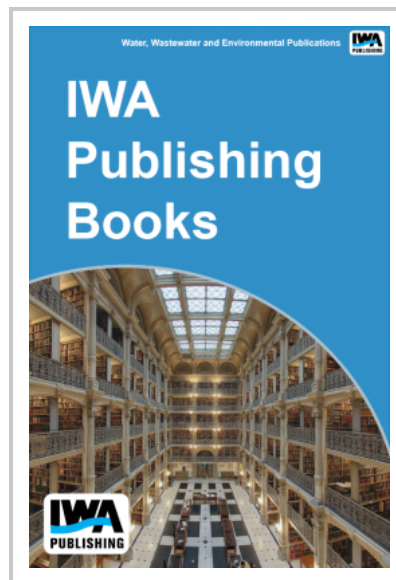


Impact of Silver Nanoparticles on Wastewater Treatment

Silver nanoparticles (AgNPs, nanosilver) are a frequently used nanomaterial with a wide range of industrial and consumer applications, including fiber coating, detergents, and hydrogels and plastics to prevent bacterial and fungal growth.

Nanoparticles released from various nanotechnology-enhanced consumer products will inevitably enter our sewers and wastewater treatment plants (WWTPs). This project evaluated how silver nanoparticles would affect wastewater treatment systems and anaerobic digestion. The researchers set up several lab-scale wastewater treatment modular units using activated sludge processes designed to remove organic matter and nutrients in wastewater. The results demonstrated that nitrifying bacteria were especially susceptible to inhibition by silver nanoparticles. At a concentration of 0.4 mg/L total Ag, a mixture of positively charged silver ions and AgNPs (50:50 in mass ratio, average size =15-21 nm) inhibited the growth of nitrifying bacteria from the modified Ludzack-Ettinger

bioreactor by 11.5 percent. In an experiment on shock loading of 100% AgNPs (lasting for 12 hours), a peak concentration of 0.75 mg/L total Ag in the activated sludge basin (more than 95% associated with biomass) was detected, and about 50% nitrifying bacterial growth inhibition (or nitrification inhibition) accompanied with a slight accumulation of nitrite concentration in wastewater effluent was observed. Studies of anaerobic digestion, a commonly used solid stabilization process in wastewater treatment plants, indicate that AgNPs at concentrations of 19 mg/L (19,000 ppb) or above in biomass might inhibit anaerobic microbial activities. Most of the silver particles are in the activated sludge. After considering concentration factor and safety factor, the suggested threshold concentration of total silver including nanosilver in wastewater influent is 0.1 mg/L. This study suggests that accumulation of silver in activated sludge could have a detrimental effect on wastewater treatment, if the concentration reaches threshold levels.



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