The Ideal Disinfectant: One Size Does Not Fit All

Rebecca Battjes, MPH, CIC, FAPIC

Disclosure

Rebecca Battjes is employed by Diversey – A Solenis Company.

The relevant financial relationship has been mitigated.

No relevant financial relationships were identified for any other individuals with the ability to control the content of the activity.

TODAY'S OBJECTIVES

01

CHARACTERISTICS

Review Drs. Rutala & Weber's key considerations for selecting healthcare disinfectants.

02

COMPLIANCE

Describe regulatory elements of disinfectants, including manufacturer's instructions for use (MIFU) & emerging viral pathogen (EVP) claims language.

03

PROCEDURES

Provide facility-wide solutions to gaps in environmental cleaning & disinfection.

“People are always looking for the single magic bullet that will totally change everything. There is no single magic bullet.”

—Temple Grandin, PhD

SEMINAL PUBLICATION

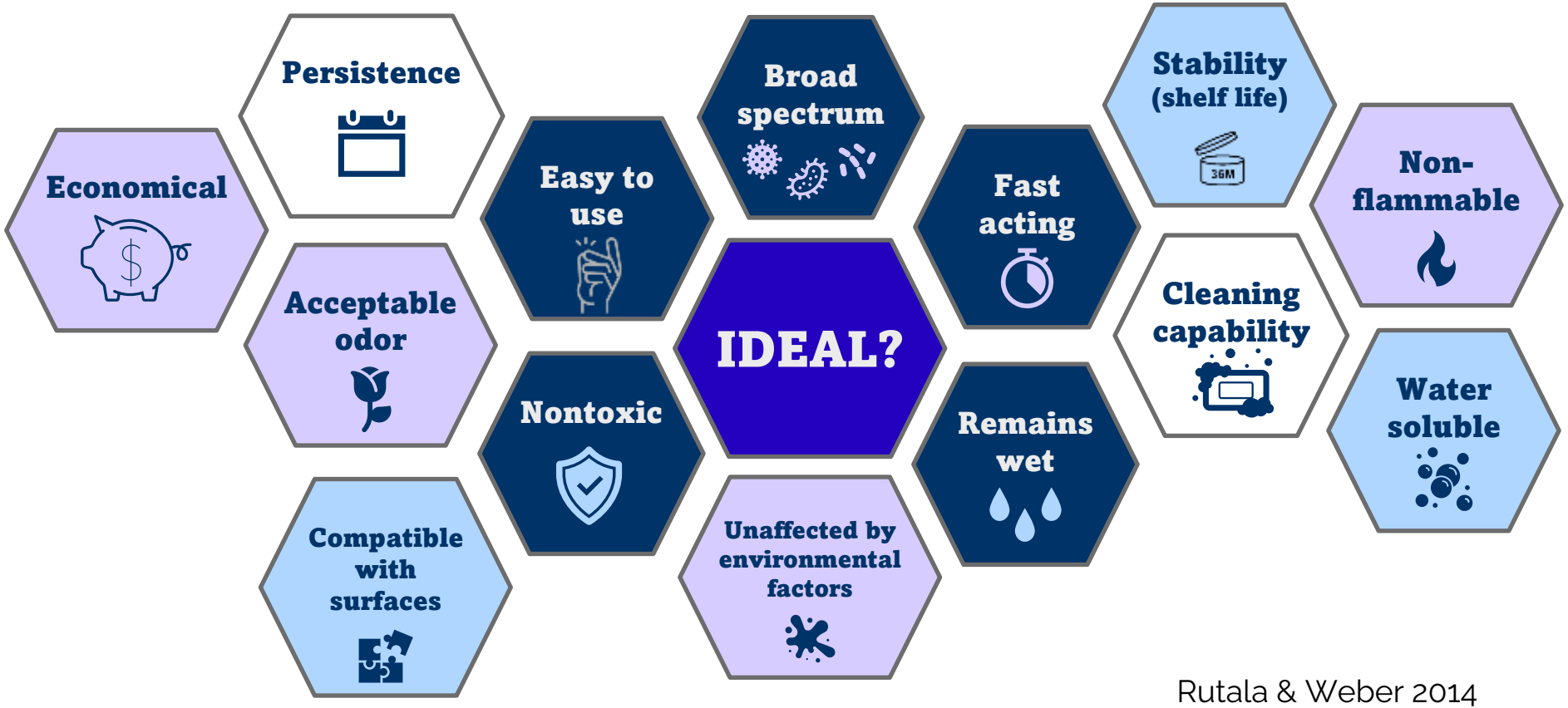
INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JULY 2014, VOL. 35, NO. 7

COMMENTARY

Selection of the Ideal Disinfectant

William A. Rutala, PhD, MPH;[1] David J. Weber, MD, MPH[1]

CRITERIA OF THE IDEAL DISINFECTANT



Rutala & Weber 2014

Before choosing disinfectants, consider who is using what disinfectant, where & when.

PRIMARY DISINFECTION RESPONSIBILITIES IN ACUTE CARE FACILITIES

DEVICE USER/ CLINICAL

- Determined by facility policy
- Shared portable medical equipment

ENVIRONMENTAL SERVICES

- High-touch surfaces
- Occupied daily room cleaning
- Discharges
- General shared areas
- Generally *not* responsible for shared portable medical equipment

CENTRAL/ STERILE SUPPLY

- Unique/ complex equipment reprocessing (e.g., IV pumps)

BUT FIRST:
CLEANING!

CLEANING BASICS

- Items must be **cleaned** using water with detergents or enzymatic cleaners **before processing**.
- Cleaning reduces the bioburden and removes foreign material (organic residue and inorganic salts) that interferes with the disinfection/sterilization process.
- Cleaning or decontamination should be done as soon as possible after the items have been used as soiled materials become dried onto the instruments.

Key Considerations for Selecting YOUR Ideal Disinfectant!

