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BACTERIOPHAGES AS TOOLS IN INVESTIGATIONS RELATED TO QUALITY, PRODUCTION AND DISTRIBUTION OF DRINKING WATER

Jonas Långmark
Thor-Axel Stenström
Swedish Institute for Infectious Disease Control, Sweden

ABSTRACT

Bacteriophages (or phages) are viruses that infect bacteria. They exist ubiquitously in the environment and are found in high abundance in aquatic environments. They also occur ubiquitously in the GIT (gastrointestinal tracts) of humans and other warm-blooded animals where they are excreted in high numbers in faeces.

Bacteriophages fulfil increasingly important role as microbial indicators. They share many fundamental properties and characteristics with enteric virions, such as morphology, size (20-60 nm), isoelectric point and genomic nucleic acid. Viewed with the aid of an electron microscope for example, F-RNA coliphages are indistinguishable from enteroviruses. Furthermore, bacteriophages' rates of decay, behaviour in, and resistance to conventional unit water treatment processes are very similar to that for many human enteric virions. Enteric bacteriophages generally outnumber enteric viruses by many orders of magnitude in water environments.

Bacteriophages are a normal component of human and animal faeces and as such are continuously excreted and therefore generally correlate poorly with the numbers of human enteric viruses in water. Thus the presence of bacteriophages in water, whilst inferring likely faecal contamination, does not necessarily infer the presence of enteric viruses of human health concern. It is therefore important to consider the use of bacteriophages not as pathogen index organisms, but rather as models for enteric virus behaviour in aquatic systems.

Bacteriophages of enteric origin generally do not replicate at the low temperatures typically associated with distribution pipe environments. This trait combined with their resistance to environmental stresses and conventional water treatment, makes them a very good conservative model (surrogate) for viruses in different types of studies within drinking water production where they are used as a tool for:

- assessment of virological quality of water,
- pollution source tracking,
- investigating the efficacy of disinfection by chlorination, iodination, UV, ozonation and other antimicrobial agents
- investigating the removal efficacy of different drinking water treatment steps

- assessing the barrier function of different filtration treatments in drinking water production.
- investigating long-term as well as short-term incorporation of particles of nano-size within the structure of biofilms in drinking water distribution systems.