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Nanoparticles: Opportunities and Threats

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The word "nanoparticles" refers to nanostructures particulated, with variable shape, but with at least one dimension in the "nano" scale, that is lower than 100 nanometers (nm). Shapes can be spherical, filamentous, tubular, and irregular. They can be formed by a variety of materials. Nanoparticles can be dispersed, fused, agglomerated, and aggregated. The common characteristics of nanoparticles concerns the diversity among proprieties related to dimensions and proprieties related to the parental chemical species. Indeed, referring to a mass value, nanoparticles have an exposed surface much higher than the same mass in shape of macro-particle. That characteristics increases significantly their chemical and biological activity.

Nanoparticles can have natural origin (coming from natural combustions such volcanos and spontaneous fires) or they can have anthropogenic origin (coming from vehicular traffic, mainly diesel related, from industrial plants, from domestic heating).

Moreover nanoparticles can be artificially produced (from engineered processes) that is specifically produced from nanotechnologies at industrial level in order to perform technological aims in various scientific and industrial fields. For that reason the term "nanotechnologies" refers to the development and production of materials and systems in the order of nanometers.

Since long time, people have been exposed to natural and anthropogenic nanoparticles. On the contrary, artificial nanoparticles are new agents, to whom people begin to be exposed only now (and possibly will be more and more exposed). Even if nanotechnologies are considered an important opportunity in the scientific and technologic development, they are seen also as a new potential risk for the human health. This risk cannot be assessed yet for lack of data. However, a lot of studies are in progress, thus important results are expected for the next future even at regulatory level.

The growing interest on nanoparticles in the scientific circles is demonstrated from the dynamics of articles in the international database Scopus®. This is a wide abstract and citation database (50 million records) of peer-reviewed literature. Scopus delivers the most comprehensive overview of the world's research output in the fields of science, technology, medicine, social sciences and arts and humanities. In Figure 1 the dynamics of Scopus® indexed papers on nanoparticles is reported. In the last 10 years the amount of articles increased 7 times, reaching the considerable value of 34,919 per year (in 2013).

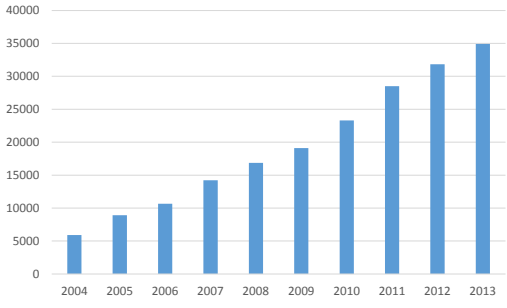

Figure 1: Scopus® indexed papers on nanoparticles.

The recent development of multifunctional nanoparticles comes from the growing needs in biomedical applications and the evolution of nanotechnology. These nanoparticles have the potential to integrate various functionalities. For instance they can provide contrast for different imaging modalities, support optimized delivery of drug and allow thermal therapies. These functionalities are obtained through advanced polymer processing, nanocrystalline synthesis, coating and oriented strategies.

In particular, the adoption of materials in nanoscale allows modifying basic properties such as solubility, diffusivity, blood circulation, drug release and immunogenicity [1]. In the last 20 years, nanoparticle-based agents have been developed for treating a variety of diseases: in particular, cancer, diabetes, asthma, allergy, infections. These nanoscale agents are developed for mitigating therapeutic toxicity, decreasing health-care costs and so on. Moreover, concerning diagnostic applications, nanoparticles help identify disease markers undetectable with traditional diagnostics. Agents for imaging contrast based on nanoparticles have also demonstrated to improve the performances of magnetic resonance imaging. Particular expectations are also based on the sector of bionanoparticles.

Unfortunately, a part of the nanomaterials typical of a successful nanotechnology ultimately find their way into the environment. A lack of knowledge concerns the behavior of nanoparticles in the environment and their interaction with the biological systems. Nanoparticles can penetrate an organism through a variety of routes, e.g. the dermal, oral and respiratory tracts. Nanoparticles are able to cross the blood-brain barrier affecting the central nervous system. These ultrafine particles can be responsible of serious pulmonary and cardiac diseases.

Old and new products are concerned with nanoparticles. Indeed a recent research demonstrated that wood ovens in pizzarias are generators of nanoparticles, inducing in the restaurant rooms a significant number of particles per cm^3, if compared with other case studies [2,3]. Another recent research demonstrated that particle size distribution measured in e-cigarette-generated mainstream aerosol showed a mode slightly higher than 100 nm and similar to conventional tobacco cigarette one [4]. No effects of the nicotine content as well as liquid flavor were found in particle size distribution data. The nanoparticle concerned results can be worthwhile for regulatory authorities aimed to rule the e-cigarette use.

Summing up, checking opportunities and threats of nanoparticles will be a concern always present in our future life. It is to be hoped

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that the opportunities related to the nanoparticle sector, specifically as a result of the synergy between bioengineering and biomedicine, will be higher than their negative effects.

References

1. Zhang L, Gu FX, Chan JM, Wang AZ, Langer RS, et al. (2008) Nanoparticles in medicine: therapeutic applications and developments. Clin Pharmacol Ther 83: 761-769.
2. Buonanno G, Morawska L, Stabile L, Viola A (2010) Exposure to particle number, surface area and PM concentrations in pizzerias, Atmos Environ 44: 3963-396.
3. Ionescu G, Zardi D, Tirler W, Rada EC, Ragazzi M (2012) A critical analysis of emissions and atmospheric dispersion of pollutants from plants for the treatment of residual municipal solid waste, UPB Sci Bull 74: 227-240.
4. Fuoco FC, Buonanno G, Stabile L, Vigo P (2014) Influential parameters on particle concentration and size distribution in the mainstream of e-cigarettes. Environ Pollut 184: 523-529.