
Physicochemical Characteristics of Nanoparticles that Determine Potential Toxicity

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INTRODUCTION

Nanoparticles (NPs) are not, as media report, a toxic entity per se, for example, just because of their size. Some NPs, because of their physicochemical features, including size, may constitute a serious hazard to human health. NPs are not only a product of the new nanotechnologies. NPs are present in the environment, and nanoscale phenomena permeate and often control natural processes. Humans have always experienced exposure to some nanosized particles in nature, which could thus be an important source of information on how to make harmless NPs. With the advent of the industrial revolution, "anthropogenic" sources of NPs appeared (e.g., internal combustion engines, power plants, etc.), which are now scattered worldwide. Whether the smallest particle fraction in polluted air is the most responsible one for adverse health effects is still a matter of debate, which could be solved by a systematic approach on what makes an NP toxic.

Because of their peculiar physical and chemical features, the study of NPs as potential toxic agents requires an interdisciplinary approach, involving multiple aspects ranging from physics and chemistry to biology and medicine. In the past, it was assumed that ultrafine particles would be easily exhaled, as opposed to those that are micron-sized, which would be retained in the lung. Conversely to this hypothesis, an enhanced toxicity to