CRITERIA OF AN IDEAL DISINFECTANT: KEY CONSIDERATIONS

CONSIDERATION	QUESTIONS TO ASK
Kill Claims	Does the product kill the most prevalent healthcare pathogens?
Kill Times and Wet Contact Time	How quickly does the product kill prevalent healthcare pathogens? Ideally, contact time greater than or equal to the kill claim.
Safety	Does the product have an acceptable toxicity & flammability rating?
Ease of Use	Odor acceptable, shelf-life, in convenient forms (wipes, spray) water soluble, works in organic matter, one-step (cleans/disinfects)
Other Factors	Supplier offers comprehensive training/education, 24-7 customer support, overall cost acceptable (product capabilities, cost per compliant use, help standardize disinfectant in facility/system)

Rutala 2014

KILL CLAIMS

- It is logistically impossible to test every one of the thousands of existing microorganisms
- Does the product kill the most prevalent healthcare pathogens, including those that:
  - Cause most HAIs?
  - Cause most outbreaks?
  - Are of concern with your team?
    - Use your **annual risk assessment & plan**!

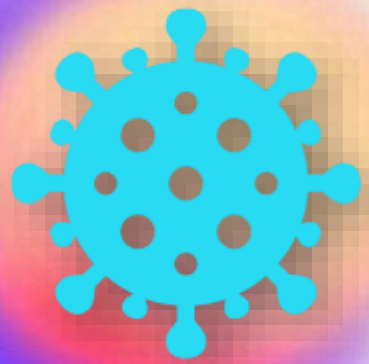


TABLE 3. Most Prevalent Pathogens Causing Healthcare-Associated Infections (HAIs)

Recommended organism (% of HAIs caused)	Why organisms are relevant
Staphylococcus aureus (15.6%)	Most prevalent overall contributors to HAIs (NHSN/CDC)[11]
Escherichia coli (11.5%)	
Coagulase-negative *Staphylococcus* (11.4%)	
Klebsiella (8.0%)	
Pseudomonas aeruginosa (7.5%)	
Enterococcus faecalis (6.8%)	
Candida albicans (5.3%)	
Enterobacter species (4.7%)	
Other *Candida* species (4.2%)	
Enterococcus faecium (4.1%)	
Enterococcus species (3.0%)	
Proteus species (2.5%)	
Serratia species (2.1%)	
Acinetobacter baumanni (1.8%)	

~27%

~53%

79% (without yeasts)

Rutala 2014

Antimicrobial-resistant pathogens associated with adult healthcare-associated infections: Summary of data reported to the National Healthcare Safety Network, 2015–2017

Distribution and Rank Order of the 15 Most Frequently Reported Pathogens Across All Types of Adult Healthcare-Associated Infections (HAIs), 2015–2017

Pathogen[a]	No. (%) Pathogens	Rank
Escherichia coli	62,571 (17.5)	1
Staphylococcus aureus	42,132 (11.8)	2
Selected *Klebsiella* spp	31,530 (8.8)	3
Pseudomonas aeruginosa	28,513 (8.0)	4
Enterococcus faecalis[b]	28,236 (7.9)	5
Coagulase-negative staphylococci	24,199 (6.8)	6
Enterobacter spp	16,568 (4.6)	7
Enterococcus faecium[b]	13,687 (3.8)	8
Proteus spp	11,463 (3.2)	9
Candida albicans[b]	11,043 (3.1)	10

Weiner-Lastinger LM et al 2020

OUTBREAKS BY PATHOGEN

THEN

- *Clostridioides difficile* spores
- Norovirus
- Aspergillus
- Rotavirus
- Adenovirus

Rutala 2014

NOW?

While not all are causing active "outbreaks," since 2018:

- Hepatitis A
- SARS CoV-2
- Mpox
- *Candida auris*
- Polio

VIRAL PATHOGENS

- **Enveloped Viruses** (Easy to Kill)
  - Influenza
  - Respiratory Syncytial Virus (RSV)
  - Parainfluenza virus
  - Human Metapneumovirus
  - Hepatitis B and C
  - HIV

Colds, Mild to Deadly

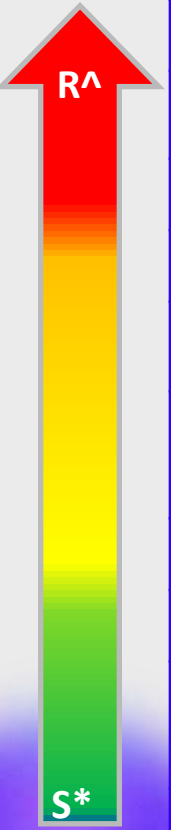
BBP

VIRAL PATHOGENS

- **Non-Enveloped Viruses** (**N**ot **E**asy to kill)
  - Norovirus
  - Rhinovirus
  - Enterovirus
  - Hepatitis A
  - *Adenovirus
  - *Rotavirus

} Larger – easier to kill

EFFECT OF LOW/INTERMEDIATE LEVEL DISINFECTANTS ON MICROORGANISMS



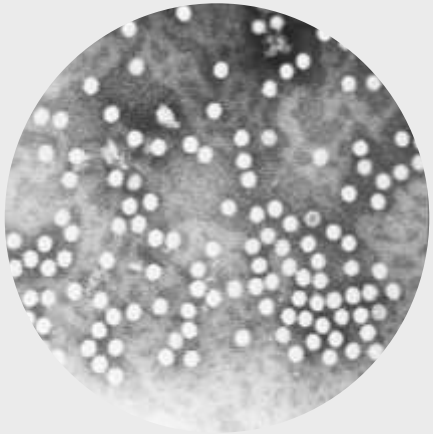
Organism	Type	Examples
Bacterial Spores	Spore	Bacillus anthracis, Clostridioides difficile
Mycobacteria	Bacteria	M. tuberculosis
Small non-enveloped virus	Virus	Poliovirus, Norovirus, Hep A, Measles
Fungal spores	Fungus	Aspergillus, Penicillium, Trichophyton
Gram negative bacteria	Bacteria	E. coli, Klebsiella including **CRE**, Pseudomonas, Acinetobacter
Fungi (Vegetative)	Fungus	Candida
Large virus (non-enveloped)	Virus	Adenovirus, Rotavirus
Gram positive bacteria	Bacteria	Staphylococcus including **MRSA,** Enterococcus including **VRE**
Virus (enveloped)	Virus	HIV, HBV, HCV, Influenza, **Mpox, SARS-CoV 2**

^Resistant
** Sensitive*

Adapted from Rutala & Weber. ICHE 2014;35(7):862; McDonnell & Burke, J Hosp Infect 2011;78(3):163-70.

