Letter to Editor

Evaluation of particle size and zeta potential for vaccine design

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Nanotechnology is a field of science that focuses on understanding and obtaining materials at the nanometer scale, which is directly related to atoms and molecules. The application potential of nanoparticles is extremely broad and diverse [1, 2].

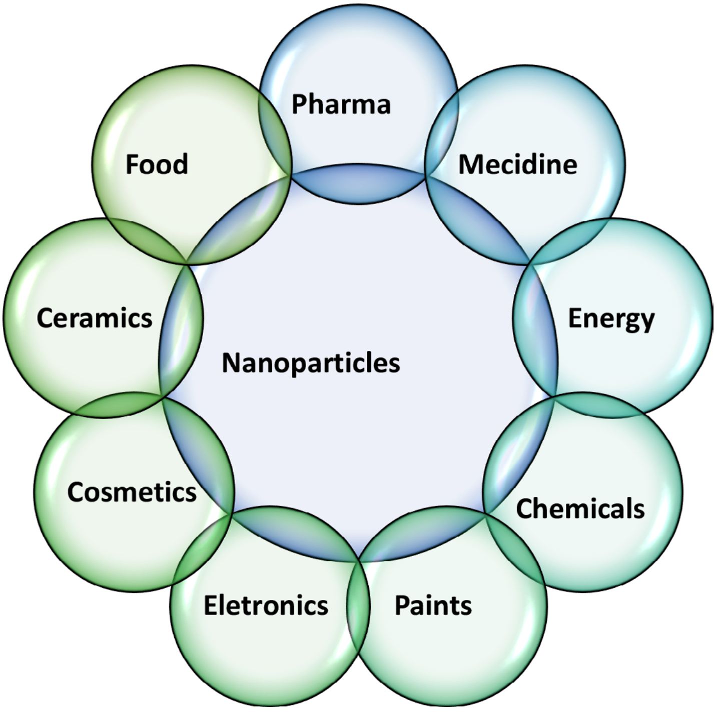

Figure 1. Potential application fields.

Instrumental analytical chemistry has become an important ally in the characterization of nanoparticles, mainly through the use of dynamic light scattering (DLS) and zeta potential techniques, enabling learning about the properties of individual particles such as: stability of suspensions, sedimentation, viscosity, reactivity, density, porosity and mainly particle size distribution [3].

The DLS technique is capable of detecting small variations in intensity referring to the scattering of light depending on the type of equipment at an angle normally of 90° due to the phenomena of Brownian motion, diffusion from the analyzed samples such as in formulations containing particles suspended in a vehicle liquid or droplets composed of lipids [3].

The zeta potential is determined as a result of the net electrical charge at the interface between the solid surface (particles) and the solvent [3]. From the medical point of view, the human body in relation to its smallest subunit, it is possible to verify that cells, molecules and even microorganisms comprise the nanoscale range, as shown in table 1.

Table 1. Materials and nanoscale [4-7].

Material	**Nanometers (nm)**
Human Cells (Average)	10.000 – 30.000
Bacteria (Typically)	2000 – 3000
Virus (Few exceptions)	15 – 300
Water (van der Waals Diameter)	0.275

The vaccine pharmaceutical product is contemplated on the nanometer scale and currently there are several technologies for its manufacture such as inactive viruses or bacteria, live attenuated viruses, mRNA, fragments, viral vector. In terms of formulation, they can be produced using adjuvants as excipients, which have a direct impact on the effectiveness and duration of the immune response, with aluminum salt being the most used. As demonstrated in the literature, the particle size has significant relevance with regard to the activation of the immune system [7, 8].

After the administration of the vaccine, the viruses, particles in nanometric scale (15-300 nm) are captured by the dendritic cells that have the ability to activate an immune response through antibodies and killer cells. However, formulations using aluminum salt as an excipient with particles on the micrometric scale act in a different immunological pathway, which is mediated by antibodies, preferably by monocytes [7, 8].

The analytical technique (DLS) and zeta potential are techniques that provide agility and assertiveness for the characterization of the size distribution profile of nanoparticles with applications both in research and development, making it possible to determine the immunogenicity pathway and quality control of vaccines with a focus on stability/shelf-life [7, 8].

Therefore, from the industrial point of view of quality control, regulatory and design of new vaccine formulations, analytical chemistry plays a fundamental role.

Disclosure statement

All authors report that they do not have any conflicts of interest.

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