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Rapid Energetic Medical Instrument Sterilization (remis)

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Sterilization of medical tools is typically achieved via an autoclave, which exposes the items to high temperature and steam for an extended amount of time (60-180 min). Another method includes chemical vapor sterilization, such as with ethylene oxide or hydrogen peroxide. These methods, while effective, are time consuming and require bulky equipment and a continuous supply of power and water, thus limiting the practical use of these systems in field hospital settings and other austere environments. The long cycle times and limited quantity of surgical kits can result in a critical shortage of sterile instruments during mass casualty situations. Sterile storage conditions in austere environments also present unique issues due to storage containers (plastic, paper, etc.) being easily damaged and losing sterility prior to use. According to the Bureau of Medicine and Surgery (BUMED), studies on future conflicts show an urgent need for methods that expedite care in mass casualty settings. There is an expeditionary medical need for innovative, rapid sterilization methods to improve surgical equipment turn-over capabilities and reduce potential infectious complications. The development of a power-free, energetics-based device for rapid (≤ 5min) sterilization of surgical instruments and hardware could support this need.

Recent efforts funded by the Defense Threat Reduction Agency (DTRA) at Naval Surface Warfare Center Indian Head Division (NSWC IHD) focused on the development of energetic-based formulations that provided rapid neutralization of biological agents with an aim of countering biological weapons of mass destruction. Utilizing this prior knowledge of rapid defeat energetic formulations, NSWC IHD developed a program that utilizes an energetics-based device for rapid sterilization of surgical equipment called Rapid Energetic Medical Instrument Sterilization (REMIS). REMIS' approach uses energetic materials and water to create an extremely high sustained temperature output along with the production of biocidal chemicals to achieve effective neutralization of biological agents. The scientists at NSWC IHD have teamed up with scientists from National Strategic Research Institute (NSRI) and Johns Hopkins University's Applied Physics lab (JHU-APL) to investigate the potential for utilizing REMIS' approach to support the needs of BUMED surgeons.

Preliminary bio-efficacy testing is being conducted using stainless steel coupons that have been inoculated with either vegetative bacteria or spores, Staphylococcus aureus or Bacillus thuringiensis, respectively. To date, REMIS has shown ≥ 8 log reduction in Sa vegetative cells, and ≥ 5 log reduction in Bt spores after a five-minute exposure to the biocidal formulation. Further system development is underway to improve REMIS' effectiveness against spores.

We would like to acknowledge the U.S. Army Medical Research and Development Command - Combat Casualty Care Research Program for funding the REMIS program.