EXAMPLES OF EXCEPTIONS TO THE HIERARCHY OF DISINFECTANTS

Human papillomavirus (HPV)



Parvovirus B19

Natural resistant to QACs

Candida auris

Demonstrating higher resistance than other Candida

https://www.cdc.gov/mmwr/pdf/rr/rr6305.pdf

ANTIMICROBIAL RESISTANCE ≠ DISINFECTANT RESISTANCE

CLAIM GAME?


Spores
(Clostridioides difficile)
Protozoa & Cysts
(Giardia, Cryptosporidium)
Mycobacteria
(M. tuberculosis)
Non-Enveloped Viruses
(Calicivirus, Rhinovirus, Adenovirus)
Fungi
(Aspergillus, Candida, Trichophyton)
Vegetative Bacteria
(E. coli, Salmonella, Staphylococcus, Pseudomonas)
Enveloped Viruses
(Coronavirus, Influenza, Hepatitis B & C, HIV)
Hardest to Kill
(least susceptible)
Easiest to Kill
(most susceptible
20 or more of the EASIEST to kill pathogens does not make a product more effective.

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Rutala 2014

KILL TIMES & WET/CONTACT TIME

Kill times may vary by pathogen on a product label.

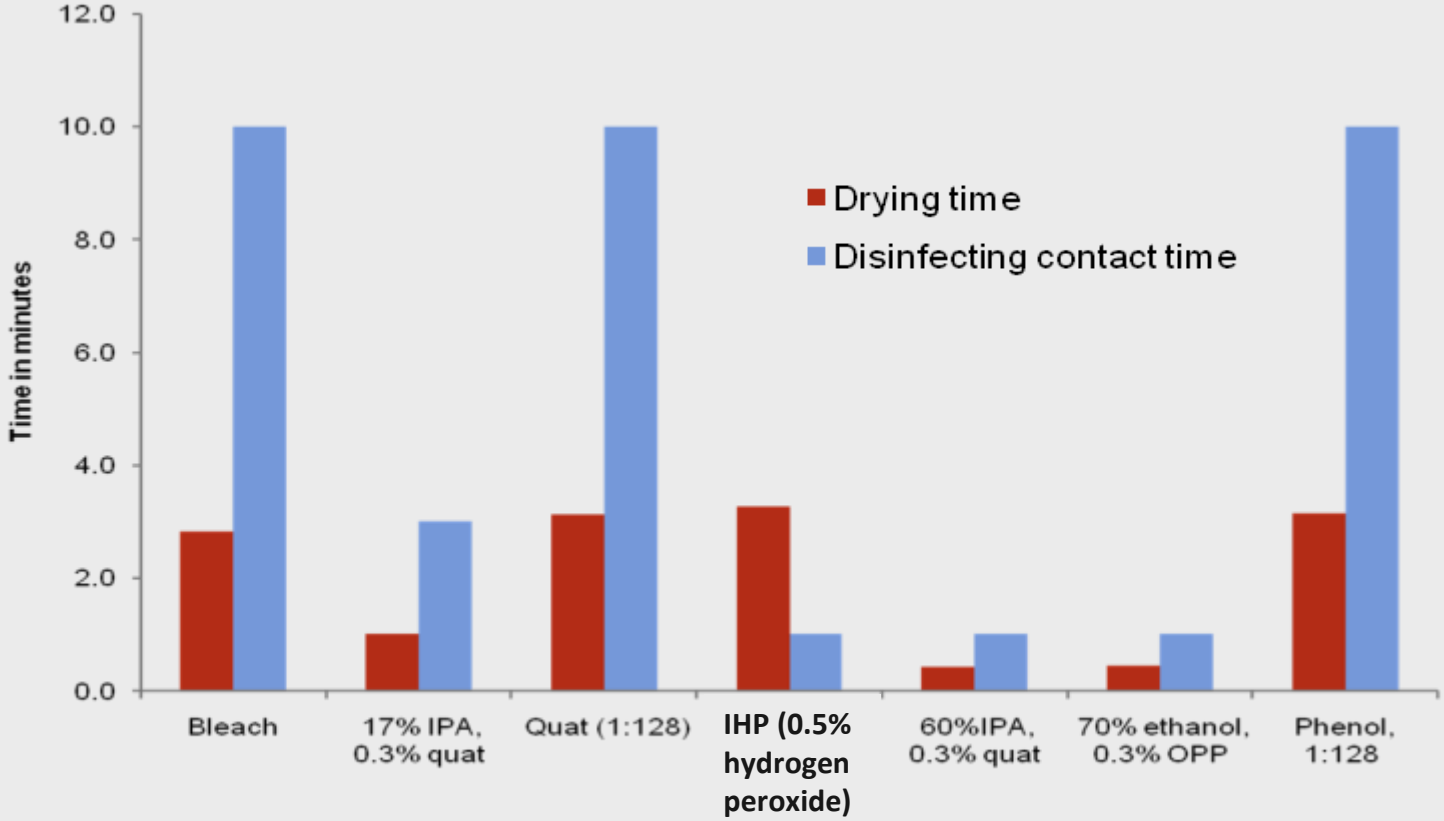
Most IP departments will adhere to the highest wet/contact time of all **relevant** pathogen kill times listed.

Some disinfectants may have higher kill times for bloodborne pathogens, which should always be adhered to in healthcare environments.

ALL HCP must know the agreed upon contact times for all disinfectants!

Regulatory & accreditation surveyors ARE TIMING disinfection!

DRY TIME VS. LABEL CONTACT TIME



Omidbakhsh 2010

PERFORM YOUR OWN RESEARCH!

http://www.diverseydigital.com/natools/videoHub/101014463.php

Select a hard, nonporous surface.

Use your smartphone's stopwatch.

Apply your facility-approved products side-by-side!

Document findings in preparation for your next survey (heard it on IP Talk!)

