Influence of viral aggregation on virus behavior in the environment

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COMMENTARY

The quantity and behavior of viruses in the environment can be significantly influenced by virus aggregates. Viral aggregates can arise in a variety of ways. Viruses can create crystal-like formations and aggregates in the host cell during replication, or they can form after virus particles have been liberated from the host cell due to changes in environmental circumstances. The type of virus, the type of salts in solution (cation, anion, monovalent, divalent), and the pH all play a role in how aggregates develop in the environment. However, the type of virus has a significant impact on the parameters that lead to aggregation/disaggregation, making predictions challenging under any given set of water quality conditions. The majority of research have found that viral aggregates promote virus survival in the environment and disinfection resistance, particularly with more reactive disinfectants. The existence of viral aggregates may cause filtration methods to overestimate viral clearance. Virus aggregation and disaggregation is a complicated process, and predicting the behavior of any individual virus under a given set of environmental conditions is challenging without experimental data. The presence of viral aggregates or aggregates was proposed more than 50 years ago and has been used to explain a variety of virus behavior characteristics such as antibodies failure to destroy viruses in suspension and disinfectant resistance in subpopulations. While various explanations for this effect have been proposed, aggregates appear to be the most popular. Understanding this phenomenon is critical for determining the disinfectant doses required to inactivate infectious viruses, as well as determining the fate and movement of infectious viruses in the environment and their removal by water and wastewater treatment procedures. Viral aggregates can be formed in a variety of ways. Large viral clumps were seen in the inside of infected cells on electron micrographs. Hundreds of virions can be found in such clumps. Picornaviruses, in particular, are produced in densely packed formations within cells. When cells burst, aggregates are most likely released. When released into the intestine, such aggregates may become linked with particulate organic debris. In faeces, large aggregates of adenovirus (whose viral particles have an overall diameter of 7090 nm), rotavirus (6080 nm in diameter), and astrovirus (2830 nm in diameter) with a radius of up to 1000 nm have been reported. Changes in pH, salt concentration, cation type and concentration, natural organic matter, and polyelectrolytes can all cause individual virions in suspension to assemble. Aggregate formation is thought to be influenced by both electrostatic and hydrophobic forces. Viruses in suspension prefer to clump together near or at their isoelectric point, where the virus's charge is near neutral and repulsive electrostatic forces are minimal. Because viruses' isoelectric points range from 1.9 to 8.4, the pH of the water can have a variable effect on the potential for aggregate formation for different viruses. The types of salts used and their quantities have an effect on the virus's charge by lowering repulsive electrostatic charges on the virus's surface. Aggregation is less affected by monovalent cations. It is well known that viruses that are associated with particulate matter have a higher chance of surviving and resisting disinfectants. They can, however, contribute to the creation of viral aggregates.

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