

APIC Seattle

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Everything You Ever Wanted to Know About Disinfectants: But Were Afraid to Ask

CLEAN FREAK

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Disclosures:

Mr. Hodgson is an Employee of Virox Healthcare, and was formerly an employee of

Bioquell. Mr. Hodgson has provided consulting work for Aquasafe, Ford, NASA,

Clayton Group, BP, NFPG, Veterans Administration, AIG, GE Water, and Johnson

and Johnson

Today's Story

- Why Environmental Hygiene is important
- Perils and Pitfalls of Using Disinfectants
- What do we need our disinfectants to be
- Becoming Chemists
- Finding the Balance



Memorable Quotes

“Healthcare executives must invest in their infection prevention programs. It’s the right thing for patients and it saves hospitals money.”

Kathy Warye, Former APIC CEO

“Sunlight is the best disinfectant,”

U.S. Supreme Court Justice Louis Brandeis



How We Know Disinfection is Not Working

Study	Pathogen	Relative Risk of patient acquiring HAI based on prior room occupancy (comparing a 'positive' room with a 'negative' room)
Martinez 2003 ¹	VRE	2.6
Huang 2006 ²	VRE – prior room occupant	1.6
	MRSA – prior room occupant	1.3
Drees 2008 ³	VRE – prior room occupant	2.2
	VRE – prior room occupant in previous two weeks	2.0
Shaughnessy 2008 ⁴	<i>C. difficile</i> – prior room occupant	2.4
Nseir 2010 ⁵	<i>A. baumannii</i> – prior room occupant	3.8
	<i>P. aeruginosa</i> – prior room occupant	2.1

1. Martinez *et al.* *Arch Intern Med* 2003; 163: 1905-12.
2. Huang *et al.* *Arch Intern Med* 2006; 166: 1945-51.
3. Drees *et al.* *Clin Infect Dis* 2008; 46: 678-85.
4. Shaughnessy. ICAAC/IDSA 2008. Abstract K-4194.
5. Nseir *et al.* *Clin Microbiol Infect* 2010 (in press).



Bugs in the Environment Put Patients at Risk

- Hospitals spend **\$**Hundreds of Thousands**\$** of dollars every year for disinfectants.
- Hospitals spend **\$**Millions**\$** of dollars every year for the labor to apply disinfectants.
 - Yet often fail to achieve disinfection
- Resulting in infections that cost **\$**Tens of Millions**\$** of dollars every year.







Top Disinfectant Offences

Tips on Ensuring we Marry Products with Protocols



“Wax On...Wax Off. Spray On...Wipe Off.” Mr. Miyagi’s Guide to Cleaning and Disinfection.



- Spraying onto a surface does not assist in bug removal, but rather deposits the solution on top of the soil:
 - Does not ensure even coverage.
 - Does not penetrate the soil or biofilm.
 - Difficult to control precisely where the disinfectant or cleaning solution is being applied when sprayed
 - Spraying atomizes the chemical making it much easier to inhale. (and the CDC/AORN does not like it!)
- Applying with a wipe or saturated cloth, we are combining the much needed mechanical friction with the detergent attributes of the chemical to achieve optimal results.



Maintaining a monogamous relationship



- Cleaning techniques required for healthcare facilities are far more complex than is accepted.
- Cleaning requires meticulous attention to detail with a well defined and ordered set of procedures (e.g. clean to dirty, top to bottom, every surface, mobile fomites, who cleans what).
- **Consider chemical reactions between disinfectants, cleaners and disinfectants, and substrates.**



The One for All Army

- Healthcare's definition of a Silver Bullet:
 - A single product that kills everything and can be used on all surfaces floor to ceiling and all equipment including toys!
- Why?
 - Convenience, inventory control, cost control
 - Simplifies training (takes away guess work and worries about lack of communication)
- Pitfall?
 - Far too many other parameters that will be compromised or sacrificed to gain that convenience
 - *Compatibility*
 - *Occupational Health & Safety*
 - *Efficacy*



The Shiny Surface Syndicate



- If it's shiny it must be clean (and free of germs)!
- **THE SYNDICATES'** obsession with shiny surfaces leads them to abandon infection control principles in search of the product; Spic & Span and Windex are two of the most commonly use culprits, that leaves the surfaces all sparkly but not disinfected.
- The upside – people believe the environment is safe because it is so shiny (HCHAPS Points!)
- The downside – using the wrong products puts people at risk for transmitting and acquiring pathogen.