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Rutala 2014

PRODUCT SAFETY RATING

BEST POSSIBLE IS EPA TOXICITY RATING OF IV

- No warning or caution (“signal words”) language on the label!
- Not harmful to health, not flammable, no physical hazard
- No gloves or other PPE (important for **patients, residents, family & visitors**)
- Staff will use gloves as per Standard Precautions & facility policy

EPA Category IV label example

EPA Category 1 label example

PRODUCT DECISIONS CAN IMPACT HEALTH & WELLNESS

Notes from the Field

Respiratory Symptoms and Skin Irritation Among Hospital Workers Using a New Disinfection Product — Pennsylvania, 2015

Brie Hawley, PhD[1]; Megan L. Casey, MPH[1]; Jean M. Cox-Ganser, PhD[1]; Nicole Edwards, MS[1]; Kathleen B. Fedan[1]; Kristin J. Cummings, MD[1]

- *National Institute for Occupational Safety and Health*, September 2019, https://www.cdc.gov/niosh/hhe/reports/pdfs/2017-0114-3357.pdf

Table 5. Symptoms, self-reported diagnoses, and total stress reported by all post-shift survey participants (N=77), July and August 2018

Health Outcome	Overall symptoms, n (%)	Work-related*, n (%)
Symptoms during shift		
Nasal irritation	30 (39%)	25 (32%)
Eye irritation	33 (43%)	31 (40%)
Sneeze	18 (23%)	14 (18%)
Throat irritation	26 (34%)	21 (27%)
Cough	15 (19%)	10 (13%)
Wheeze or whistling in the chest	10 (13%)	8 (10%)
Chest tightness	6 (8%)	4 (5%)
Shortness of breath	16 (21%)	16 (21%)
Difficulty breathing	5 (6%)	5 (6%)
Lower airway symptoms (cough, wheeze, chest tightness, shortness of breath, or difficulty breathing)	31 (40%)	28 (36%)
Skin symptoms	6 (8%)	4 (5%)

- *National Institute for Occupational Safety and Health*, September 2019, https://www.cdc.gov/niosh/hhe/reports/pdfs/2017-0114-3357.pdf

Eye and airway symptoms in hospital staff exposed to a product containing hydrogen peroxide, peracetic acid, and acetic acid

8 2023

By Blackley, Brie Hawley ; Nett, Randall J. ; Cox-Ganser, Jean M. ; ...

http://dx.doi.org/10.1002/ajim.23488

Source: Am J Ind Med. 66(8):655-669

Conclusion: “Hospital workers exposed to HP, PAA, and AA reported acute work-related eye, upper airway, and lower airway symptoms at low levels of measured exposure. Increased exposure to the mixture of the two oxidants, HP and PAA, as well as the TM of HP, PAA, and AA, were significantly associated with increases in work-related acute and chronic eye and nasal irritation, wheeze, and shortness of breath.”

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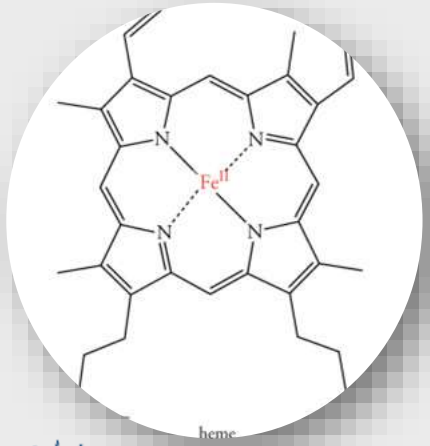
Rutala 2014

EASE OF USE

- Acceptable odor
- Shelf life
- One step or two step?
- Convenience
  - Ready-to-use, liquids, sprays, refills & multiple wipe sizes, etc.

QUAT BINDING

- Some cleaning tool fabrics, such as cotton and microfiber, are known to bind with quaternary ammonium compounds ("quats"). *This is known as **"quat binding"***
  - Active ingredients (quat) have a tendency to become attracted to, and absorbed into, microfiber and cotton fabrics
  - Cotton fabrics and most microfibers are negatively charged or anionic
  - Quats are positively charged, or cationic, and are attracted to the negatively charged fabric surfaces
  - **IMPORTANT: If the quat is applied to the surface for the contact time, binding is avoided.**



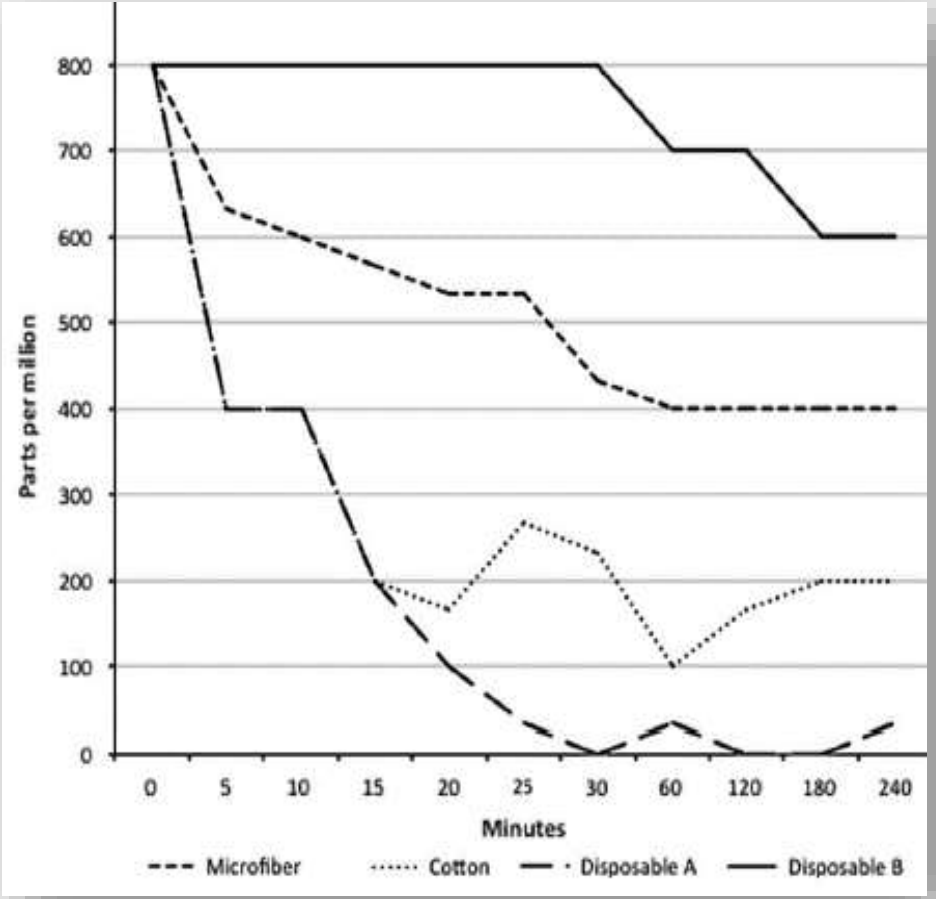
Quat binding risks generally do not apply to prewetted, ready-to-use disinfectant wipes.

