Norovirus Surrogates: Feline, Murine or Human

**Situation:**

Human Noroviruses are estimated to be responsible for up to 95% of nonbacterial epidemic gastroenteritis worldwide. Norovirus outbreaks occur most commonly in semi‐closed communities such as nursing homes, schools, hospitals, cruise ships and military settings. Noroviruses are small, round non‐enveloped viruses that are stabile in the environment and are innately more resistance to chemical microbicides.

Developing test methods for determining efficacy of microbicides can be difficult as the organisms of interest cannot always be reliably cultured in the lab. As a result surrogate organisms that show genetic and stability similarities are used.

**How are disinfectants tested for efficacy against Norovirus?**

At present there is no recognized cell culture infectivity model for testing efficacy against Human Norovirus. Efficacy testing relies on the use of viral surrogate models. A number of factors are considered in selecting a surrogate microorganism such as (a) safety for lab workers, (b) ease of culture and quantitation in the lab, (c) relative resistance to physical and chemical agents, (d) stability in the ambient environment and (e) a reasonable fast turn‐around of test results.

Feline Calicivirus (FCV) is currently accepted around the world as the representative surrogate. FCV is primarily a respiratory pathogen in cats and is found mainly in respiratory secretions. It is also found in cat feces, which can play a role in FCV spread. FCV is also known to infect dogs where it can cause acute diarrhea, thereby making FCV a very suitable surrogate for Human Norovirus for use in efficacy testing of disinfectants.

In recent years, Murine (Mouse) Norovirus (MNV) has also been suggested as a suitable surrogate and shows greater genetic similarities, pathological and environmental stability to Human Norovirus. MNV can be cultured in the lab. While there are greater genetic similarities between Murine Norovirus and Human Norovirus, Murine Norovirus appears to be less stable and less resistant to microbicides than FCV.

The debate on which virus is a better surrogate for the Human Noroviruses is likely to continue for some time to come. The reality, however, is that the moment you grow a virus in the lab you alter its surroundings and characteristics, including its susceptibility and its resistance to physical and chemical agents.
Why is efficacy testing not conducted using the Human Norovirus (HNV)?

A well-established and easy-to-use system to reliably grow and measure the infectivity levels of Human Norovirus is not commercially available. Recently, Straub et al. (2007) reported the growth of a Human Norovirus in a three-dimensional cell culture model; however, no published information is yet available using this system to test chemical microbicides against the Human Noroviruses.

Prevention and Control of Norovirus using Disinfectants:

Routine cleaning and disinfection of the patient’s surroundings should be done daily to reduce bacterial and viral load. Using a Health Canada or EPA approved hospital grade disinfectant with efficacy against Norovirus is an important part of minimizing the risk of environmental transmission. Surfaces in the patient room such as tables, bed rails, bedside commodes, wheelchairs and other assistive devices should be cleaned and disinfected. It is important to note, that not all hospital grade disinfectants contain detergent properties to aid in the cleaning process nor are all disinfectants good cleaners. If the product is not a good cleaner (manufacturer should be able to provide cleaning efficacy data upon request) a cleaning step using a detergent before applying the disinfectant should be considered.

Sharing of non-critical equipment (such as thermometers, blood pressure cuffs, and intravenous poles) should be not permitted. If use of common equipment or items is unavoidable, then the equipment must be cleaned and disinfected thoroughly before use on another patient. When a patient has been discharged from a room terminal cleaning should include changing the bedside curtains.

Implications for Accelerated Hydrogen Peroxide:

Accelerated Hydrogen Peroxide has gained a reputation for being the most effective and safest disinfection product on the market. Unlike most disinfectant technologies, AHP is a very good cleaner as well as an effective disinfectant that carries a 30-second Broad-Spectrum Sanitizing claim that provides a 5-Log reduction (99.999% kill) against gram positive and gram negative vegetative bacteria. Allowing the surface to remain wet for the appropriate disinfection contact time (1 to 5 minutes depending on formulation) provides a 6-Log reduction (99.9999% kill) against vegetative bacteria and a 3 Log reduction (99.9% kill) against both enveloped (easy to kill such as Influenza) and non-enveloped (difficult to kill such as Norovirus) viruses required to achieve terminal disinfection. Additionally, at the use dilution, AHP is non-irritating to skin and eyes, free of volatile organic compounds, fragrances and dyes which in turn makes it very user friendly and environmentally preferable.

