TRAC RESEARCH

# HOW TO CHOOSE & USE *environmental surface disinfectants*

## *1. Do all disinfectants kill equally well?*

**NO** – different formulations and chemical ingredients sold under different brand names kill very differently. This is particularly true when human proteins such as blood, saliva, etc. are present—as they always are in dental offices!

**Example Label**

**ACTIVE INGREDIENTS:**
Alkyl (50%$C_{14}$, 40%$C_{12}$, 10%$C_{16}$)
dimethyl benzyl ammonium saccharinate .....0.10%
Ethanol...(Ethyl Alcohol) .....58.00%
**OTHER INGREDIENTS: .....** 41.90%
**TOTAL: .....**100.00%

### How can clinicians tell which surface disinfectants kill well?

***Chemical formulation is the key.*** In the U.S., disinfectants must list percent ACTIVE and OTHER ingredients on the label using the exact form shown **at right**. Clinicians must look for this listing on their disinfectant to understand what they are using. Table 1 below shows kill potential of 6 different Active Ingredients.

**NOTE: Percentages are by weight NOT volume. Google to see how to convert weight to volume.**

Many years ago researchers characterized the kill potential of different Active Ingredients in disinfectants used worldwide *(see published works by Block, S.S. and by Morton, H.E.).* TRAC Research has re-confirmed this work repeatedly since 1989 *(see JADA, Oct. 1989, and many CRA Newsletters and Clinicians Reports),* testing in triplicate in controlled studies over 200 products sold in 6 countries. The chart below summarizes results using two pathogens known as difficult to kill with chemicals *(tuberculosis bacteria and poliovirus 1 Mahoney Strain)* in the absence and presence of fresh human whole blood:

### TABLE 1: Kill potential of commonly used disinfectant Active Ingredients

**= Inactivated 3 $\log_{10}$ of a 1 million organism challenge *(99.9% kill)*. = Failed to inactivate 3 $\log_{10}$ of a 1 million organism challenge *(<99.9% kill)*.**

| 6 Major Active Ingredients used alone or in combination in commercially available environmental surface disinfectants used in dentistry | NO Blood in test system | | Fresh Human Whole Blood in test system | |
|---|---|---|---|---|
| | Tuberculosis bacteria | Poliovirus 1 *(Mahoney)* | Tuberculosis bacteria *(+50% blood)* | Poliovirus 1 *(Mahoney) (+10% blood)* |
| **CHLORINE** 2.6% by volume | killed | killed | not killed | killed |
| **ETHYL ALCOHOL** ≥70% by volume or 58% by weight | killed | killed | killed | killed |
| **IODOPHOR** | not killed | killed | not killed | not killed |
| **ISOPROPYL ALCOHOL** ≥70% by volume | killed | not killed | killed | not killed |
| **PHENOLIC** | killed | not killed | not killed | not killed |
| **QUATERNARY AMMONIUM COMPOUND** | not killed | not killed | not killed | not killed |

***Chart Summary:***

- **Certain formulations based on high ethyl alcohol kill well both in the absence and presence of fresh human whole blood *IF* a specific grade of ethyl alcohol is used along with trace ingredients that allow even spreading, retard evaporation, and aid protein wetting. NOTE: Ethyl Alcohol (ethanol) alone will NOT inactivate (kill) at the same level.**
- **Products whose formulations rely on the other 5 Active Ingredients generally have inadequate kill.**
- **Clinicians can generally predict a disinfectant's kill by comparing active ingredients on the label to Table 1 above.**

**NOTE: A clinician's technique & diligence CANNOT overcome a disinfectant's chemical inadequacy.**

**OVER →**

## 2. Should I clean before I disinfect?

**YES, CLEAN** – using a disinfectant that kills in the presence of clinically relevant proteins such as high ethyl alcohol-based BioSURF, GermXtra*, or Lysol III. After removing visible debris with one of these three disinfectants, re-apply the BioSURF, GermXtra* or Lysol III for the disinfection step. In other words, spread BioSURF, GermXtra*, or Lysol III twice – once to clean and once to disinfect. **(*NOTE: GermXtra is not sold currently in the U.S.)**

Because most disinfectants are NOT able to kill in the presence of human proteins, clinicians have been directed to clean before they disinfect. Unfortunately, clinicians have chosen to clean with products that do not kill in the presence of human proteins. This forces the cleaning person into direct contact with contaminated surfaces at a time when pathogens are most likely to be still viable. *INSTEAD*, surfaces should be coated twice with a broad spectrum disinfectant that kills in the presence of proteins: first coating for cleaning; second coating for final disinfecting.

