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“The secret of success is constancy of purpose”

Benjamin Disraeli



Factors Influencing Biocide Effectiveness

Dr. Jean-Yves Maillard
Welsh School of Pharmacy, Cardiff University

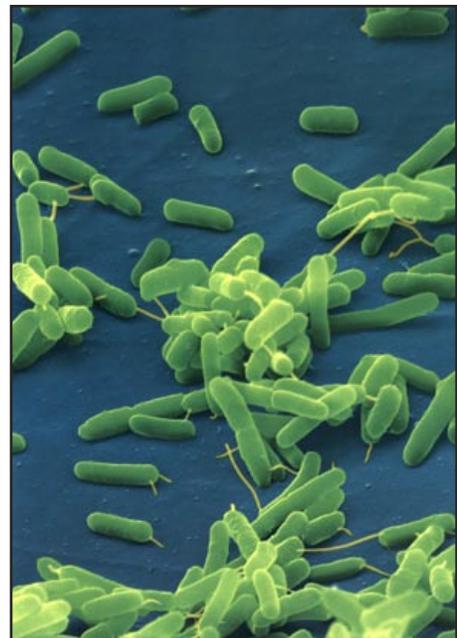
Several factors influence the efficacy of biocides (i.e. germicides) in practice. These factors include for the most important, concentration, contact time, temperature, pH, organic load, but also several others related to the conditions of usage of the products, for example, surface, hard water, etc. These factors have a profound significance for the end-use of antimicrobial-containing products and yet their impact is rarely discussed.

The concentration of a biocide is probably the most important factor affecting activity. There needs to be sufficient concentration of the agent to kill target microorganisms. However, microbicidal efficacy should be balanced with toxicity; indeed high concentration of a biocide will very often result in increased toxicity. The in-use concentration of a biocide depends on the type of chemical and the intended usage - referring to the level of risk to the patient. Failure to be aware of the concentration exponent, that measures the effectiveness of a biocide upon dilution, leads to improper usage, allowing microorganisms to survive causing contamination to a product and possible infection, or creating unnecessarily toxicity to the environment.

After concentration, the contact time of a biocide is most important. The duration of treatment is critical for compliance with hand washing/antisepsis, surface disinfection, and for chemical sterilization. Usually the manufactures of these chemicals state the time that the items must be in contact with the biocide for maximum activity. However, there is often poor compliance with these contact times among nurses and clinicians in hospitals, particularly for hand hygiene and surface disinfection. The results of poor compliance can be devastating, enabling the spread of nosocomial infections, including antibiotic resistant organisms. There is not a straight mathematical relationship between contact time and concentration (ie. a stronger dilution does not enable a shorter contact time), but typically a longer contact time will mean better efficacy.

The effect of temperature over biocidal activity is very often ignored. It is measured by the temperature coefficient, which indicates the increase in activity when the temperature is raised by 1°C. However, for biocides the difference in activity over just 1 degree Celsius is insignificant so the Q10 value is used instead. This measures an increase in activity when the temperature is raised by 10°C. For example, the Q10 value for phenol is 4, meaning that for every 10 degree increase in temperature, the efficacy of the phenol biocide increases by a factor of 4. As comparisons, the Q10 for ethanol is 45, and for ethylene glycol mono-ethyl ester is 300. Practical applications of this are the increased activity of a biocide when combined with

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Stethoscopes and Effectiveness of Disinfection Procedures

Nicole Kenny
Technical Specialist
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Pre-Disinfectant

Post-Disinfectant

The use of stethoscopes in healthcare is universal. Medical students proudly wear them, trophy-like, around their neck. They are a fixture on necks and in pockets of clinical staff in acute care and long term care facilities. On many hospital wards, stethoscopes are shared among ward staff. Stethoscopes come into contact with numerous patients or residents every day, and it would seem likely that they harbor organisms that can be transferred between individuals.

The role of stethoscopes as a vehicle of organism transmission has been recognized in many studies. As early as 1972, Gerken et al described the presence of *S. aureus* on 20% of stethoscopes examined. Two decades later, Breathnach et al (1992) demonstrated that most stethoscopes become contaminated by *Staphylococci* and postulated that they could serve as vehicles of infection. Since then, several publications have supported the theory that stethoscopes are frequently colonized by potential pathogenic organisms yet disinfection of stethoscopes has not yet become established practice.

