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Signaling pathways involved in metal-based nanomaterial toxicity towards aquatic organisms

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Abstract

Environmental risk assessment of engineered nanomaterials (ENMs) is an emergent field since nanotechnology industry is rapidly growing due to the interesting physicochemical properties of nanomaterials. Metal-based nanomaterials are among the most rapidly commercialized materials and their toxicity towards aquatic animals have been investigated at different levels of the biological organization. The objective of this synthesis review is to give an overview of the signaling molecules that have a key role in metal-based NM mediated cytotoxicity in both marine and freshwater organisms. Since toxicity of metal-based NMs could be (partly) due to metal dissolution, this review only highlights studies that showed a specific nano-effect. From this bibliographic study, three mechanisms (detoxification, immunomodulation and genotoxicity) have been selected as they represent the major cell defense mechanisms and the most studied ones following ENM exposure. This better understanding of NM-mediated cytotoxicity may provide a sound basis for designing environmentally safer nanomaterials.

Keyword : Nanoparticle, cell signaling, apoptosis, immune system, genotoxicity, oxidative stress