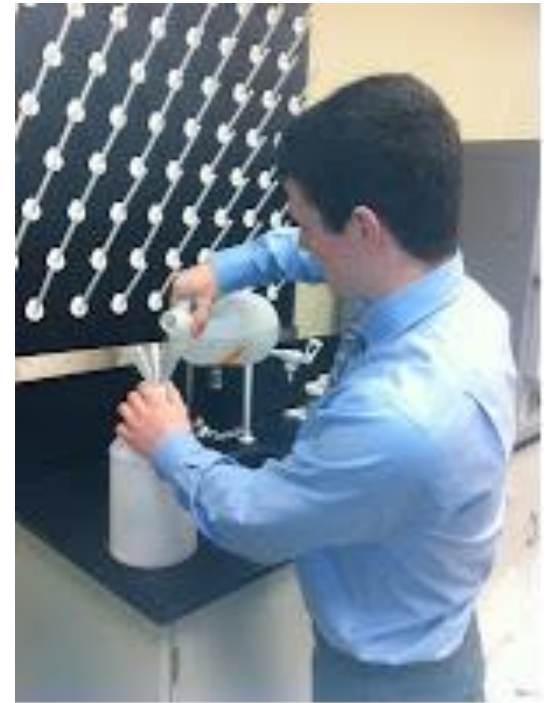
Disband the Glug-Glug Gang

- Don't ignore the label instructions by over or under mixing the cleaners and disinfectants that we intend to use
 - Know the dilution, and dilute properly
 - Verify that automated dilution systems are working (use the (right) test strip)
 - Know the shelf life once diluted
- Do not add more because you think the color is wrong or the product is not foaming enough
- Do not add less to save money!!
- Do not add room deodorizers to make the product smell pretty



Miss Manners' Proper Etiquette for Filling Bottles

- Don't let Top Off Artists get away!
 - By mixing new or fresh with old we could be creating an inferior product.
 - End result is a bottle that does not have the right concentration of disinfectant because new product has been mixed with old.
 - Don't try to save old product, you will have to throw out unused disinfectants (typically at the end of the shift),



More Is Better Bandits

- **MORE IS BETTER BANDIT** believes it if works at the right dilution it will work **EVEN BETTER** if I add more!
 - They also add more because they think the color looks wrong or the product is not foaming enough
 - Runs rampant during pandemics and outbreaks (especially if we are dealing with a new bug) believing that even if they have been told the disinfectant works at a specific dilution and contact time that they annihilate the pesky pathogen by adding more.
- The result often ends in Occupational Health complaints and/or degradation of surfaces being disinfected by using a product that is too concentrated.
- It is a federal offence!!!! The best solution to these bandits could be to call the US Marshal....



The Instruction Ignorers

- Believe that labels are meant for others to read so will use a disinfectant in the way they **THINK** it should be used and not how it was **INTENDED** to be used.
 - Trying to dilute ready-to-use products.
 - Using high level disinfectants designed for surgical instruments on room surfaces.
 - It's a wipe, it must be okay to use for personal hygiene or as a baby wipe!
- There are reasons labels exist so **READ THEM** and most importantly follow the directions!



**It is a violation of Federal Law to use
this product in a manner inconsistent
with its labeling.**



Contact Time Bandits

- The most common crime, it happens every day in every hospital, and the criminals are not just the folks in EVS.
- If a disinfectant is not applied for the correct contact time you do not get disinfection:
 - When applied to a surface the disinfectant **must** remain visibly wet for the manufacturers stated contact time.
 - If the disinfectant dries before the contact time it **must** be reapplied
- You are lucky to get them to wipe it once and you want them to do what!
- My nurses don't have time for that.....



It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.



The feds may not come after you but the Joint Commission will



CMS and Disinfectants

- According to the CMS Manual System it is a citable deficiency under 42 CFR 416, 482 and 485 if:
 - High touch surfaces in patient care areas are not disinfected with an EPA registered biocide
 - Point of Care Devices used for more than one patient are not disinfected after every use following the manufacturers instructions
 - Operating rooms are not disinfected between patients (AORN Challenge)
 - Hemodialysis station & equipment are not adequately disinfected the between patients (ERSD)
 - A sanitary physical environment is not maintained including appropriate techniques for cleaning and disinfecting surfaces, **carpeting** and furniture.
 - Disinfectants, antiseptics, and germicides are not used in accordance with the manufacturers instructions.
- Maintenance of a Sanitary environment is the responsibility of the designated infection control officer as part of the overall infection control program, (42CFR482.42) Conditions of Participation



The Sink or Swim Squad

- Whether you call it training, instructing or educating it all comes down to the fact that we **CANNOT** expect our staff to know how to correctly use the products and tools to do their jobs unless we **TEACH** them how to use them.
 - We can expect them to need retraining on a regular basis.
 - Training means everyone who uses (is supposed to use) disinfectants, no exceptions.
- The examples of misuse and abuse of disinfectants all come down to the fact that if we teach everyone the where's, what's, why's and how's to using disinfectants and cleaning chemicals we won't have any stories of how we have seen them used and abused.



42CFR482.42 makes the
infection control
officer responsible for training



What's in *your* bottle?



