MITIGATION - SCIENCE AND TECHNOLOGY ADVANCES FOR CHEMICAL AND BIOLOGICAL HAZARD MITIGATION

Renewable Antimicrobial Paints For Interior Surfaces

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Mold infestation of painted surfaces of DoD infrastructure, housing, healthcare, and other facilities is a long-standing problem and has been identified as a grave risk to the health and safety of servicemembers and their families. Bacterial and virial pathogens, whether weaponized or endemic, pose a threat to military and civilian workers in these facilities. Furthermore, individuals who suffer from allergies can be sensitized by some aerosols, which heighten their immune response through prolonged exposure.

Sick Building Syndrome (SBS) and widespread mold contamination in warm and humid environments adversely affect public health, operational efficiency, mission readiness, and the effectiveness of personnel. In the case of mold, patients who acquire infections while receiving care are not covered under insurance plans, which passes the cost and burden of care onto the provider. SBS was also a factor in the spread of SARS-CoV (2003) and norovirus. With the COVID-19 pandemic and seasonal influenza, there is increased interest in developing and implementing technologies that can clean and decontaminate the air of indoor facilities.

Self-cleaning surfaces can limit these SBS issues, but many longtime antimicrobial additives used in paints are being prohibited due to concerns over bacterial resistance and possible harm to human health. Our team developed a solution to reduce indoor spaces' microbial risk, with a particular emphasis on mold contamination. We developed antimicrobial formulations, which can be added directly to commercial-off-the-shelf water-based acrylic paints. a few of which have been evaluated by external laboratories and shown promise in reducing colony and spore counts for multiple species of bacteria and mold, respectively. One such formulation relies on the in-situ production of chloramide compounds. This class of heterocyclic organic molecules has a long history in decontamination, preservation, water purification and has been grafted onto textiles to produce self-decontaminating materials to protect against chemical and biological threats (Salter, 2009; Ren, 2009; Sun, 2008). The chemistry is relatively simple, and the mechanism relies on the principal compound’s ability to store stable, oxidizing chlorine that is active via direct contact with microbials. In the case of paints and other coatings, the surfaces can be reactivated using a quick wipe with a dilute solution of household bleach. The frequency of this recharge cycle can vary, but in typical indoor spaces, one to two times per year is sufficient to maintain surface efficacy. Preliminary lab trials have demonstrated reduction in colony forming units or spore count for multiple species of bacteria and fungi, while five field trials established extensive periods with no mold growth in multiple venues, one of which has persisted for over three years. The coatings would be useful in reducing the exposure cross section of CB threats such as fugitive emissions or transmission of infectious aerosols between DoD personnel.

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