New study discovers copper destroys highly infectious norovirus

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Dr Sarah Warnes and Professor Bill Keevil.

Scientists from the University of Southampton have discovered that copper and copper alloys rapidly destroy norovirus – the highly-infectious sickness bug.

Worldwide, norovirus is responsible for more than 267 million cases of acute gastroenteritis every year. In the UK, norovirus costs the National Health Service at least £100 million per year, in times of high incidence, and up to 3,000 people admitted to hospital per year in England.

There is no specific treatment or vaccine, and outbreaks regularly shut down hospital wards and care homes, requiring expensive deep-cleaning, incurring additional treatment costs and resulting in lost working days when staff are infected. Its impact is also felt beyond healthcare, with cruise ships and hotels suffering significant damage to their reputation when epidemics occur among guests.

The virus is highly infectious and can be contracted from contaminated food or water, person-to-person contact, and contact with contaminated surfaces, meaning surfaces made from copper could effectively shut down one avenue of infection.

The study, which was designed to simulate fingertip-touch contamination of surfaces, showed norovirus was rapidly destroyed on copper and its alloys, with those containing more than 60 per cent copper proving particularly effective.

Copper alloys have previously been shown to be effective antimicrobial surfaces against a range of bacteria and fungi. The Southampton research reported rapid inactivation of murine norovirus on alloys, containing over 60 per cent copper, at room temperature but no reduction of infectivity on stainless steel dry surfaces in simulated wet fomite and dry touch contamination. The rate of inactivation was initially very rapid and proportional to the copper content of alloy tested. Viral inactivation was not as rapid on brass as previously observed for bacteria but copper-nickel alloy was very effective.

One of the targets of copper's antimicrobial activity was the viral genome and a reduced number of the gene for a viral encoded protein, VPg (viral-protein-genome-linked), which is essential for infectivity, was observed following contact with copper and brass dry surfaces.

Lead author Sarah Warnes, from the Centre for Biological Sciences at

the University of Southampton, says: "The use of antimicrobial surfaces containing copper in clinical and community environments, such as cruise ships and care facilities, could help to reduce the spread of this highly infectious and costly pathogen.

"Copper alloys, although they provide a constant killing surface, should always be used in conjunction with regular and efficient cleaning and decontamination regimes using non-chelating reagents that could inhibit the copper ion activity."

Co-author Professor Bill Keevil, from the University's Institute for Life Sciences, adds: "Although the virus was identified over 40 years ago, the lack of methods to assess infectivity has hampered the study of the human pathogen.

"The virus can remain infectious on solid surfaces and is also resistant to many cleaning solutions. That means it can spread to people who touch these surfaces, causing further infections and maintaining the cycle of infection. Copper surfaces, like door handles and taps, can disrupt the cycle and lower the risk of outbreaks."

The study 'Inactivation of norovirus on dry copper alloy surfaces' is published in the latest issue of the journal *PLOS ONE.*

Previous laboratory studies by the University of Southampton have described the rapid death of bacterial, fungal and viral pathogens such as MRSA on copper alloy surfaces and also prevention of antibiotic resistance horizontal gene transfer between pathogens.

More information: www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0075017

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