Disinfectant Desired Traits

Tips and Tricks to choosing
the ideal disinfectant



Criteria of an Ideal Disinfectant

The US Centers for Disease Control and Prevention (CDC) highlight following areas as being the critical decision making criteria when selecting a disinfectant product:

- i. Disinfectant should exhibit germicidal efficacy against a broad spectrum of microorganisms.
- ii. Product should exhibit this efficacy in a rapid and realistic contact time.
- iii. Product should have good cleaning properties and remain active in the presence of organic matter.
- iv. Product should be non-toxic and have low irritancy and allergenic properties.
- v. Product should be environmentally preferable and should not damage the environment on disposal.
- vi. Product should carry wide material compatibility. It should not cause the deterioration of metallic surfaces, rubber, plastics and other materials.



Strength is **NOT** always found in numbers

- Do not get caught in the advertising hype: our product kills X pathogens while the competition only kills Y
- Look at types of organism and remember Spaulding

Bacteria

- Gr +ve
- Gr -ve
- Endospore

Viruses

- Enveloped
- Non-Enveloped

Fungi

- Yeasts
- Molds

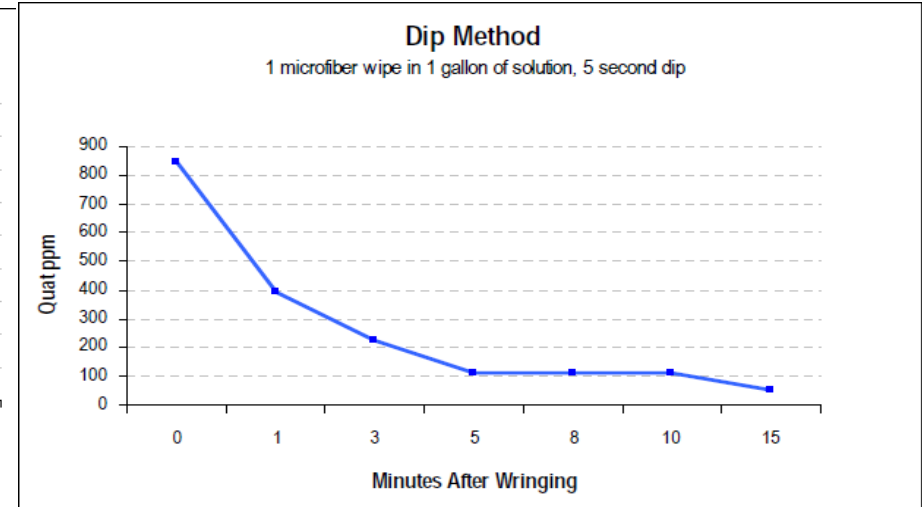
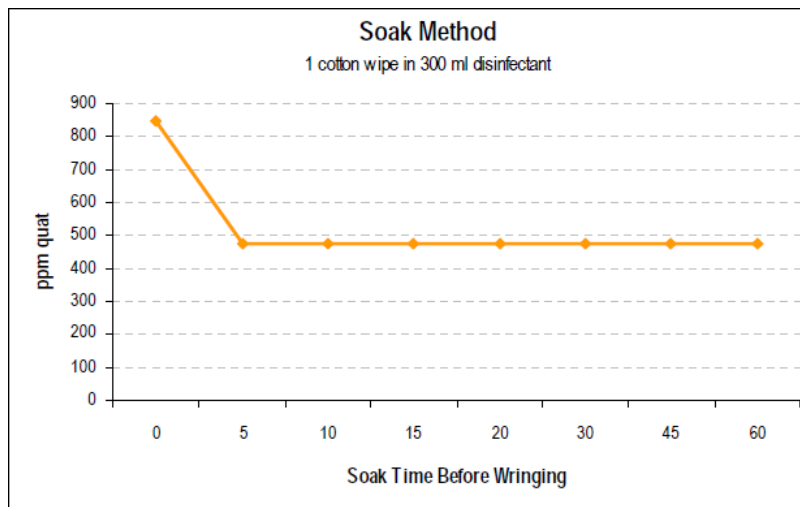
- Antibiotic resistance does not equate disinfectant resistance



Who Stole My Disinfectant?

- Quat Binding/Adsorption

- Quats bind to fabrics, the longer you soak the more it binds.
- You may start out with the correct dilution, after a few min. or so you no longer have a disinfectant (just ask MIC).
- Microfibers are worse than cotton cloths (but at least they clean)



The Blob

- Surface tension of water produces pooling and streaking after application with a cloth
- Addition of surfactants and wetting agents do more than just clean

Bleach and water no surfactant or dispersants,
In every guideline, dry bits not disinfected



Quat. concentrate with minimal
Surfactant, note dry areas



AHP with full surfactant and dispersant package
even coverage with no dry patches

