Novel methods to assess the effectiveness of individual disinfectants

Disinfectants are crucial in the fight against infectious diseases. However, it is often unclear which is the best disinfectant for the job. Professor Daisuke Sano of Tohoku University, Japan has developed culture-independent methods to evaluate the effectiveness of an individual disinfectant, olanexidine gluconate. Prof Sano and his research team suggest that olanexidine gluconate is effective against a wide range of viruses, including norovirus, and works on both human skin and environmental surfaces. This suggests that olanexidine gluconate has the potential to play a key role in infection control.

The importance of keeping surfaces and hands clean to minimise transmission of infectious diseases is well known. Disinfectants – substances that destroy pathogens such as bacteria, viruses, and fungi – are often used to help control the spread of infectious diseases. Different disinfectants are used for different purposes and the choice of chemical depends on the type of pathogen that is being targeted. For example, disinfectants can be based on a variety of chemicals such as alcohols, aldehydes, phenols, acids, iodine, or chlorine. Some disinfectants may not be chemical based, such as ultraviolet light (the same light emitted by the sun) or heat. However, less is known about the effectiveness of these individual disinfectants. In order to test how well a disinfectant works, an appropriate evaluation system is required – for example, by growing bacteria in a lab which the disinfectant can be tested against.

Professor Daisuke Sano and his team at Tohoku University have built several evaluation systems to inform decisions about which disinfectants should be used for certain pathogens. One example of this was for human norovirus, a gut bug which causes vomiting and diarrhoea. There is currently no therapeutic agent or vaccine that can treat or prevent human norovirus infection; therefore, most emphasis is placed on disrupting routes of viral infection, such as transmission via contaminated surfaces or human hands. Despite this, no hand antiseptics have yet proven completely effective against norovirus.

A NOVEL ANTISEPTIC AGAINST HUMAN NOROVIRUS

Olanexidine gluconate (OLG) is a novel compound used in the field of medical surgery in Japan. They developed an OLG-based hand antiseptic and tested its efficacy against human norovirus. They investigated five different materials based on a variety of different OLG, ethanol (alcohol), and pH formulations, including several hand rubs and a liquid that could be used to clean skin before surgery. Prof Sano also explained that there is not a simple culture system that can be used for norovirus, making it difficult to evaluate suitable disinfectants. The researchers developed a system that did not rely on an ability to culture the virus, allowing them to identify a disinfectant that is effective against human norovirus. Instead, they have a robust outer shell protein which may make them less susceptible to other stressors, such as heat and chemicals.

CULTURE-INDEPENDENT METHOD FOR EVALUATING DISINFECTANTS

This culture-independent technique involved a process using RNase A and photo-reactive DNA-binding dye before quantitative reverse transcription polymerase chain reaction (RT-qPCR). This acts as a measure of viability; in other words, the amount of undamaged, and likely infectious, virus in the sample. In order to correlate the results of the RT-qPCR assay with viral infectivity levels, the researchers used a mouse norovirus which could be cultivated to create a standard curve that linked the RT-qPCR results with the level of virus in the sample.

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wiping surfaces, and used it to evaluate effectiveness against enveloped viruses.

In this study, the research group tested how well OLG worked as an environmental disinfectant on a non-porous surface, as well as its effectiveness against different strains of enveloped viruses. To begin with, they tested how well the disinfectant performed under laboratory conditions, where it was added into a liquid containing enveloped viruses. OLG was tested against five different enveloped viruses grown in cells in the laboratory: human coronavirus, feline coronavirus, influenza virus, herpes virus and respiratory syncytial virus. A small amount of the virus suspension was mixed with either OLG or a control substance containing no viricidal properties, and incubated with either OLG or a control substance at room temperature. After this, a variety of techniques were used to determine how many of the virus particles had survived this incubation phase.

The researchers then tested OLG on a stainless-steel surface and evaluated the effectiveness of OLG against feline coronavirus at 3 time points (1, 5 and 10 minutes) after application and 3 time points after the surface had been wiped. They also looked at how long the antiviral abilities of OLG lasts by allowing the disinfectant to dry out on a surface before coming into contact with the virus.

Prof Sano explains that using a variety of different exposure methods is likely to be a more accurate representation of how well OLG works, as it has greater similarity with how the disinfectant would be used in a real-life scenario. The results showed that OLG was indeed effective against the variety of enveloped viruses that it was tested against.

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Through novel evaluation systems, Prof Sano has shown that the antiseptic molecule, OLG, is effective against enveloped and non-enveloped viruses.

OLG is a promising antiviral disinfectant candidate, because it is effective on both skin and surfaces.