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Investigating Anti-Bacterial and Anti-COVID-19 Virus Properties and Mode of Action of Pure Mg(OH)2 and Copper-infused Mg(OH)2 Nanoparticles and Coated Polypropylene Surfaces

Robust anti-microbial surfaces that are non-toxic to users have widespread application in medical, industrial, and domestic arenas. Magnesium hydroxide has recently gained attention as an anti-microbial compound that is non-toxic, biocompatible, and environmentally friendly. Here we demonstrate melt compound and thermally embossed methods for coating polypropylene with Mg(OH)2 nanoplatelets and copper-infused Mg(OH)2 nanoplatelets. Polypropylene articles coated with Mg(OH)2 nanoplatelets and copper-infused Mg(OH)2 nanoplatelets exhibit a log 8 kill of E.coli within 24 hours. In addition, Mg(OH)2 NPs suspension, at 0.25% reduced SARSCoV-2 virus titers in the solution by 2.5 x 103 PFU/mL or 29.4%, while the Cu-infused Mg(OH)2 NPs suspension, at 0.25% reduced titers by 8.1 x 103 PFU/mL or 95.3%. Fluorescence microscopy revealed that reactive oxygen species (ROS) are produced in bacteria in response to Mg(OH)2 and Cu-infused Mg(OH)2 nanoplatelets which appears to be an important but not the sole mode of anti-microbial action of the nanoplatelets. Plastics with anti-microbial surfaces from where biocides are non-leachable are highly desirable. This work provides a general fabrication strategy for developing anti-microbial plastic surfaces.

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A Low-cost High-throughput Targeted Sequencing for the Accurate Detection of Respiratory Tract Pathogen

Introduction: The current gold standard for SARS-CoV-2 diagnosis by real-time RT-PCR has limitations of gene numbers that can be detected. In this study, we developed a low-cost and high-throughput next-generation sequencing technology that can overcome the limitations of RT-PCR.
Methodology: A targeted sequencing panel (TSP) consisting of approximately 500 amplicons was designed that can simultaneously detect a broad range of gene loci of SARS-CoV-2 and genes for the most common viruses of respiratory infectious viruses in a single run of up to 96 samples. 448 samples and 31 control samples were examined independently with both TSP and RT-PCR, results were compared for accuracy and other indicators.
Results: TSP identified 50 SARS-CoV-2 positive samples with a 99.33% match to RT-PCR results. It is not surprising that TSP also identified multiple viral infections from 96 samples, whereas RT-PCR could not. TSP demonstrated its ability to conclude diagnosis for those undecided from RT-PCR tests.
Conclusion: Our data demonstrated that TSP is a fast and accurate test for detecting multiple pathogen infections of the respiratory tract.