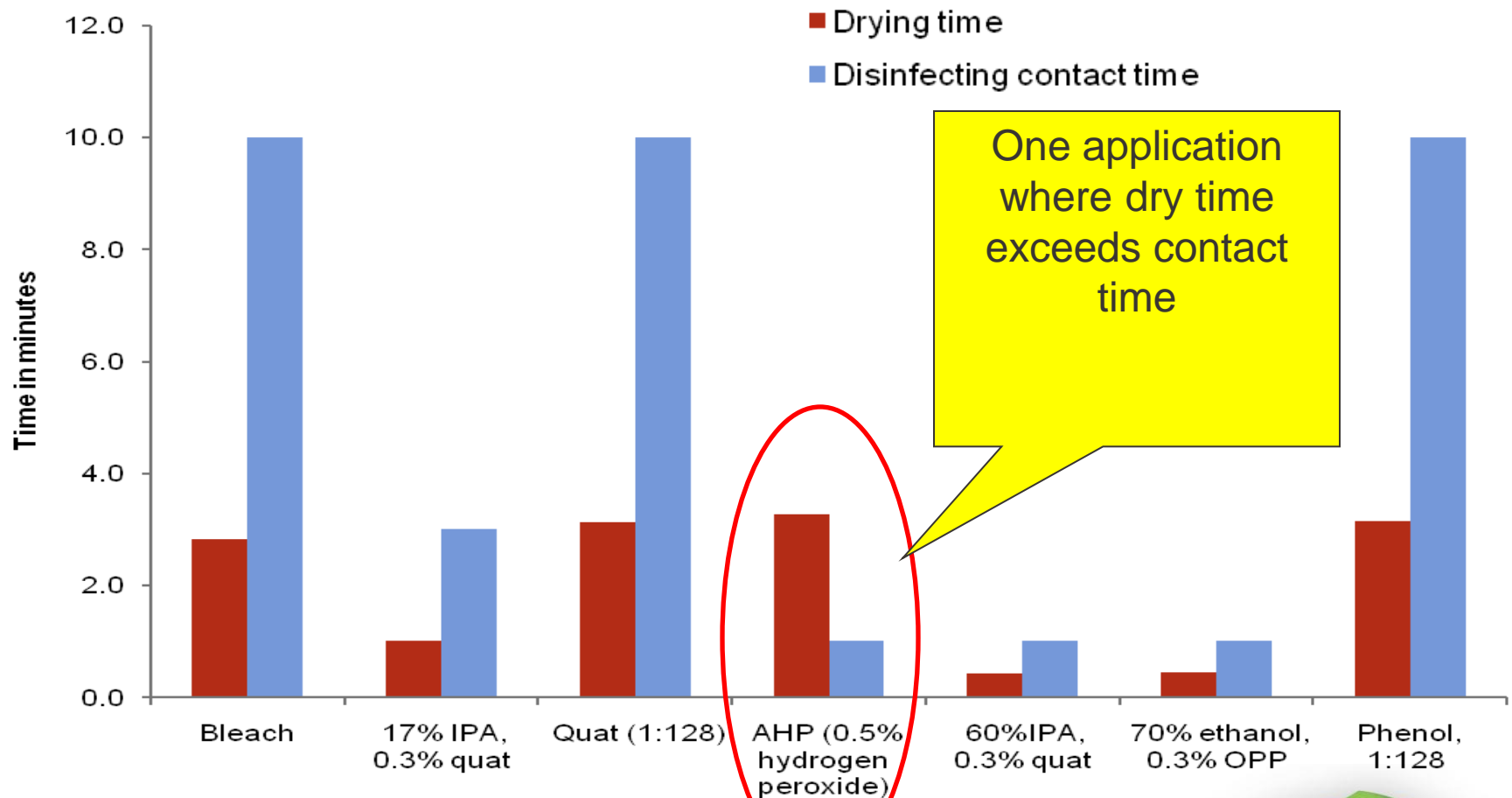


Gone in 60 Seconds!!!

- The speed with which a disinfectant can exhibit its killing ability on hapless microorganisms is critically important.
- Disinfectants with long, unrealistic contact times (e.g. 10 min.) require multiple reapplications in order to keep the surface adequately saturated for the requisite period of time.
 - Do not believe the 1 min. is good enough crowd, there are lots of papers that show otherwise (see slide 4).
- Alcohol based disinfectants that evaporate prior to their contact time being met will also require multiple applications.
- Ideally a single application of the product will result in the surface being sufficiently wetted for the required period of time which equals dead bugs and no transmission.



Improved Hydrogen Peroxide works within the time that it takes for a surface to dry



J AOAC Int 2010 Nov-Dec;93(6):1944-51.



To Clean or Not To Clean.....

