Wastewater treatment fails to remove all nanoparticles, new EU study suggests

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Nanomaterials are being used increasingly in the manufacturing industry, but questions remain about the best way to efficiently remove these nanoparticles from industrial wastewater processes or sewage treatment plants. Recent research suggests that some nanoparticles escape from treatment plants and are discharged into water. Studies have suggested that nanoparticles can remain in the environment for long periods and can be toxic to aquatic life. Treated water from sewage plants and waste industrial processes is frequently discharged into aquatic systems, and there is concern that residual nanoparticles present in these effluents could harm aquatic life.

Swiss researchers studied what happened to a common nanomaterial, cerium oxide, when it was added to a laboratory-scale model of a water treatment plant. The model plant contained activated sludge taken from an actual wastewater treatment plant in Zurich. Cerium oxide is used to polish silicon wafers in the computer industry and optical lenses for mobile phones.

The researchers anticipated that the nanoparticles would cluster together to form larger bodies and sink into the sludge, allowing them to be easily removed from the wastewater. However, analysis of both the sludge and wastewater collected from the model plant revealed that a significant number of the nanoparticles had not been removed from the treated sludge. Six percent of the cerium oxide was found in treated effluent that had been washed through the sludge. The researchers suggest this might be because other ingredients found in the wastewater could act like 'surfactants', substances that bind to the outside of the nanoparticles and prevent them from clustering together.

These surfactants could come from the industrial process itself, where they are used to disperse the cerium oxide particles, for example, from proteins found in the sludge or from the bacteria living in the sludge which naturally

secrete chemicals to avoid forming clusters with one another.

In the study, higher concentrations of cerium oxide were used than would normally be found in wastewater from industrial plants. This implies that in normal circumstances there would be less likelihood of smaller concentrations of nanoparticles coming together and sinking in the sludge of commercial plants.

Further studies are required to understand how different nanoparticles behave in water treatment sludge and how they can effectively be removed from industrial wastewater and sewage treatment plants.