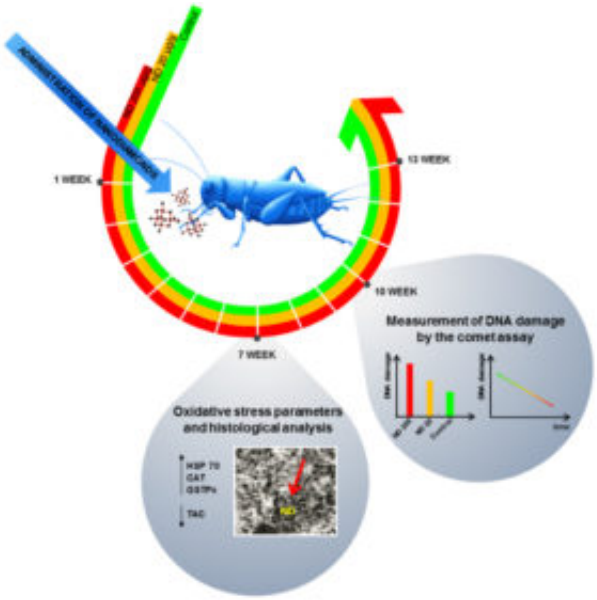
Nanodiamonds are just around the corner

The expansion of nanotechnology cause increased penetration of nanoparticles into the environment and their exposure of animals becomes inevitable. Consequently studies on their effects and potential toxicity is now gaining attention.



Nanodiamonds (ND) are allotropes of carbon which were discovered several decades ago. Currently hundreds of tons of ND are produced worldwide in various areas every year. They can be used in electrochemical coatings, polymer compositions, antifriction coatings, polishing, lubricants, biosensors, imaging probes, implants and drug carriers. A distinct feature of nanodiamonds, compared to carbon nanotubes and other graphitic nanoparticles, is that after attaching various groups to their surface, quite sophisticated surface functionalization is possible without compromising the useful properties of the diamond core. One example of potential impact can be interaction with food molecules. It is not known either what the fate of ND is after getting into the body with food. This is one of the reasons why better understanding how ND interact with cells, tissues and organs is essential for safe use of these particles. It is suspected that the underlying mechanisms of nanoparticle toxicity are oxidative stress, genotoxicity, inflammation and immunotoxicity. There are indications that the toxicity of nanodiamonds is associated mainly with the induction of the first two.

The aims of this work were to characterize the nanodiamonds' toxicity after exposure to different concentrations administered with food during the whole life cycle of *Acheta domesticus*. DNA damage by comet assay, DNA regeneration in a consecutive time points (0, 5, 15, 30 min after damage induction with the use of H_2O_2), total antioxidant capacity (TAC), activity of selected antioxidant enzymes (CAT, GSTPx), and the level of heat shock protein (HSP 70) were analyzed in selected organs.

The results of this research definitely prove: the toxicity of ND, which depends on their concentration; induction of some oxidative stress enzymes (CAT, GSTPx); and HSP 70 level increases. In lower doses ND do not induce high toxicity, which allows us to think trace amounts of these substances might be safe for organisms. In higher doses, however, ND undoubtedly interact in a toxic manner, causing decrease in an organism's efficiency and lifespan. These findings are relevant to the histological alterations observed in the intestinal cells. Taking quick development of nanotechnology into consideration, as well as increasing interest in industrial nanomaterials, increased risk of releasing these particles into various ecosystems cannot be overlooked. Further studies that may give more complete information on potential risk for the environment and living organisms are needed.

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Publication

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