- The physical action of cleaning removes dirt that can be used by some pathogens for food, it removes dirt that can harbor pathogens and protect them from disinfectant.
- Physical cleaning helps remove biofilm, the protective slime coating that defends bugs from sunlight and other disinfectants.
- Cleaning can achieve a 3 to 4 log reduction – at the very least, cleaning improves the effectiveness of disinfectants.
- Some disinfectants require precleaning as a separate step prior to disinfection, is your disinfectant a one step protocol or a two step protocol?
- Cleaning takes time and it takes manpower. Cutting corners by cutting down on the amount of time our staff have to clean a surface is setting people up to fail.
- Collect what you clean, microfiber is much better than cotton.
- Cleaning needs to be done right – the first time. Cleaning can save lives.



What's in a HMIS Rating?

- Hazardous Materials Information System

Gotta make sure I don't get any on me!

Chemical Name	
HEALTH	0
FLAMMABILITY	0
PHYSICAL HAZARD	0

Hazardous Materials Identification System

HAZARD ID

4 Severe Hazard
3 Serious Hazard
2 Moderate Hazard
1 Slight Hazard

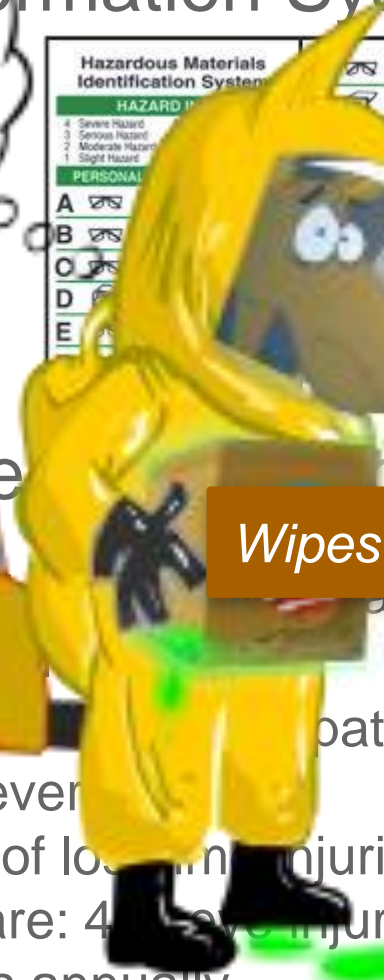
PERSONAL PROTECTIVE EQUIPMENT

A
B
C
D
E

- Safety equipment posing:



disinfectant



Wipes

- In order to make one
- Occupational respiratory
- Illness associated with Quats even
- CDC Study estimated number of occupational injuries associated with use of disinfectants in healthcare: 4 eye injuries, 271 neurologic injuries, 252 respiratory injuries annually.

FoodSis © 2000



See No Evil....

- Many of the common cleaning and disinfecting products used at home, in daycares or schools and healthcare facilities are known to leave behind chemical residues
- Not all residues are equal.
 - If you don't rinse your dishes after washing them by hand, you may taste the soap residue, but it's not going to kill you.
 - Phenols are known to leave a residue that can cause skin irritation, have been identified as known carcinogens and are not to be used around children.
 - Quat residues are not considered toxic, but the residues they leave behind can bind dirt and bugs and build up overtime, recent murine studies suggest that residues are impacting fertility and embryo development.





