Nanotechnology in medicine: risk assessment

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Currently there are approximately one hundred nanotechnological products applicable in nanomedicine and available in the market. The common known engineered nanomaterials when applied in medicine are also known as **NanoBioMaterials** (NBM). They can be differentiated into metals or metal oxides, of ceramic origin, other hybrids, those based on carbon, or of organic origin. Depending on their bioreactivity grade, NBMs can be classified in bioinert, bioactive, biomimetic, bioresorbable, or stimulating specific cellular responses at molecular level.

They are used as treatment in therapies against cancer, hepatitis and infectious diseases; as anesthetics, for the treatment of cardiovascular problems, in disorders inflammatory and immunological; in pathologies endocrine diseases, in degenerative diseases and in many other cases.[1] [2] Nanomedicine also raises large challenges when facing problems of health through the development of novel diagnostic methods, the improvements in the administration systems of drugs, effective tools for monitoring of the biological parameters, devices which allow the elimination of pathogens microorganisms, artificial cells and mechanisms that make immunological rejection impossible in organ transplants, leaving behind this way a lot of the strategies used by conventional medicine, nowadays very useful for vaccine development and applications.[3]

However, there are still several hindrances in the use of NBM related to their safety, considering that NBM present practically the same potential routes of exposure as another pollutant: dermal, respiratory or oral. Studies reveals various ranges of toxicity and biocompatibility, which reflects the distinct response of biological system toward different nanostructures and nanomaterials. To date, the knowledge on the interactions of nanomaterials with biological systems is limited and harmonized standards do not exist.

In this sense, it is important that the risk assessment considers not only the use in the consumer, but the entire life cycle of the product. Life Cycle Assessment (LCA) and environmental risk analysis (RA) are both suitable methods to assess the environmental and safety performance of a product. But in the NBMs case, The LCA studies existing thus far in nanotechnology have barely begun to cover aspects related to robust data collection or the degree of detail on the level of nanoparticle emissions[4], so it is necessary to increase the knowledge in this field.

References

[1] Etheridge ML., et al. Nanomedicine, (2013), 9(1): 1-14
[2] Pelaz B., et al. ACS Nano (2017), 11(3): 2313-2381
[3] Assolini JP., et al. Parasitology Research. (2017) 116(6): 1603-1615
[4] Hischier R. and Walser T. Science of the Total Environment (2012), 15(425): 271-282

Figures

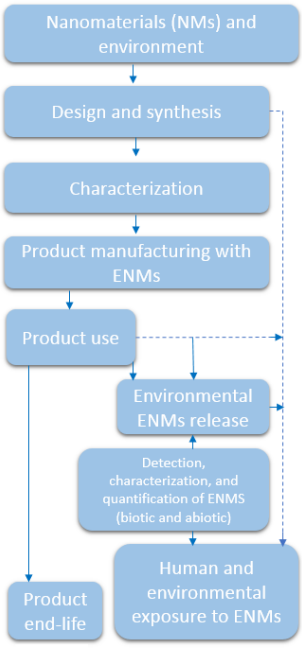

Figure 1: Main lyfe cycle stages of an engineered nanomaterial extrapolated to a nanobiomaterial