In a study published in February this year ("Stethoscopes: a study of contamination and the effectiveness of disinfection procedures", Waghorn et al) the authors randomly selected a group of junior medical staff and physiotherapists and asked them to submit their personal stethoscopes for microbiological testing. Also, several communal stethoscopes from patient wards were tested. In all, 41 stethoscopes were examined. All 41 stethoscopes showed evidence of bacte-

rial contamination before disinfection. The level of bacterial growth varied, but the heaviest degree of contamination (>50 cfu) was found on stethoscopes belonging to doctors (64%), compared to 28% of communal ward stethoscopes and 20% of physiotherapists' stethoscopes. This study found that following the use of isopropyl alcohol swabs, stethoscope contamination was greatly reduced, but several heavily contaminated specimens remained heavily colonized after the disinfection procedure. Isopropyl alcohol is known to be inactivated by gross organic soiling and it is likely this factor that allowed contamination to persist. We can speculate that use of a low level surface disinfectant with rapid action, no residue, and no toxicity in in-use dilutions would more significantly reduce even the heavily contaminated stethoscopes.

It is widely recognized that stethoscopes become colonized with mainly gram-positive bacteria in the hospital environment. They may therefore act as both reservoirs and vehicles of potentially infectious agents. In one report (Bernard et al, 1999), only 22% of stethoscope users polled admitted cleaning their stethoscopes regularly. Nunez et al (2000) found, on the other hand, that 45% of clinical staff cleaned their stethoscopes "annually or not at all".

The practice of disinfecting or sanitizing stethoscopes between each patient examination requires more aggressive promotion. Easy access to appropriate disinfectants in liquid or wipe format should be maintained. Clinical staff may require education in the technique of cleaning their stethoscopes to ensure proper decontamination occurs. The introduction of ward or department-specific stethoscopes may also warrant consideration, particularly in clinical areas where the risks from nosocomial infection are high.

Success is relative. It is what we can make of the mess we have made of things.
 - T. S. Eliot

A World First: **AHP** Hand Wash

After several years of collaboration with Virox, Deb Ltd has launched a new hand wash in Europe. Florafree AHP – Foaming Sanitizing Hand Wash is a unique, worldwide patented 3-in-1 foaming hand wash containing Accelerated Hydrogen Peroxide to cleanse, sanitize and condition the skin. Florafree-AHP is proven to kill 99.999% of food poisoning bacteria, moulds & yeasts. Its unique formula is environmentally friendly, perfume free, dermatologically tested and contains skin conditioners to moisturise, re-hydrate and leave the skin feeling smooth after use.

FloraFree®
 skin hygiene



Check out the Deb website at www.deb.co.uk or email enquiry@deb.co.uk for more information on the Florafree-AHP product.

Virox Update

5-Minute High Level Disinfectant DIN Received!

We are very excited to announce that after several years of research & development we have received the DIN number for a new 5 Minute High Level Disinfectant. Please come by our booth at CHICA to pick up information on the new product.

Website Update: www.virox.com

NEW MEMBER SECTION TO LAUNCH! Do you want to be sure you get all the updates on Virox? Interested in being included on all of the invitations to all Virox's FREE education seminars? Log on to www.virox.com and click the Member's Sign-Up icon to enroll!

REVAMP to the COMPATIBILITY SECTION: The past year has proven to be very successful for working directly with a number of different medical device manufactures, healthcare furniture manufactures etc. The compatibility section has been entirely overhauled to include information on materials commonly used to manufacture devices and test reports we have received directly from manufacturers who have tested our products.

Virox prides itself on being a resource tool to the infection control community so please check out our website frequently as new links will be posted regularly.