The Chemistries

How to compare apples to oranges

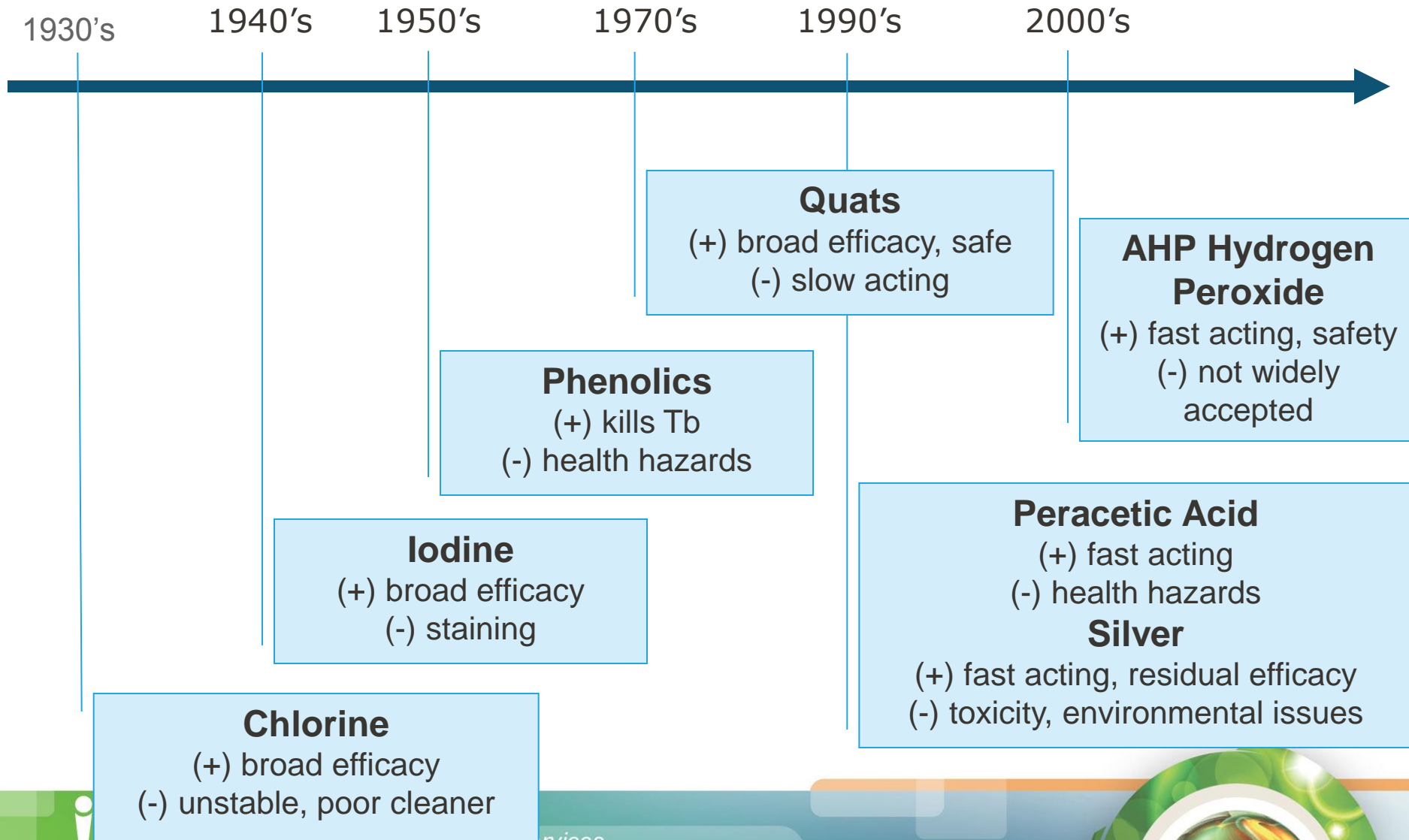


Basic Facts

- Disinfectants are the backbone of Infection Control
- >8000 Products registered in the U.S. & Canada
- 50% of which are used for Healthcare Infection Control
- There are 300 different active chemistries
 - 14 are in 95% of the disinfectant products
 - 6 are the most common



History of active ingredients in healthcare disinfectants



Quaternary Ammonium Compounds (QUATs)

- **Speed of Disinfection – C**
 - *A 10 minute contact time is mediocre or average amongst disinfectants and ultimately unrealistic to achieve disinfection on a regular basis.*
- **Spectrum of Kill – C**
 - *Narrow spectrum effectiveness against only bacteria, fungi and easy to kill enveloped viruses is nothing to write home about. Other disinfectants will be required to supplement the use of quats in healthcare.*
- **Cleaning Effectiveness – B**
 - *Although quats carry some detergency capabilities, cationic surfactants are inferior to the cleaning efficiency of non-ionic and anionic surfactants found in other disinfectant formulations.*
- **Safety Profile – B-**
 - *At their in-use concentrations, quats are generally non-toxic and non-irritating for users. However, older generations have been known to contain hormone disrupting components. Residues can cause fertility issues, in mice. Likewise, added dyes and fragrances are common which can cause sensitivities or even negatively impact indoor air quality.*
- **Environmental Profile – C+**
 - *Quats are known to accumulate in the environment and because of their widespread use this ultimately raises aquatic toxicity concerns. Newer formulations have been formulated to achieve Eco-certifications such as Green Seal and EcoLogo.*



Alcohol

- **Speed of Disinfection – B to C**
 - *Contact times range from minutes to hours depending on the concentration, type of alcohol used and organism to be inactivated*
 - *Due to the ready evaporation of alcohol, contact times need to achieve disinfection cannot be attained without reapplication*
- **Spectrum of Kill – B to C**
 - *Similar to the speed of disinfection, performance in this criteria is tied to the in-use concentration and type of alcohol used*
- **Cleaning Effectiveness – D**
 - *Alcohols are not efficient cleaners as they do not have detergency properties, however, some alcohols can dissolve both polar and non-polar substances, like salts and greases*
- **Safety Profile – C**
 - *Alcohols are classified as combustible and flammable chemicals that are unsafe to be used near heat sources and sparking devices , don't clean large areas (ie floors)*
 - *Health effects of alcohols are also severe, depending on the type of alcohol a person is exposed to*
- **Environmental Profile – B to C**
 - *Alcohols are classified as volatile organic compounds which are agents known to cause concerns with respect to air quality and if released into the environment in large quantities can cause environmental and aquatic toxicity*
 - *In low concentrations they are considered degradable when released to the environment*