Image: https://www.sciencedirect.com/topics/chemistry/quaternary-structure

QUAT BINDING

Microfiber wipers, cotton towels, and 1 of 2 types of disposable wipes soaked in a Quat disinfectant revealed significant binding of the disinfectant.

Boyce 2016



DISPENSERS: 33 STATIONS TESTED

Number of Dispensers	Issue
7	<200 ppm
17	200-400 ppm
6	400-600 ppm
2	No Concentrate
1	Inoperative

RTU WIPES OR DILUTABLE DISINFECTANTS

WIPES

Can be cost effective & sustainable,

No mixing.

Grab & go!

DILUTABLE

Ensure equipment is working

Label ALL containers!

No topping off or double dips!

MICROFIBER VS. DISPOSABLE WIPES?

DISPOSABLE DISINFECTANT WIPES

American Journal of Infection Control 42 (2014) 329-30

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Brief report

The value of ready-to-use disinfectant wipes: Compliance, employee time, and costs

Timothy L. Wiemken PhD, MPH, CIC*, Daniel R. Curran MD, Emily B. Pacholski MPHc, Robert R. Kelley PhD, MPHc, Rehab R. Abdelfattah MD, Ruth M. Carrico PhD, RN, FSHEA, CIC, Julio A. Ramirez MD, FACP

Division of Infectious Diseases, University of Louisville School of Medicine, Louisville, KY

Study Demonstrated

- Disinfectant wipes increased compliance and improved speed.
- Disinfectant wipes yielded a cost savings over traditional towel and bucket method

Wiemken et al. AJIC 2014;42:329-30

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Rutala 2014

OTHER FACTORS

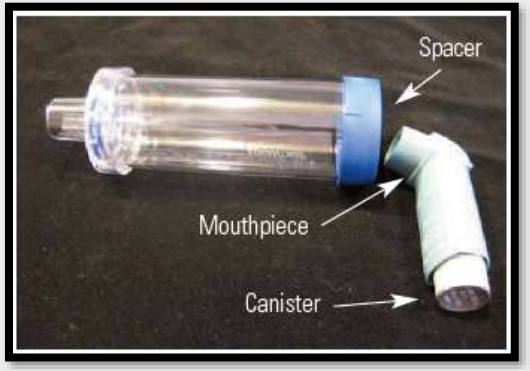
- Does the supplier offer comprehensive training and ongoing education, both in-person and virtual?
- Does the supplier offer 24-7 customer support?
- Is the overall cost of the product acceptable (considering product capabilities, costs of infections that may be prevented and costs per compliant use)?
- Can the product help standardize disinfectants used in your facility?

KEY REGULATORY CONCERNS

MANUFACTURERS' IFUs

- Contentious for **disinfectant suppliers**
  - Newer disinfectants are not included in MIFUs
- Contentious issue for **equipment manufacturers**
  - May have found 'a' disinfectant that works
  - May not have tested a true disinfectant (soap & water)
- MOST contentious for **INFECTION PREVENTIONISTS!**
  - IPs are caught in the middle, spending hours looking for answers.

Tonometer tip courtesy of presenter



https://www.ismp.org/resources/revisiting-need-mdi-common-canister-protocols-during-covid-19-pandemic

MANUFACTURER'S IFUs

- Check if your disinfectant supplier has a **compatibility specialist/expert** that works with instrument components or provides our solutions to manufacturers!
    - Data = evidence
- Per TJC at APIC 2022:
    - Cannot write a risk assessment for an issue identified in a risk assessment
    - FDA expects you to communicate with device manufacturer *first*
    - If solution cannot be reached, use FDA's DICE to communicate IFU issues

https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/contact-us-division-industry-and-consumer-education-dice

Email IFU concerns to IFU@apic.org!

- Convening stakeholder organizations to work with APIC to propose a new regulatory framework for cleaning, disinfection, and sterilization of medical devices that includes (but is not limited to):
  - A **standardized format for IFUs**;
  - IFU language which takes into account the needs of infection prevention and control, sterile processing, environmental services, and end users to protect patients;
  - **Device labels which are easily accessible to users for the duration of the product's lifespan**, indicate when the IFU was last updated, and provide information on who users may contact in case of questions;
  - A **public repository for IFUs** so that users will have access to appropriate information for devices that are no longer manufactured and/or when the manufacturer is no longer in business.

