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Hydrogen Peroxide Gas-Plasma Sterilization Studies on Viruses and Oocysts

Gina Pugliese, RN, MS
Martin S. Favero, PhD

In recent years, a number of newly developed low-temperature sterilization systems have emerged and currently are being used worldwide. In particular, there are approximately 2,200 hydrogen peroxide gas-plasma systems worldwide, with over 1,100 in the United States. A number of studies have been performed on the efficacy of low-temperature sterilization systems against a variety of microorganisms, with the primary emphasis on inactivation of bacterial spores. Vegetative bacteria and some fungi have been tested, but there are few viral inactivation studies. As with other sterilization systems, the assumption is made, and correctly so, that, because the sterilization cycles were validated using bacterial spores resistant to the process, vegetative bacteria and viruses would be inactivated.

In the April 1998 issue of the *American Journal of Infection Control,* two studies are reported on this subject.[1,2] Roberts and Antonoplos conducted studies to determine the capability of a hydrogen peroxide gas-plasma sterilization process (STERRAD, Advanced Sterilization Products, Johnson & Johnson, Irvine, CA) to inactivate several types of viruses. Six test agents were used: HIV type 1, human hepatitis A virus, respiratory syncytial virus, vaccinia, herpes simplex virus type 1, and poliovirus type 2.[1] The test viruses were suspended in cell culture medium and dried on the bottom of sterile glass petri dishes. The inoculated dishes were processed in the hydrogen peroxide gas-plasma system for half the normal sterilization cycle time. Four inoculated carriers for each virus were used in two separate half cycles. Infectivity of the test viruses and cytotoxicity to the indicator cell lines were assayed. The hydrogen peroxide gas-plasma sterilization process produced inactivation of the six viral test agents under these experimental conditions. The reduction in viral titers ranged from 2.5 $\log_{10}$ to 5.5 $\log_{10}$, a 99.68% to 99.999% decrease. The authors concluded that the results clearly demonstrate the virucidal effectiveness of the hydrogen peroxide gas-plasma sterilization process against both lipid and nonlipid viruses.

In another study, investigators from Laboratoire de Parasitologie Experimentale, Centre Hospitalo-Universitaire of Rouen, France, evaluated the hydrogen peroxide gas plasma system for sterilization of endoscopic material contaminated by *Cryptosporidium parvum* using an immunosuppressed rat cryptosporidiosis model.[2] Rats were challenged with oocysts either air-dried, or air-dried and treated with vacuum alone, or air-dried and treated with vacuum associated with gas plasma. No rat was found infected after gas-plasma exposure of oocysts, whereas vacuum or air-drying alone resulted only in a decreased infectivity. The authors concluded that, although oocysts of *Cryptosporidium* are extraordinarily resistant to liquid chemical sterilants, the hydrogen peroxide gas-plasma sterilizer completely inactivated them.

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