Quat-Alcohol

- **Speed of Disinfection – A to B**
 - *Contact times range dependant on the formulation, concentration of Quats and alcohol as well as the type of alcohol used*
 - *Due to the ready evaporation of alcohol, contact times need to achieve disinfection cannot be attained without reapplication*
- **Spectrum of Kill – A to B**
 - *Similar to the speed of disinfection, performance in this criteria is tied to the formulation*
- **Cleaning Effectiveness – C**
 - *The Quat component will provide some detergency capabilities, cationic surfactants are inferior to the cleaning efficiency of non-ionic and anionic surfactants found in other disinfectant formulations*
- **Safety Profile – C to D**
 - *This criteria is tied to the formulation, generally to improve contact time or spectrum of kill the formulator has to forego the safety profile.*
 - *The type of alcohol and concentration found in the formulation will impact the safety profile greatly*
- **Environmental Profile – B to C**
 - *Alcohols are classified as volatile organic compounds which are agents known to cause concerns with respect to air quality and if released into the environment in large quantities can cause environmental and aquatic toxicity*
 - *In low concentrations they are considered degradable when released to the environment*



Bleach



- **Speed of Disinfection – A to C**
 - *Most best practice guidelines recommend 10 minute contact times be utilized with bleach based solutions*
 - *Higher concentrations (>1000ppm) can elicit more rapid kill against bacteria and viruses*
- **Spectrum of Kill – A to C**
 - *Similar to the speed of disinfection, performance in this criteria is tied to the in-use concentration*
 - *5000ppm is recognized as sporicidal; 1000ppm as effective against non-enveloped viruses; <1000ppm solely for use as a low level disinfectant*
- **Cleaning Effectiveness – C to D**
 - *Chlorine solutions have no inherent detergency capabilities; best practice guidelines unanimously support the practice of cleaning surfaces with a detergent prior to using bleach as a disinfectant*
- **Safety Profile – B to D**
 - *This is another parameter largely affected by the in-use concentration of the solution, >1000ppm solutions are generally irritating to eyes and skin (respiratory irritation also becomes a greater concern at higher concentrations); <1000ppm solutions require less precaution*
- **Environmental Profile – C**
 - *Although chlorine compounds are not persistent in the environment upon disposal, because they tend to be so highly reactive the risk lies more in the potential cross-reactions with other chemicals that may be present in waste-water*



Phenols

- **Speed of Disinfection – C**
 - *Most phenol concentrates retain 10 minute contact times. This is not an ideal contact time, and can only be reached through multiple applications.*
- **Spectrum of Kill – B to C**
 - *There are intermediate level phenols, that is, they are efficacious against mycobacterium.*
 - *Phenols are known to be unable to eradicate non-enveloped viruses such as Norovirus, which is a major weakness of the technology.*
- **Cleaning Effectiveness – B**
 - *Phenols exhibit a high affinity for working in an organically contaminated environment, although best practices always recommend pre-cleaning of surfaces prior to disinfection.*
- **Safety Profile – D/F**
 - *Phenols consistently exhibit harsh safety profile and typically warrant careful usage and handling instructions.*
 - *Do not use in Neonate areas!*
- **Environmental Profile – C**
 - *Phenols are readily biodegradable compounds; however they are also extremely reactive disinfectants and can contaminate the environment with harmful by-products.*



Improved Hydrogen Peroxide

- **Speed of Disinfection – A to B**
 - *Formulation dependent, surface disinfectants range from 30 second sanitizing to 30 sec - 5 minute disinfection*
 - *Instruments disinfectants 8 minute high level disinfection and 6 hour chemical sterilization*
- **Spectrum of Kill – A**
 - *Similar to above, spectrum of kill is formulation dependant*
- **Cleaning Effectiveness – A**
 - *Excellent cleaning capabilities due to a blend of non-ionic and anionic surfactants which are known to provide superior cleaning in conjunction with H_2O_2 which also aids in cleaning*
- **Safety Profile – A to B**
 - *At their in-use concentrations, surface disinfectants are non-toxic and non-irritating for users.*
 - *Instrument disinfectants non-toxic and do not require special ventilation systems*
- **Environmental Profile – A**
 - *H_2O_2 degrades into water and oxygen.*
 - *Newer surface formulations have been developed to achieve Eco-certifications such as EcoLogo and EPA's Design for the Environment (DfE).*



Conclusions

Have we learned to read (and interpret) the fine print?

Marketing materials are crafted by masters of obfuscation, the EPA regulates some of this.



STOP the Chemical Abuse!

- Eliminate the All For One Army
- Disband the Glug-Glug Gang & More is Better Bandits
- Sweep up the Shiny Surface Syndicate
- Don't Allow the Sink or Swim Squad to Prosper!
- Escape from the Contact Time Bandits
- Read the MASTER Label!



Your Infection Prevention Program

Will you create your infection prevention based
on price?

OR

Create the right program to cut costs?



Questions?