Nicole Kenny, Virox & Melanee Eng Chong, UHN at SHEA 2005



Robert Belisle of Virox at SHEA 2005, Los Angeles

Conference & Education Spring/Summer Schedule

Virox is honoured to be participating in the following functions:

May 1 & 2 – Esthetique Spa International in Toronto

May 4 & 5 – Canadian Sanitation Supply Association (CSSA) in Toronto

May 5 – 7 – Ontario Dental Association (ODA) in Toronto

May 7 – 11 – CHICA Annual Conference in Winnipeg

May 29 – 31 – AIPI in Chicoutimi

June 16 – HANDIC Education Day in Hamilton

June 19 - 23 – APIC in Baltimore

June 25 – 28 – CALAS in Vancouver

July 14 – 16 – Educational Marketing Association Workshop in Ottawa

Virox is very excited about participating in so many conferences & education days. We wish the best to all of the various organizers and would like to thank them for their dedication and effort in organizing these very important educational opportunities. We look forward to attending and talking to all of the participants.

2005 Speakers' Series

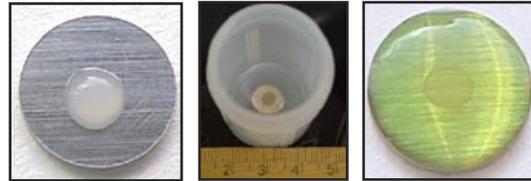


On June 8th, 2005 Dr. Michael Gardam, Director Infection Prevention & Control for University Health Network will conduct a talk on Pandemic Influenza: Are We Prepared? The seminar will be held at the Hilton Garden Inn in Oakville in order to provide seating capacity for as many people as possible. To ensure you are included in the notification email for this event please contact Nicole Kenny at 1-800-387-7578 x118 or by email at nkenny@virox.com.

The greatest use of life is to spend it for something that outlasts it.
- William James

Carrier Tests to Assess Microbicidal Activities of Chemical Disinfectants for Use on Medical Devices and Environmental Surfaces

Susan Springthorpe and Syed A. Sattar, Centre for Research on Environmental Microbiology
Faculty of Medicine, University of Ottawa



The current microbicide test methods of AOAC International have numerous design flaws. This is particularly true for evaluating disinfectants meant for use on medical devices and environmental surfaces. To address these concerns we have developed simpler, more stringent and quantitative carrier test (QCT) protocols for the purpose; a recent report discusses these issues in detail (Journal of AOAC International, Vol. 86 (1), 182-201, 2005).

Microbial contaminants on environmental surfaces and medical devices are often in a dried state and their decontamination

is thus more difficult than when the microbes are in suspension. Any label claims for microbicidal activity must, therefore, be based on test protocols using representative carriers with dried inocula. Our approach is a 2-tiered QCT. In the first tier (QCT-1) the relatively smooth surface of glass is used with an excess (1 mL) of the test microbicide. The second tier (QCT-2) is more stringent as it uses disks of brushed stainless steel as carriers, only 50 microlitres of the test formulation on each carrier and an added soil load to simulate the presence of residual body fluids or accumulated surface dirt.

The review mentioned above discusses the factors that affect disinfection in general and their relevance to the design and performance of microbicide test protocols. Product performance criteria as well as several recommendations are also included for consideration by manufacturers, regulators, researchers and end-users. It is hoped that the review and its recommendations will initiate needed discussion and resolution of the many issues identified.

Infection Control Field Trip **Bolivia** March 4-11, 2006

Dr. Esther Damiani of the Bolivian National Institute for Health Laboratories, and Paul Webber of Webber Training Inc invite you to spend a week with infection control professionals in Bolivia. During your time there you will teach about your technique for managing infectious disease transmission, and you will learn about infection control in Bolivian healthcare facilities. You will get to know your fellow ICP's in Bolivia, work with them in their hospitals and community health clinics, and share many social experiences. You will also have an opportunity to explore this mystical South American nation.