Accelerated Hydrogen Peroxide’s efficacy against FCV, MNV and HNV:

All DIN and EPA registered Hospital Grade Disinfectants based on AHP carry a Norovirus claim and have been proven to be effective against FCV. In fact, peer reviewed studies that support these claims have been published in the Canadian Journal of Infection Control (CJIC) and the American Journal of Infection Control (AJIC) as well as numerous articles in Industry Trade Magazines supporting the use of AHP during Norovirus Outbreaks on cruise ships.
With the introduction of MNV as a possible surrogate against Norovirus, to ensure that AHP-based products remain on the cutting edge, Virox has conducted efficacy testing against MNV. The study was conducted by the Centre for Environmental Microbiology (CREM), an independent third party laboratory. The results concluded that the AHP-based surface disinfectants were effective against MNV.

Lastly, AHP has been included in a recent study conducted on various Norovirus strains by Dr. William Rutala who is both a Professor in Infection Control at the University of North Carolina at Chapel Hill as well as the Director of Hospital Epidemiology, Occupational Health and Safety Program at the University of North Carolina Hospitals. Dr. Rutala’s study compared the efficacy of various disinfectant chemistries against Murine Norovirus and Human Norovirus. The study which has been submitted for publication, but was presented at the 2008 APIC Conference in Denver, CO, showed that Accelerated Hydrogen Peroxide was effective against both viral strains.

References:

A Product based on accelerated and stabilized hydrogen peroxide: Evidence for broad-spectrum germicidal activity, Syed A. Sattar, PhD and V. Susan Springthorpe, M.Sc.
Excerpt: “Accelerated Hydrogen Peroxide (AHP) contains ingredients which are considered safe for humans & benign to the environment. This product has superior cleaning power and increased germicidal potency and has numerous potential applications where cleanup & disinfection are crucial. The product diluted at 1:16 can be used as a general purpose disinfectant (products sold under Virox 5, Percept, Accel, Peroxigard)” pg. 6 & 7

Broad-spectrum microbial activity, toxicologic assessment, and materials compatibility of a new generation of accelerated hydrogen peroxide-based environmental surface disinfectant, N. Omidbakhsh, B.Sc, Virox Technologies Inc.
Excerpt: “Accel TB (also sold under Oxivir TB, Optim 33TB, Carpe Diem TB) showed a high safety and materials compatibility profile in addition to being a fast acting, intermediate-level disinfectant” pg. 1

Evaluation of the Effectiveness of a 0.5% AHP RTU Against Murine Norovirus, Syed A. Sattar, Ph.D.
Excerpt: “The test product was able to bring about a >4 log10 reduction in the viability titre of the virus in a contact time of 5 minute at ambient temperature, indicating virucidal activity against this virus.” pg. 3

Evaluation of the Effectiveness of a 0.5% Formulation of Accelerated Hydrogen Peroxide (AHP5) Against Human Rhino Virus Type 14, a Feline Calicivirus and a Human Rotavirus, Syed A. Sattar, M.Sc., Dip. Bact., M.S., Ph.D., RM (CCM)
Excerpt: “AHP (Virox 5, Percept, Accel, Peroxigard) was able to bring a >3Log reduction in the viability titre of Human Rhinoirus, Feline Calicivirus, and Human Rotavirus” pg. 5 & 6

Some Disinfectants Effective Against Feline Calicivirus (as a surrogate for Norovirus), Robert E. Wheeler, MD, FACEP
Excerpt: “AHP (products sold under Virox 5, Percept, Accel, Peroxigard) brought a >4Log reduction against Feline Calicivirus with a 2 minute contact time versus competitive products”