

Summary Findings - STRIVE Report No. 109

Norovirus in wastewater and shellfisheries

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Abstract Norovirus is a leading cause of gastroenteritis in humans. This report describes the survival of Norovirus (NoV) through wastewater treatment, in the aquatic environment, and subsequent uptake in oysters. As NoV cannot be grown, recently developed molecular methods were used to determine NoV concentrations in wastewater and oysters. Results obtained using these molecular tools were placed in context by comparing with them with results for a surrogate virus for which an infectivity assay was available. The project increases our knowledge of the impact of NoV in wastewater effluent in shellfisheries in Ireland.

Key Words Norovirus, wastewater, treatment, real-time PCR, shellfish, oysters, FRNA bacteriophage

Background

Norovirus is a leading cause of gastroenteritis in the community and it is found in high concentrations in municipal wastewater. Bivalve molluscan shellfish such as oysters are filter-feeders and can become contaminated with human pathogens including NoV when grown in areas impacted by municipal wastewater discharges. Wastewater treatment is a critical control point used to reduce the extent of pathogen discharge into aquatic environments. The survival of a number of bacterial and viral pathogens in wastewater is extensively studied. However, little information is available for NoV. This is principally because, despite numerous attempts, it is not possible to grow NoV. More recently, robust and accurate molecular methods for quantifying NoV have become available. This project used these methods to directly measure NoV survival in wastewater and concentrations in oysters. In addition concentrations of a surrogate for NoV, namely FRNA bacteriophage, that can be cultured was also monitored.

Key points

- Molecular methods used in the project were found to be inappropriate to determine NoV reductions in wastewater because they detect both infectious and non-infectious virus.
- Bacteriophage used as a surrogate for infectious NoV virus demonstrated that an approximate 4 log (99.99%) reduction of infectious virus can be achieved by wastewater treatment and UV disinfection.
- Untreated wastewater contained significantly greater concentrations of infectious virus than treated wastewater. This has implications for combined sewer overflow discharges which contain dilute untreated wastewater.
- Despite the fact that the current method for NoV quantification detects both infectious

and non-infectious virus particles it has been demonstrated that an increasing NoV concentration in oysters relates to an increasing risk of illness. Therefore NoV concentrations in oyster growing areas can provide an appropriate index of the relative risk to consumers from contaminated oysters.

Findings /Recommendations

- The currently available molecular method for detecting NoV is not an appropriate means of assessing the effectiveness of wastewater treatment to reduce infectious NoV in wastewater. Therefore development of methods that distinguish between infectious and non-infectious NoV particles is required.
- Combined sewer overflow effluent contains higher numbers of infectious virus than treated effluent and current operational guidelines for combined sewer overflows should be assessed to establish the impact in shellfisheries.
- Guideline operational criteria for virus reduction during wastewater treatment including disinfection should be established in WWTPs impacting shellfisheries. Operational criteria could be based FRNA bacteriophage (infectious virus) reduction.
- In addition to limiting the extent of NoV contamination of oysters a wider risk-based management approach to controlling risk is required. NoV monitoring in oyster growing areas could assist this process. Guidelines to control the risk associated with NoV contaminated oysters should be developed by the relevant state agencies.

For Further Information

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This report is published as part of the EPA Science, Technology, Research and Innovation for the Environment (STRIVE) Programme 2007–2013.

<http://www.epa.ie/pubs/reports/research/water/strive109-norovirusinwastewaterandshellfish.html>

Publications connected to this Research

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