Of particular interest are presentations on;

- Infection Prevention for Invasive Procedures
- Neonatal Sepsis
- Environmental Surface Decontamination
- Instrument Reprocessing



March 4-11, 2006 Lapaz, Bolivia

For More Information Contact Paul Webber
800-363-5376 • paul@webbertraining.com
Registration Deadline: January 16, 2006



AHP vs. Enzymatic Cleaners for Medical Devices

Excerpted from "A new hydrogen peroxide-based medical device detergent with germicidal properties: Comparison with enzymatic cleaners", by M. Alfa and M. Jackson

Hydrogen peroxide acts as an oxidant whose hydroxyl free radicals kill a wide range of microorganisms by attacking essential cell components, including lipids, proteins, and DNA. This compound does have sporocidal activity at high concentrations and prolonged contact times and is widely used as a biocide. The value of accelerated hydrogen peroxide (AHP) as an environmentally friendly cleaning agent has been reported, although it can be corrosive to aluminum, copper, brass, or zinc. The KDS formulation of accelerated hydrogen peroxide was evaluated, combined a 5-log killing ability with effective cleaning within a realistic exposure time, which makes it an ideal detergent for the reprocessing of medical devices.

The surface carrier analysis and simulated-use data indicated that KDS at 3 minutes of exposure time at RT was as effective a cleaning detergent as Metrizyme or Gzyme at their manufacturer's recommended exposure time (10 minutes and 3 minutes, respectively). The soil parameters assessed during the cleaning evaluation included protein, hemoglobin, carbohydrate, and lipopolysaccharide (endotoxin). The AT5-B test soil used in this evaluation has been formulated to provide a protein, hemoglobin, carbohydrate, and endotoxin challenge that is similar to what might be expected if a medical device were exposed to the human respiratory or gastrointestinal tract. Furthermore, despite the presence of the dried organic/inorganic soil challenge, KDS was significantly more effective at killing microorganisms including *E faecalis* and *S aureus* when compared with Gzyme. Although KDS was also more effective at reducing the microbial load compared with Metrizyme, it did not reach statistical significance. One area of concern might be that organisms capable of producing catalase might be expected to be more resistant to a disinfectant that contains hydrogen peroxide. However, our data indicate that even though *S aureus* produces catalase, it is still reliably killed by KDS. Because the gram-negative organisms were killed from the drying process and washed off more

readily, it was not possible to perform statistical analysis on the post-detergent data for the surface carriers. The organic/inorganic challenge and the overnight drying conditions used in this study are even more harsh than those reported by Sattar et al or Rochon and Sullivan in their evaluations of accelerated hydrogen peroxide. Despite these harsh challenge conditions, KDS effectively killed the organisms tested and facilitated the removal of soil.

Unlike the other detergents tested in this study, KDS has the capacity to kill microorganisms and to clean patient soil from medical devices. This suggests that it would be an optimal detergent to ensure protection of HCWs, and at the same time to provide excellent cleaning. The need to ensure adequate protection of HCWs during the reprocessing of medical devices has recently been widely emphasized. Indeed, personal protective equipment (including gowns, gloves, and face shields) is recommended to reduce the risk of HCW contamination during medical device reprocessing. Having a cleaning agent that also provides microbial killing provides an added margin of safety against accidental HCW contamination. Furthermore, the killing characteristics of this cleaning agent would ensure a minimal bioburden remaining after the cleaning process and should facilitate the subsequent disinfection/sterilization stage for the medical device being reprocessed. In our evaluations, we tested killing ability against 106 cfu/carrier for surface evaluation or 108 cfu/mL for the inoculation of an endoscope lumen. The reported bioburden found on surgical instruments after being used with a patient but before being cleaned was often less than 1000 cfu/device; this level remained constant despite cleaning, although the type of contaminating organisms that were detected often changed from patient-derived to water-derived. Narrow-lumened endoscopes have higher levels of organisms, reaching as high as 109 cfu/lumen; cleaning could reduce these levels by 3 to 4 Log. Previous reports have indicated that stabilized hydrogen peroxide has low toxicity, low corrosiveness, and good killing ability

against vegetative bacteria, mycobacteria, fungi, and viruses. The data from our current study indicate that KDS, which is an accelerated formulation of hydrogen peroxide, has the ability to effectively kill gram-positive and gram-negative bacteria, even in the presence of a dried organic/inorganic challenge at microbial levels that are similar to those found in patient-used endoscopes. The cleaning efficacy of KDS for medical devices may be enhanced in actual use, since manual cleaning always incorporates brushing to remove soil, whereas our test carrier and suboptimal endoscope cleaning protocols did not include brushing. Although material compatibility was not the purpose of our study, there were no observed adverse effects to the colonoscope material components during the limited course of our studies.