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Talk
CLEAN
to Me

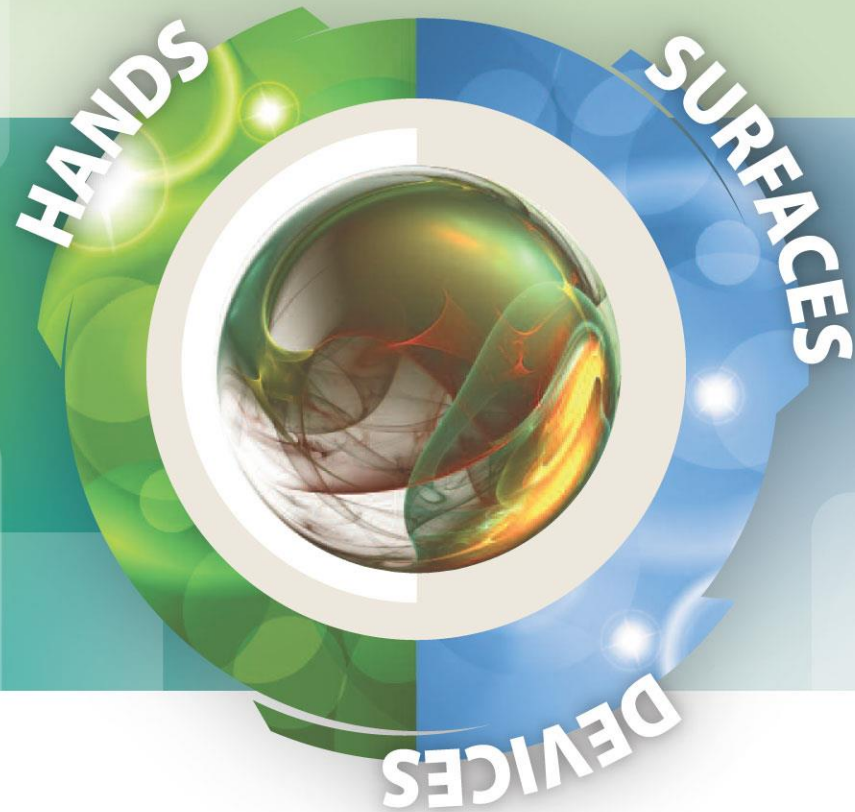




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Experts in Chemical Disinfectants for Infection Prevention



www.infectionpreventionresource.com

References

- Infection Control Guidelines: Hand Washing, Cleaning, Disinfection and Sterilization in Health Care, Health Canada. Dec 1998, Vol 24S8
- Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Health Care, Health Canada. July 1999, Vol 25S4
- Guidelines for Environmental Infection Control in Healthcare Facilities, CDC. MMWR June 2003, Vol 52, No RR-10
- Best Practices for Cleaning, Disinfection and Sterilization in All Health Care Settings, PIDAC, February 2010



References

- Block S. Disinfection. Sterilization, and Preservation, 5th Ed. 2001
- Mayhall CG. Hospital Epidemiology and Infection Control, 3rd Ed. Philadelphia. Lippincott Williams & Wilkins, 2004:1473-1522
- Cokendolpher JC & Haukos JF. The Practical Applications of Disinfection and Sterilization in Health Care Facilities, Chicago. American Hospital Association, 1996: 47-59
- Rutala WA. APIC Guideline for Selection and Use of Disinfectants AJIC 1990:17(2) 99-117
- Best Practices for Environmental Cleaning for Prevention and Control of Infections in All Health Care Settings, PIDAC, December 2009



References

- Bessems E. The effect of practical conditions on the efficacy of disinfectants. *Int Biodeter & Biodeg* 1998:177-183
- Crawford L et al. A Comparison of Commonly Used Surface Disinfectants: Alcohol-, Phenol-, Chlorine- and Quat Disinfectants.
www.infectioncontrolday.com/articles/0b1feat2.html
- Russel AD. Glutaraldehyde: Current Status and Uses. *Inf Con & Hosp Epi* 1994;15 (11) 724-733
- Rutala WA. Sporicidal Activity of Chemical Sterilants Used in Hospitals. *Inf Con & Hosp Epi* 1993; 14(12) 713-718
- Ascenzi, Handbook of disinfectants and antiseptics



References

- Guidelines for Environmental Infection Control in Healthcare Facilities, CDC. MMWR June 2003, Vol 52, No RR-10
- Rutala WA & Weber DJ. The benefits of surface disinfection. AJIC 2004;32(4) 226-229
- Woldkoff P et al. Risk in cleaning: chemical and physical exposure. Sci of Total Env 1995;215:135-156
- Sattar SA. Current issues in testing, selection and use of microbicides in infection control: a critical review. AICJ 2004;9(3):84-100
- Degussa, Hydrogen Peroxide: Properties, Handling and Application
- Hugo, Inhibition and destruction of the microbial cell

