Peroxide in nanoparticles is an effective method to disinfect areas contaminated with B-agents

Introduction: The traditional disinfection techniques using wet sprays and wipes do not eliminate the main cause of contamination by bacteria, spores, fungi or even viruses identified as: "the recurrent cycle of contamination". Although the contamination risks in relation to external agents have been clearly identified and treated, it is certainly not the case for the surfaces and their environment: the air. There is a permanent exchange between both the surface and the air, which can be the origin of an important contamination. Especially contamination, which was a result of a bioterror attack.

Study Design: Over a period of two years studies were carried out by Dutch hospitals to disinfect MRSA (multi-resistant Staphylococcus aureus) infected areas, like operation theatres, in the hospital with an innovative H2O2 (hydrogen peroxide) ultra mist generator, the IC-4™. The IC-4™ unit operates on basis of liquid spraying by aid of ultrasonic elements. A special generator operates the ultrasonic elements, an array of ceramic discs. This generator is a kind of electronic switch, generating electronic pulses activating these ceramic discs. These pulses are given with a frequency of ca. 1.7 MHz (1.700.000 Hertz). The ultra sonic elements are placed in a container with the detergent. The detergent (liquid) cannot follow the frequency of the ultrasonic plates and the cavitation phenomenon is seen in the dispersion. A spray containing hydrogen peroxide with ultra small particles is created.

Results and Discussion: The size of these particles is very small (ca. 1µ); its weight very low, followed by an excellent absorption of these particles in the air. No condensate is formed. These particles are attractive for micro-organisms and they absorb them resulting in their own death by the peroxide. The nanoparticle shields the active peroxide towards surfaces and this prevents that surfaces in the treated area are damaged by oxidation. Another feature of the peroxide containing nanoparticles is the fact that no droplets are formed, so it does not show not the so-called "umbrella" phenomena. As a consequence the nanoparticles will also be active behind a barrier and in small holes. Tests were done with bacteria-, spores- and virus-contaminated areas. Reduction rates were above log 5 and these results were also obtained in 'hidden' areas.

Conclusion: The hydrogen peroxide nanoparticles are very effective in the disinfection of MRSA infected hospitals. The system has shown that it can be applied for effective disinfection of contaminated areas with other bacteria, viruses and spores as well. It is to be expected that it will be also effective in contaminated areas after a bioterror attack.
Efficacy of the new *Yersinia pestis* subunit vaccine in animal models of plague

Until recently, the vaccine against *Yersinia pestis*, the etiological agent of plague, consisted of a formalin-inactivated, whole-cell vaccine. The vaccine was discontinued because it apparently only protected the vaccinated host against bubonic plague but not pneumonic plague. We have since found that the whole-cell vaccine only induced antibodies against the capsule F1 protein but not antibodies against the virulence protein (V-antigen) that appears to be required for a robust protection. The new plague vaccine consists of subunits of the F1 capsule protein and V-antigen either as individual subunits or a fusion of the two subunits. The genes for each these proteins are encoded on two separate virulence plasmids; one of the plasmids is specific for *Y. pestis*. Initially, it was proposed that only antibodies against the vaccine subunits were sufficient for protection against an exposure to the pathogen. Part of this reasoning was from studies with immune serum or monoclonal antibodies against the F1 or V-antigen subunits that showed that these sources of antibodies can passively protect an animal against a plague infection. Nevertheless, we have shown that the participation of the innate immune system is required for complete protection against a pneumonic plague challenge with *Y. pestis* CO92 a fully virulent strain of plague. Although it is not completely clear how protection is mediated by the new subunit vaccine, the subunit vaccine has been through a Phase IIA human clinical trial. We will present the efficacy of the new *Y. pestis* plague subunit vaccine in two animal models of plague.

Biography

Amemiya received his doctoral degree from Rutgers University in Microbiology in 1973. He did his post-graduate studies in gene regulation in the laboratory of Lucy Shapiro at Albert Einstein College of Medicine, Bronx, N.Y. Later, he went to the National Institute of Neurological Diseases and Stroke in 1986, where he examined gene regulation in JC virus that caused the demyelinating disease progressive multifocal leukoencephalopathy in immune suppressed patients. In 1999, he went to the U.S. Army Medical Research Institute of Infectious Diseases, Bacteriology Division, where he has been involved in vaccine development for *Burkholderia mallei* and *Yersinia pestis*. His primary interest has been in the immune response and innate immunity in animal models.

kei.amemiya@us.army.mil
Microbial forensics: Present and future

Microbial forensics, emerged from the creation of the first-ever Weapons of Mass Destruction (WMD) forensic investigative program in the FBI Laboratory in 1996. At the beginning, this program was an interagency endeavor involving the FBI, Department of Defense military medical laboratories, Centers for Disease Control and Department of Energy National Laboratories. Today, the forensic characterization and source attribution of biological weapons and associated forensic evidence is a very important priority in U.S. biodefense planning and preparedness. Concomitantly, the Federal interagency involved in this arena has become a “whole of Government” enterprise. The science of microbial forensics draws upon a variety of disciplines and capabilities and is designed, developed, validated and applied to inform investigative, intelligence, legal and policy questions and support decision making. Microbial forensics seeks to address requirements of sound science, but also those of the users of the information. The soundness of the science is an end-to-end proposition, from sample collection through reporting and interpretation of results and communication of conclusions. Microbial forensics is rapidly evolving and has and will continue to leverage advancing methods and technologies developed for other purposes which exploit biological, genomic, biochemical, chemical and physical information of forensic value for both sample characterization and also intercomparison that can be usefully and validly interpreted. Even with powerful current and emerging analytical and knowledge exploitation capabilities, the field is confronted by gaps, opportunities and “grand scientific challenges” which overlap with those of other fields and some of which converge on the limits of scientific knowledge.

Biography

Randall Murch is Professor in Practice at Virginia Tech University. Prior to Virginia Tech, he was with the U.S. Federal Bureau of Investigation for 23 years and served in a variety of investigative, forensic and technical, supervisory and management roles and positions. He is a well-recognized expert in microbial forensics, created the national capability while in the FBI, and has worked with other leaders in government, academia, the National Laboratories and private sector to mature and evolve it. He has published and presented extensively in this field, and others. He holds B.S., M.S. and PhD degrees in the Life Sciences.

rmurch@vt.edu