Nanosilver Impact on Wastewater Treatment Systems

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Introduction

With relatively low manufacturing costs and wide ranges of applications, Nanosilver (n-Ag) has become one of the most extensively used nanoparticles (NPs) in the manufacturing industry. N-Ag boasts strong antimicrobial properties which have made its use popular in various medical applications, water purification systems, and as a decontaminate. N-Ag has been found to be effective at eliminating odors when imbedded into clothing such as socks (*1*). The increase in products containing Ag NP's has augmented the likelihood of their release into the environment.

Environmental Implications

N-Ag's anti-microbial properties poses a concern to the biological stages of wastewater treatment plants (WWTP) where microorganisms decompose organic material during aeration processes. The minuscule size of NPs makes it extremely difficult to physically remove during treatment using current conventional methods. N-Ag can further infiltrate natural systems upon the dispersal of treated wastewater (WW) and solid effluent (*2*).

1. N-Ag sources include: clothing, toothpastes, paints, bandages, and surface disinfectants.
2. N-Ag enters sewer system from household washing of clothing.
3. WWTP are unable to remove n-Ag from water due to their small size. Ag NPs could have detrimental effects on the beneficial microorganisms in WW treatment. (*2*)
4. N-Ag remaining in the treated effluent stream may re-enter the environment via reuse facilities and agricultural land application of WW treatment.
5. Ag NPs may enter water environments, potentially disrupting surface numerous biological ecosystems.
6. N-Ag enters human drinking supply with potential for the development of antibacterial resistant strains of bacteria. (*2*)

The "Silver Bullet"

N-Ag Transport in the Environment

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Study and Findings

The aim of this study was to test whether Ag-NPs released into WW would result in alterations to basic water quality parameters. Results showed insignificant changes to pH, turbidity, conductivity, and BOD5 when n-Ag (100 nm) was introduced to post secondary clarifier effluent at concentrations of 75 and 2500 μg/L. However, immediately after n-Ag introduction in the WW, dissolved oxygen (DO) levels in n-Ag treated samples were greater then in the unaltered control WW samples. This difference suggests a halt in bacterial respiration at initial n-Ag contact. Further exploration into bacterial response during initial n-Ag introduction would be interesting considering the similar mixing processes during coagulation / flocculation stages in WW treatment.

Conclusion

The use of nanomaterials throughout the manufacturing industry is quickly surpassing the understanding of their possible environmental impacts. N-Ag raises tremendous concern on the implications it may create on beneficial bacterial process found throughout the environment and it's theoretical threat to the well being of plant, wildlife, and human health. Although there are a multitude of benefits from this technology, further understanding on its possible implications needs to be closely monitored as the environmental impacts of n-Ag release from commercial products are unknown (*3*).

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References

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