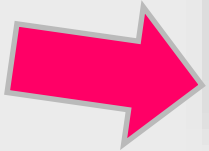
Tomlinson et al 2024

EMERGING VIRAL PATHOGENS:
NO ONE CAN PREDICT THE FUTURE

EPA REGISTRATION

The List of Lists

- https://www.epa.gov/pesticide-registration/selected-epa-registered-disinfectants#pathogens



- List A: EPA's Registered Antimicrobial Products as Sterilizers
- List B: EPA Registered Tuberculocide Products Effective Against *Mycobacterium tuberculosis*
- List C: EPA's Registered Antimicrobial Products Effective Against Human HIV-1 Virus
- List D: EPA's Registered Antimicrobial Products Effective Against Human HIV-1 and Hepatitis B Virus
- List E: EPA's Registered Antimicrobial Products Effective Against *Mycobacterium tuberculosis* Human HIV-1 and Hepatitis B Virus
- List F: EPA's Registered Antimicrobial Products Effective Against Hepatitis C Virus
- List G: EPA's Registered Antimicrobial Products Effective Against Norovirus
- List H: EPA's Registered Antimicrobial Products Effective Against Methicillian Resistant Staphyloccus aureus (MRSA) and/or Vancomycin Resistant Enterococcus faecalis or faecium (VRE)
- List J: EPA's Registered Antimicrobial Products for Medical Waste Treatment
- List K: EPA's Registered Antimicrobial Products Effective Against Clostridium Difficile Spores
- List L: EPA's Registered Antimicrobial Products That Meet the CDC Criteria for Use Against the Ebola Virus
- List M: Registered Antimicrobial Products with Label Claims for Avian Influenza
- List N: Disinfectants for Use Against SARS-CoV-2
- List O: Disinfectants for Use Against Rabbit Hemorrhagic Disease Virus (RHDV2)
- List P: Antimicrobial Products Registered with EPA for Claims Against Candida Auris
- List Q: Disinfectants for Emerging Viral Pathogens (EVPs)

EPA LIST Q (as of 09/26/2024)

Pathogen	Difficulty to Inactivate	Description
Marburg Virus	Tier 1 (enveloped virus)	Marburg virus disease is a rare disease that is caused by an infection from the Marburg virus. Learn more. See also: List Q.
Ebola virus	Tier 1 (enveloped virus)	Ebola is a rare disease that is caused by an infection from the Ebola virus. Learn more. See also: List L and List Q.
Mpox virus	Tier 1 (enveloped virus)	Mpox (formerly monkeypox) is a rare disease that is caused by infection with mpox virus. Learn more. See also: List Q.
SARS-CoV-2 and variants	Tier 1 (enveloped virus)	SARS-CoV-2 is the virus that causes COVID-19. See also: List N.
Rabbit Hemorrhagic Disease Virus (RHDV2)	Tier 3 (small, nonenveloped virus)	RHDV2 is a highly contagious fatal disease in rabbits. It does not impact human health. See also: List Q and List Q.

EVP TIERS

- **Not printed on container (secondary) label**
- Found on EPA Master Label & List Q

TIER	VIRUS CATEGORY	EXAMPLES	EPA DESCRIPTION
1	Enveloped	HIV, HBV, HCV, SARS-CoV 1& 2	When disinfectants damage their lipid envelope, the virus is no longer infectious.
2	Large nonenveloped	Adenovirus, rotavirus	Large NE viruses are encased in protein capsids that make them more difficult to inactivate compared to enveloped viruses.
3	Small nonenveloped	Polio, norovirus, HAV	Hardest to inactivate. Both their protein capsids AND their small size make them less vulnerable compared to other viruses.

https://www.epa.gov/pesticide-registration/disinfectants-emerging-viral-pathogens-evps-list-q

THE JUGGLING ACT

PROCEDURES

ROLES & RESPONSIBILITIES

CLEARLY DEFINE . . .

- WHAT?
- WHO?
- WHEN?
- WHERE?
- HOW?

CLEANING RESPONSIBILITY	ITEM	APPROVED DISINFECTANT	FREQUENCY
C.N.A.	Blood pressure machine	Wipe A	Between patient use
	Feeding pumps	Wipe A	Weekly, PRN & at discharge
	Handheld thermometers	Wipe A	Between patient use
	Shower gurney	Wipe A	Between patient use
	Warming blanket machine	Wipe A	Between patient use
	Shower chairs	Wipe A	Between patient use
EVS	Beds: handrails	Wipe A	Daily with room cleaning
	Beds: horizontal surfaces	Wipe A	Discharge
	Bedside cabinets	Wipe A	Daily with room cleaning
	Call bell/remote	Wipe A	Daily with room cleaning
	Commode	Wipe A	Daily with room cleaning
	Computer keyboards at Nursing station	Wipe A	Daily
	Privacy curtains	Wipe A	Every 30 days, PRN, and at discharge
	Wheelchairs	Wipe A	Every 30 days & PRN
HIM	Medical record chart	Wipe A	Daily
Lic. Nurse	Bladder scanner	Wipe C	Between patient use
	Glucose meter	Wipe B	Between patient use
	IV pumps while in use and after d/c	Wipe A	Weekly, PRN & at discharge
	Med Carts	Wipe A	Daily and PRN
	PCA pumps	Wipe A	Discharge
Rehab	Rehab equipment	Wipe A	Between patient use
RNA	Hoyer lift	Wipe A	Between patient use
	Scales, patient	Wipe A	Between patient use
RT	Cough assist machine	Product X	Between patient use
	IPV	Wipe A	Between patient use
	i-Stat	Wipe A	Between patient use
	Pulse Oximeters	Wipe A	Between patient use
	Space Lab	Wipe C	Weekly, PRN & at discharge
	Ventilators	Wipe C	Weekly, PRN & at discharge
	Vest machine	Wipe C	Between patient use
	Welch Allyn	Wipe C	Weekly, PRN & at discharge

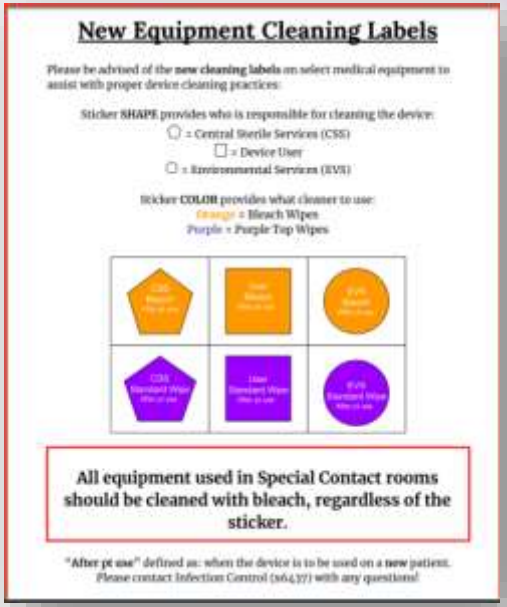
https://community.apic.org/viewdocument/cleaning-monitoring-and-medical-equipment-cleaning-responsibilities?CommunityKey=a42080cc-43bc-4706-beba-216aa38f9940&tab=librarydocuments

