Outward issues in nanotechnology

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Over the last decades much progress has been made in order to search solutions for the control and treatment of conventional pollutants generated by human and industrial activities, on which the legislation makes an exhaustive control and the science and engineering have given different solutions (1).

The progress of science and technology has introduced a number of potential contaminants which, especially in the future, will suppose a major challenge both for detection and for quantification; preliminary steps needed to undertake the purpose of their elimination or reduction. In our case, we refer to the micro and nanomaterials. The presence of these compounds presents numerous technical and institutional challenges to society, to environment and for professionals who need to address solutions to what is seen as the next scientific-technological revolution, which has been described as the nanotechnology.

The discovery of fullerenes by Curl, Kroto and Smalley in 1985 (Nobel prize in Chemistry in 1996) (2) represents, together with the discovery in 1981 of scanning tunneling microscope by Binnig and Rohrer (Nobel Prize in Physics in 1986), two of the first great achievements in the development of nanoscience (1). In 1991 Iijima observed the formation of needle-shaped species, when using the method of vaporization of graphite by electric arc discharge for the production of fullerenes in multigram quantities (4). By transmission electron microscopy (TEM) it was found that each of these clusters consisted of needles containing concentric layers of graphite. These structures are known today under the name of carbon nanotubes (CNT's) multi-wall (MWNT's) (5). Later Iijima himself et al. (6) and Bethune et al. (7), found that the addition of some metallic elements such as iron or cobalt, to one of the electrodes, produced tubular structures with a single sheet of graphite, i.e, what today is known as single wall nanotubes (SWNT's). One year earlier, Dr. Ugarte discovered by observing the microscope fullerenes and nanotubes, the presence of a new type of concentric circular structures which are now called as carbon nano-onions (NOC's) (8). In addition to these structures, all of them three-dimensional, we should mention the graphene, two-dimensional structures, that are constituted by hexagonal rings of carbon atoms with sp2 hybridization, i.e, are sheets of graphite.

Nanotechnology is one of the most important drivers of growth in developed countries (1). In 2011 the estimated economic impact in Europe will be nearly 300 miliardo dollars, and in 2016 it will exceed one billion U.S. dollars; it is not unreasonable to think that the continent's economic health depends on safe development of these emerging technologies (2).

Every technological advance brings risks, and in the case of nanotechnology and nanoscience the risk are high, and they should be properly monitored and evaluated to avoid serious consequences on health and environment (2,3), as it was evidenced in a article published in Nature (4). It is essential to know whether exposure to nanoparticles supposes risks to the health of workers and the general public, because this type of materials are included as consumer products today, and they will increase in future. On the other hand, it must create and maintain confidence about the production and handling of nanomaterials, based on a correct assessment and control of potential health risks from exposure to nanomaterials (5).

Traditionally, risk evaluation is based on describing the elements of exposure and danger. This approach can be used to evaluate the risks of exposure to engineered nanomaterials. The sequence of a risk evaluation (6) can be:

1 .- IDENTIFICATION OF DANGER

2 .- EVALUATION OF DOSE-RESPONSE

3.- EVALUATION OF EXPOSURE AND RISK

4 .- RISK MANAGEMENT

In this work we will deal separately with each of these aspects to get evaluate the risk associated with these activities and the state of current knowledge. The identification of danger is a key aspect in any evaluation of risks. The danger represents the potential to produce adverse effects and the risk is the probability of occurrence of these adverse effects.

The primary exposure to nanoparticles may occur through the lungs, skin or gastrointestinal tract, but its metabolism or displacement to other organs causes them to different mechanisms of toxicity, depending on the route by which are transported nanoparticles and, of course, depends on the functionalities that they have been equipped on its surface.
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The physicochemical properties of the surface of the nanoparticles seem to play an important role in the effects on systemic circulation after his arrival in the lung (13). It is unknown the exact nature of the toxicity and the TLV for inhaled or cardiovascular system.

The toxic process might arise from the ability of nanoparticles to activate platelet aggregation or affect the endothelium, so as to promote the formation of thrombi or could arise from oxidation reactions of nanoparticles in the lungs. In any case, it seems obvious that it needs to understand the mechanisms by which nanoparticles can cause adverse effects on the body.
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The methodology to evaluate and quantify the danger associated with nanoparticles are specified in the guidelines of the OECD and the European Regulation REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) in order to be considered.