Decontamination of Category A Viruses on Porous Surfaces and Sensitive Equipment Using Chloride Dioxide

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The need for an on-site decontamination technology for Category A viruses became critically evident after Ebola cases were confirmed in the United States in 2014. Although some hospitals are equipped to handle patients who are infected with Category A viruses including filoviruses (e.g., Ebola and Marburg), arenaviruses (e.g., Lassa, Machupo), and Smallpox, there are very few decontamination options to address the rooms and vehicles that the patient occupied before they were admitted. Autoclaving and incineration, the two most common treatments for disposing of infectious waste, are generally impractical for large furniture and vehicles. In addition, many commercial disinfectants are corrosive or incompatible with sensitive equipment. Decontamination of porous materials, like textiles, upholstery, and carpet is particularly challenging, and transporting large volumes of Category A infectious waste to an off-site treatment facility has inherent safety risks and costs.

In this study a safe, robust, cost-effective, and patented method for generating pure ClO_2 gas was evaluated for its ability to non-destructively decontaminate hard surfaces, porous materials, and sensitive equipment. A novel gas dispersion system using a ClO_2 generating micro-reactor was developed and tested under a simulated setting. Full-scale ClO_2 demonstrations showed consistent inactivation of >4-logs of Phi6 bacteriophage virion (a surrogate of the Ebola virus) within 10 hours on contaminated porous and non-porous materials. The process was also shown to be non-destructive to sensitive items including a lap top computer and mobile phone. Such a system could be utilized for room decontamination for Ebola treatment centers within the U.S., interior decontamination of emergency medical service (EMS) vehicles used to transport Ebola patients, interior decontamination of infectious waste transport vehicles, and decontamination of residences (home or hotel room) used by an Ebola patient. In comparison to other fumigation technologies, the proposed ClO_2 generation method is easy to transport, relatively inexpensive, and requires no special training to operate. While the initial targets are Category A viruses, which are rarely seen in the U.S., the technology is applicable to numerous pathogens and markets such as health care, food safety, sports/fitness, and military sustainment.