APIC 2022 Noncritical Disinfection Poster

#APIC2022

Selected Equipment for Labeling

Equipment or Item	Group Responsible	Manufacturer Recommended
IV pump	CSS	Bleach
SCD Pump	EVS	Bleach
Vital Sign Machines	User	Bleach
Wall Mounted Vital Sign Machines	EVS	Bleach
EKG Machine	User	Bleach
PCA	CSS	Bleach
Feeding Pump	EVS	Bleach
Defibrillator on Code Cart	CSS	Quaternary Ammonium
Wall Mounted Patient Monitor/Leads/Pulse Ox/Cuff	EVS	Quaternary Ammonium
Bladder Scanner	User	Quaternary Ammonium
Telemetry Pack	User	Quaternary Ammonium



New Equipment Cleaning Labels

Please be advised of the **new cleaning labels** on select medical equipment to assist with proper device cleaning practices:

Sticker **SHAPE** provides who is responsible for cleaning the device:

- ⬠ = Central Sterile Services (CSS)
- ☐ = Device User
- ○ = Environmental Services (EVS)

Sticker **COLOR** provides what cleaner to use:

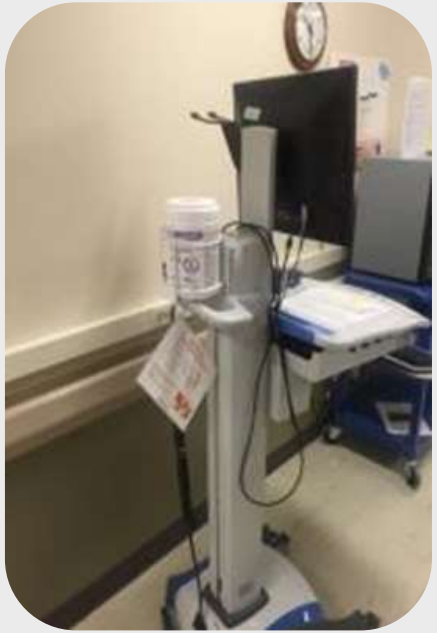
- Orange = Bleach Wipes
- Purple = Purple Top Wipes

All equipment used in Special Contact rooms should be cleaned with bleach, regardless of the sticker.

"After pt use" defined as: when the device is to be used on a new patient.
Please contact Infection Control (x6437) with any questions!

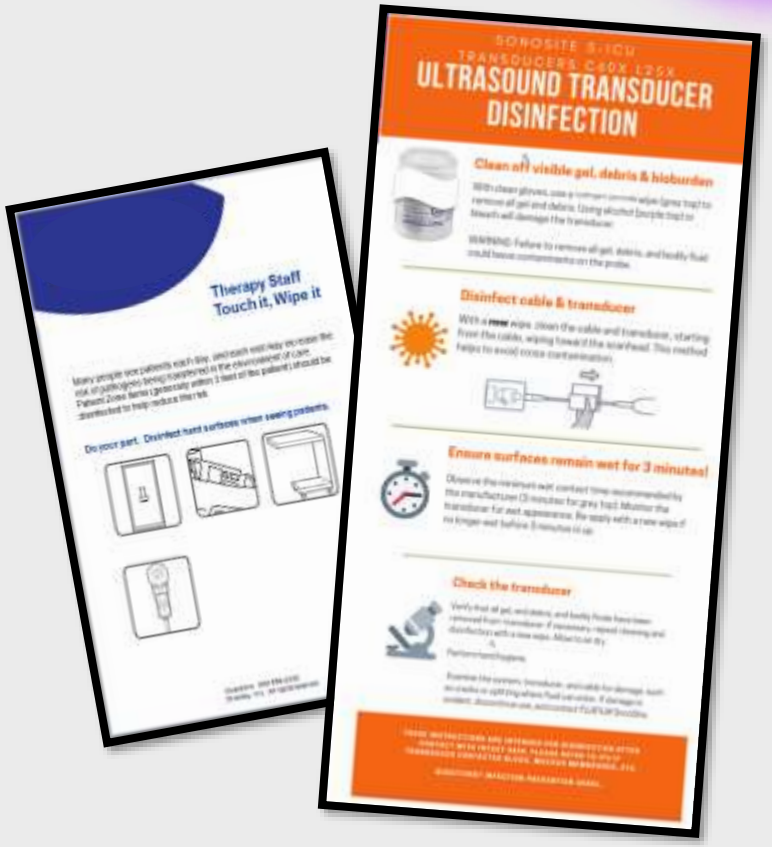
Dabkowski M. 2022. **Improving Cleaning Compliance of Noncritical Equipment with Labels and Auditing**. APIC 2022 oral abstract. Accessed securely online as conference attendee at https://c53ac34983397363b9e2-fa85729df59db74d0fed9dc21ffea231.ssl.cf1.rackcdn.com//1884872-1491675-004.pdf.

MUST BE AVAILABLE AT POINT OF CARE!



POINT OF CARE DISINFECTION

- It is everyone's job to disinfect, but it is *not* everyone's job to disinfect everything, every time!
- If, during care, you touched it or used it: Disinfect it!
- **Training cards/checklists for ALL who do the cleaning/disinfection.**



REMEMBER:

If it's something used on more than one patient, multiple times a day, EVS cannot be solely responsible for disinfecting it.

