Influence of Size and Shape on Toxicity in Nanomaterials

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Nanosizing effect is usually interpreted in the aspects of the increase of specific surface area. Since chemical reactivity is remarkably enhanced with the decrease of particle size, it is very probable that the effect appears unexpectedly as toxicity in some cases, as well as high functionality usually targeted in nanotechnology. Effects related to the ionic dissolution correspond to this category. One example is the acceleration of toxicity observed in Ni where tumor was generated in the long term implantation for 0.5 mm particles, compared with necrosis occurred in short term.

There are, however, other kind of effects. Biocompatible Ti causes inflammation in abraded fine particles, and asbestos, a kind of clay minerals, induces mesothelioma after a long-term, large quantity of exposure. These phenomena can be understood as the physical particle and shape effect, apart from the material properties of either toxicity or biocompatibility. It arises from the interaction between particles and cell/tissue, which bases on their relative size relationship. It is the non-specific effect occurring in any materials and is pronounced in the micro/nano scale, which is different from the material-dependent, chemical toxicity effect due to the ionic dissolution, usually dominant in bulk materials.

Nanoparticles might be the objects whose existence has not been assumed by living body defense system. The nanoparticles of less than 50nm can invade into the internal body through the respiratory or digestive system and make internal diffusion.