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new hot papers - 2010

March 2010

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Renata Behra talks with *ScienceWatch.com* and answers a few questions about this month's New Hot Paper in the field of Environment/Ecology.

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Article Title: Toxicity of Silver Nanoparticles to Chlamydomonas reinhardtii

Authors: Navarro, E;Piccapietra, F;Wagner, B;Marconi, F;Kaegi, R; Odzak, N;Sigg, L;**Behra, R**

Journal: ENVIRON SCI TECHNOL, Volume: 42, Issue: 23, Page: 8959-8964, Year: DEC 1 2008

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SW: Why do you think your paper is highly cited?

There is a general lack of information on the fate and effects of engineered nanoparticles (NPs) in aquatic systems. Our study presents the first data on the toxic potential of silver NPs in a green alga and emphasizes the need to characterize the fate of particles in experimental media in order to correctly interpret ecotoxicity data.

Emerging studies indicate that particle properties are expected to change depending on the chemical characteristics of their receiving environmental media. For instance, changes in size and charge do occur depending on the acidity, ionic strength, or water hardness of the medium.

Since the same changes can be projected to also influence particle uptake and effects in aquatic organisms, they require particular consideration in studies on particle toxicity.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

Silver NPs could be toxic because of their size, shape, and surface charge. On the other hand, silver NPs could be toxic because they release silver ions, which are known to be highly toxic to aquatic organisms, including algae.

The study describes an experimental approach that allows distinguishing between the contribution of NPs as such and silver ion exposure to toxicity, using cysteine as a ligand to bind dissolved silver ions.

Our research presents evidence for the negative effects of silver NPs on algal photosynthesis and demonstrates that the short-term toxicity of silver NPs is caused by the formation of silver ions from particles upon contact with algae.

"Our studies address questions on the influence of physicochemical changes occurring to NPs in freshwaters on their bioavailability and hazards to algae."

"Increasing use of nanomaterials-based consumer products by society, proportionally increases the release of nanoparticles into the environment."

SW: Would you summarize the significance of your paper in layman's terms?

The study indicates that silver NPs are toxic to algae. Together with other findings demonstrating the release of silver NPs into the environment, our findings indicate that associated ecotoxicological risks should not be underestimated. Thus, in case of silver, a priority goal should be to prevent silver NPs spreading in the environment.

SW: How did you become involved in this research, and were there any problems along the way?

We have become involved in this research following the internationally claimed needs to assess risks associated with the release of nanomaterials into the environment. In the case of metal-based particles that may dissolve upon oxidation and lead to the formation of toxic metal ions, this line of research could build on our expertise in the biogeochemistry and ecotoxicity of metals.

SW: Where do you see your research leading in the future?

Our studies address questions on the influence of physicochemical changes occurring to NPs in freshwaters on their bioavailability and hazards to algae. The main objective is reaching a fundamental understanding of the processes governing NPs' changes and toxicity, because, depending on their surface modifications, NPs might enter cells through different pathways. Such information will be important also for understanding how NPs will be transferred along the food chain.

SW: Do you foresee any social or political implications for your research?

Increasing use of nanomaterials-based consumer products by society proportionally increases the release of NPs into the environment. Mitigation of concerns and communication of potential environmental risks depends on the availability of high-quality data on the fate and hazards of NPs. Such type of information will provide a strong scientific foundation for the development of future legislations and is expected to influence the societal risk perception for nanomaterials-based consumer products.

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KEYWORDS: ESCHERICHIA-COLI; PSEUDOKIRCHNERIELLA-SUBCAPITATA; ANTIBACTERIAL ACTIVITY; HYDROGEN-PEROXIDE; GREEN-ALGAE; PARTICLE SOLUBILITY; COPPER; PHOTOSYNTHESIS; NANOMATERIALS; CYTOTOXICITY.

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