To address the issues associated with wash-off, quantitative data for both the inoculum and the recoverable bioburden have been provided, in addition to quantitation of residual viable organisms after detergent exposure. This allows the determination of the fluid effect and the ability to differentiate the killing effect from the cleaning properties of the solutions being evaluated. In addition, the endoscope testing performed as a part of this evaluation provides simulated-use testing data that meets the "worst-case" testing parameters as outlined by the draft document for washers and washer-disinfectors and high-level disinfectants.

In summary, we have reported data to indicate that the KDS formulation has both effective microbial killing and soil cleaning ability. This type of detergent formulation would provide greater protection to HCWs from the infectious risk caused by aerosols during medical device reprocessing and would reduce the microbial load to which the subsequently used sterilant/high-level disinfectant would be subjected. The addition of microbial killing provides an increased margin of safety not currently found in other detergent formulations. These data support the value of performing in-use testing on this detergent formulation.

Factors Influencing Biocide Effectiveness

Continued from page 1

heat, or the efficacy of a biocide upon storage of an antimicrobial-containing product (and particularly the efficacy of preservatives) in a cool environment.

The effect of pH on antimicrobial activity is complex and can affect the micro-organism as well as the biocide. For some biocides, an increase in pH decreases their activity because their active state is the non-ionised form (e.g. phenols, acetic acid, benzoic acid). For others (e.g. cationic biocides, glutaraldehyde) an increase in pH will enhance their activity because of an increase in ionization of the molecules or an increase in reactivity. In practical application, the pH must be carefully balanced in the formulation containing a biocide to ensure maximum activity but also the stability of the formulation. Important changes in pH (for example, following inappropriate dilution) might affect the efficacy of the biocide but also the formulation of the product.

Organic matter - blood, pus, soiling, milk, etc - is an important factor to consider notably in the healthcare environment. Organic matter or soiling may contribute to a decrease in biocidal activity by absorbing the biocide thereby reducing its effective concentration and by protecting the micro-organisms, for example, by reducing the diffusion of a biocide, decreasing its "bioavailability". The cleaning process, which is the elimination of soiling, is therefore very important, and is usually part of the disinfection policy. Cleaning can be accomplished through mechanical action, or through the combination of a detergent with a biocide. Some biocides may exert mild detergent property (such as quaternary ammonium compounds), and many detergents themselves may exhibit some biocidal activity. Very

often products used to disinfect surfaces are a combination of detergent and biocide.

The micro-organisms themselves, their number and properties will also affect the efficacy of a biocide. For example, bacterial endospores are much more difficult to kill than are enveloped viruses. In addition, bacterial biofilm are often less susceptible to disinfection than planktonic organisms. The biofilm matrix, but particularly the presence of a biofilm phenotype increase biocidal resistance. Microbial growth conditions, i.e. physical (temperature, presence of oxygen, etc) and chemical conditions (presence of nutrients or different ions) will affect their susceptibility to disinfection to some extent.

Finally, the in-use conditions of the biocidal product may affect its overall antimicrobial efficacy. The type of surfaces to be disinfected; its porous state, its nature (animate vs. inanimate), or to some extent its incompatibility (e.g. absorption of quaternary ammonium compounds and phenolics to plastics) may play a role in reducing the effective concentration of the antimicrobial. Likewise, relative humidity (particularly with gaseous biocides), the use of hard water (for dilution) will impact on biocidal activity.

Maintaining high microbicidal efficacy of a biocidal product is not simple, since activity can be affected by a number of factors. A greater understanding these factors is a key for the appropriate design and usage of these antimicrobial products.

Every great and commanding movement in the annals of the world is due to the triumph of enthusiasm. Nothing great was ever achieved without it.

- Ralph Waldo Emerson

Virox is Pleased to Help Support These National Conferences



May 7 -11, 2005

www.chica.org



June 19-23, 2005

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