Surfactant coatings alter nanoparticles' behaviour in water treatment plants

By Katie Bird , 17-Nov-2009

Related topics: Formulation & Science

Coating nanoparticles with a surfactant of the sort often found in personal care products may aid their removal from wastewater treatment systems, according to scientists in the UK.

Concerns are being voiced about the fate of the increasing number of nanoparticles finding their way into wastewater streams through use in cosmetic, pharmaceutical and food products as well as industrial use.

Much remains unknown about how the tiny particles interact with current wastewater treatment systems; but, a recent study published in the journal of Environmental Science and Technology suggests that the surface coating of the nanoparticles may dramatically alter their behaviour.

One of the study's lead authors, Dr Steve King from STFC's ISIS Neutron Source, explained how coating the particles (silica nanoparticles were used in the study) with a non-ionic surfactant (Tween 20 in this case) helped them to sediment out of the wastewater in which they were dispersed.

"Our research shows that the sedimentation of Tween coated oxide nanoparticles in the waste water treatment system is going to be enhanced when compared to non coated nanoparticles."

Separation by gravity is the first step of what is often a two step wastewater treatment system: large particles sediment out of the wastewater stream and are removed as sludge to be either deposited in a landfill or used as fertilizer; and, the resulting liquid is then treated using a microbial digestion process to remove the remaining pollutants.

According to the study, the uncoated nanoparticles remained in dispersion over a 24 hour period whereas after 90 minutes the sedimentation of the coated nanoparticles was nearly ten times that of the uncoated.

The silica nanoparticles used in the experiment were especially manufactured to have a Tween coating. However, King explained that the nanoparticles used in many cosmetics and pharmaceutical applications may already be coated with this kind of surfactant or something very similar.

This *may* mean that the nanoparticles entering the wastewater stream from personal care products are being separated out more successfully than originally assumed, but this is by no means certain, he said.

Research needs to be done on whether the coating is degraded between bathroom plughole and treatment plant or whether the nanoparticle picks up other coatings along the way, King explained.

In addition, further investigation is needed to explore the effect of other surfactant coatings and different types of nanoparticles on the rate of separation.

Separating out the nanoparticles before the treatment moves into the microbial phase could be beneficial as concerns have been raised about their potential toxicity to the microbes.

"Not only is microbial treatment unlikely to be effective on most nanoparticles as it only works on organic, or carbon based, pollutants, there have been some questions over whether some nanoparticles may in fact be toxic to the microbes," King said.

If this were to be the case then some nanoparticles remaining in the liquid phase could lead to an incomplete microbial treatment process.

If the nanoparticles are separated off in the treatment plant as part of the sludge they may find their way onto the land as part of an agricultural fertilizer.

According to King, other research projects are looking into the potential effects of the particles on the soil environment.

Source: *Environmental Science and Technology*
2009, volume 43, number 22
Fate of Silica Nanoparticles in Simulated Primary Wastewater Treatment
Helen P. Jarvie, Hisham Al-Obaidi, Stephen M. King, Michael J. Bowes, M. Jayne Lawrence, Alex F. Drake, Mark A. Green, Peter J. Dobson

Your comments

LATEST AUDIO & VIDEO NEWS

Lifting the lid on what defines the beauty foods category
Marketing is essential to cracking men's grooming, claims analyst
New orders, new clients: business looking up for contract manufacturers

LATEST NEWS HEADLINES

New data on parabens suggests no adverse hormonal effect on the body
Exposure to nano titanium dioxide could up cancer risk, says study
Surfactant coatings alter nanoparticles' behaviour in water treatment plants
Acquisitions in the packaging industry
Cosmoprof Asia continues to grow

MOST POPULAR NEWS

1. **Skin lightening can be dangerous, according to Mayor of Paris**
2. **P&G acknowledges its top performing global suppliers**
3. **BASF launches new anti-ageing active**
4. **Innovation of the year award for lip-gloss timestrip technology**
5. **Microcapsules developed to deliver chemicals 'on demand'**

ON YOUR RADAR

Green packaging
Metabolix' field trials investigate bioplastic-producing crops
Bioplastics have huge potential but infrastructure needs to catch up

Anti-ageing
Lipoaminoacids provide comprehensive anti-ageing protection, study
Manufacturer fights back over LED anti-ageing study

Naturals and organics
USDA crackdown on misuse of 'organic' not imminent, say standards holders
Seaweed extract may help improve the appearance of ageing skin

Financial focus
The time is now for niche players to target the developing markets
New orders, new clients: business looking up for contract manufacturers

MORE NEWS ARTICLES ON THIS TOPIC

- Exposure to nano titanium dioxide could up cancer risk, says study
- Public dialogue on nano should take a back seat until there is more data
- Nanoencapsulation: difference between 'making money and breaking even'
- German authorities warn consumers against nano
- EPA outlines new strategy to study nanomaterials

LATEST NEWS IN FORMULATION & SCIENCE

- Exposure to nano titanium dioxide could up cancer risk, says study
- New data on parabens suggests no adverse hormonal effect on the body
- Surfactant coatings alter nanoparticles' behaviour in water treatment plants
- Intertek offers wider testing services to respond to regulatory change
- Alban Muller launches plant extract combinations for oil based products