TARGETED MOMENTS OF DISINFECTION

BEFORE

Placing food or drink on the over-bed table

BEFORE/AFTER

Any aseptic procedure (e.g., wound/line care)

AFTER

Any procedure/task involving feces or respiratory secretions within the bed space

AFTER

Patient/ resident bathing

AFTER

Any object used on/by a patient/resident touches the floor

Gauthier 2020

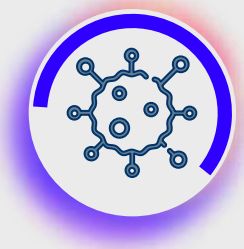
VALIDATION

VALIDATION METHODS

VISUAL AUDIT

FLUORESCENT MARKER

ATP



CULTURE

https://www.cdc.gov/hai/toolkits/evaluating-environmental-cleaning.html

VALIDATING THE ENVIRONMENTAL HYGIENE PROGRAM*

	METHOD	PROS	CONS
	**Visual audits**	Easy to perform, cost effective, engages staff	Difficult to standardize, may be seen as punitive w/o team engagement, Hawthorne effect, IP resources
	**Satisfaction surveys**	Encourages resident participation, including family & visitors, quantitative measurement	Subjectivity, **emphasizes visible cleanliness only, not true disinfection**, no benchmarking
	**Environmental culture**	May be useful during an outbreak or research project, quantitative	Not recommended by CDC as routine measure, **high cost**, long turn around times, results may not correspond to the outbreak
	**ATP**	Easy to use & train others, immediate feedback, can be helpful when evaluating new/novel cleaning methods	Detection of organic matter (bioburden) is **not reliable predictor** of infection risk, **high cost of equipment & supplies**, storage of swabs
	**Fluorescent marking**	Very inexpensive, easy to perform, immediate results	Does not identify pathogens, only detects cleaned/not cleaned, may be seen as punitive w/o team engagement

Modified from Infection Prevention Guide to LTC 2nd ed, APIC, 2017.

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PRODUCTS

SODIUM HYPOCHLORITE: ADVANTAGES

- Bactericidal, tuberculocidal, fungicidal, virucidal
- Sporicidal – effective against *C. difficile*
- Fast acting
- Inexpensive (in dilutable form)
- Not flammable
- Unaffected by water hardness
- Reduces biofilms on surfaces
- Relatively stable (e.g., 50% reduction in chlorine concentration in 30 days)
- Used as the disinfectant in water treatment
- EPA-registered

Rutala, Weber. Am J Infect Control 2019; A96-A105.

SODIUM HYPOCHLORITE: DISADVANTAGES

- Reaction hazard with acids and ammonias (e.g., QACs)
- Leaves salt residue
- Corrosive to metals (some ready-to-use products may be formulated with corrosion inhibitors)
- Unstable active (some ready-to-use products may be formulated with stabilizers to achieve longer shelf life)
- Affected by organic matter
- Discolors/stains fabrics
- Potential hazard is production of trihalomethane
- Odor (some ready-to-use products may be formulated with odor inhibitors). Irritating at high concentrations.

Rutala, Weber. Am J Infect Control 2019; A96-A105.

QUATERNARY AMMONIUM COMPOUNDS

ADVANTAGES

- Bactericidal, fungicidal, virucidal against enveloped viruses (e.g., HIV)
- Good cleaning agents
- EPA registered
- Surface compatible
- Persistent antimicrobial activity when undisturbed
- Inexpensive (in dilutable form)
- Not flammable

DISADVANTAGES

- Not sporicidal
- In general, not tuberculocidal & virucidal against non-enveloped viruses
- High water hardness and cotton/gauze can make less microbicidal
- A few reports documented asthma as result of exposure to benzalkonium chloride
- Microbicidal activity affected by organic matter
- Absorption by cotton, some wipes may diminish microbicidal activity
- Multiple outbreaks ascribed to contaminated benzalkonium chloride

Rutala, Weber. Am J Infect Control 2019; A96-A105.

ALCOHOLS

ADVANTAGES

- Bactericidal, fungicidal, virucidal, tuberculocidal
- Fast acting
- Non-corrosive
- Non-staining
- Easy-to-use
- Used to disinfect small surfaces like rubber stoppers on med vials
- No toxic residue

DISADVANTAGES

- Not sporicidal
- Affected by organic matter
- Slow acting against nonenveloped viruses
- No detergent or cleaning properties on its own
- Damages some instruments (rubbers, glues)
- Flammable (large amounts require special storage)
- Generally, not used on large surfaces
- Outbreaks ascribed to contaminated alcohol

Rutala, Weber. Am J Infect Control 2019; A96-A105.

PERACETIC ACID

ADVANTAGES

- Bactericidal, fungicidal, virucidal and sporicidal (e.g., *Clostridioides difficile*)
- Active in the presence of organic material
- Environmentally friendly by-products (acetic acid, O2, H20)
- EPA-registered
- Surface compatible

DISADVANTAGES

- Lack of stability, dilution = short shelf life
- Potential for material incompatibility (e.g., brass, copper)
- More expensive than most other disinfecting actives
- Odor may be irritating (patients AND staff!)
- Can cause mucous membrane and respiratory health effects
    - Employee complaints, non-compliance in the literature

Rutala, Weber. Am J Infect Control 2019; A96-A105.

IMPROVED HYDROGEN PEROXIDE

ADVANTAGES

- Bactericidal, tuberculocidal, fungicidal, virucidal
- Fast efficacy
- Easy compliance with wet-contact times
- Best possible EPA toxicity category: IV
- Benign for the environment
- Non-staining/whitening
- EPA-registered
- Surface compatible
- Environmentally friendly by-products

DISADVANTAGES

- More expensive than some other disinfecting actives
- Not sporicidal at low concentrations

NOT INCLUDED IN RUTALA et al 2023 UPDATE

Electrolyzed/ Ozonated Water

Inexpensive (typically, generated onsite)

Device is EPA-registered, but end use solution is not

NYU Langone study comparing EW, PAA & NaDCC, discontinued EW due to higher bacterial counts (Solomon et al 2023)

NaDCC

Chlorine compound, similar to bleach

If RTU spray, read IFUs carefully & check compliance (must spray surface, wait entire contact time)

In tablet form, Inexpensive

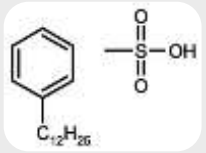
Citric Acid

New to market/ understudied

Excellent safety profile

Fast-acting (1 minute)

Higher costs



DDBSA

New to market/ understudied

Dodecylbenzenesulfonic Acid

Fast acting

THANKS!

ANY QUESTIONS?

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