results were factored into precision and bias tables that are now a part of the ASTM standard.

Source: National Institute of Standards and Technology (news : web)