**Step 1. Pre-clean Prep.** Wet a 4x4 inch cotton filled gauze pad with disinfectant making it dripping wet to create a **"custom wipe"** just before use. ***Currently, no commercial pre-wet wipes provide kill in the presence of oral proteins.***

**Step 2. Pre-clean.** Generously spread disinfectant evenly and scrub to remove visible debris. Re-wet the gauze pad frequently during the cleaning step & change to a new pad if the surface is large. Do not spray directly onto surfaces.

**Step 3. Contact Time.** Leave surfaces generously wet at least 3 minutes for BioSURF & GermXtra, and 10 minutes for Lysol Spray III, to allow disinfectant penetration of oral proteins and effective kill.

**Step 4. Final Disinfect.** Final disinfect cleaned surfaces using a second generously wet 4x4 pad, and leave surfaces damp, allowing to air dry.

**Step 5. Optional.** If desired, use a new clean paper towel to smooth streaks or puddles after contact time is completed.

## 3. Are pre-wet wipes, such as the popular CaviWipes, a good solution for surface disinfection?

**NO—for two reasons:** (1) The quaternary ammonium compound Active Ingredient used in this product (and most other wipes) is neutralized by human proteins and fails to provide healthcare level disinfection; and (2) The pull-out dispensing exposes the chemicals on the wipes to air and drying degradation, even before they are used.

We have tested many different brands of pre-wet wipes, and NONE achieve a broad spectrum kill, either in the absence or presence of human proteins. For this reason, we consider pull-out-dispensed pre-wet wipes to be dangerous to both patients and clinicians and contra-indicated for healthcare settings of any type.

**OVER** ➡

## 4. Why is it a bad idea to spray disinfectants directly onto surfaces?

**THREE REASONS:** (1) Spraying leaves many areas uncovered with liquid between the spray droplets in which organism kill does not occur; (2) *All* disinfectants are strong chemicals that should not be aerosolized; and (3) Hand pump spray containers used by most for direct application draw in air that is used to expel the liquid. Exposure of the disinfectant chemicals inside the container to this air degrades their kill potential even before they are ever expelled.

INSTEAD OF SPRAYING DIRECTLY ONTO THE SURFACE – spray liberally into an applicator, such as a 4x4" gauze sponge, and then use it to spread the disinfectant evenly over the surface to be disinfected. The surface should be left generously wet for a period of time to allow the disinfectant to penetrate and kill the microorganisms. This wait period is called "contact time". *All* disinfectants require a contact time that varies according to the formulation of the disinfectant. Directions on many disinfectant containers specify 10 minutes. Most clinicians make the mistake of wiping surfaces too quickly after application OR wipe as they apply, allowing no real contact time.

## 5. Should disinfectants be tested by an independent lab to confirm kill claims?

**YES** –because marketing and promotional claims can be *very* misleading.

In the U.S., environmental surface disinfectants must kill 99.9% of a specified test organism (3 $\log_{10}$ reduction of a 1 million organism challenge) to be registered as disinfectants by the Environmental Protection Agency (EPA). Unfortunately, EPA does not test disinfectants to validate performance data submitted by companies.

EPA has suggested kill of the tuberculosis bacteria as the benchmark for disinfectants used in healthcare. However, our work has shown repeatedly that disinfectants that kill the tuberculosis bacteria often cannot kill some of the more difficult-to-kill viruses. Virus kill is not required for EPA registration. However, it is viral infections that present the highest risk to dental clinicians and patients in the U.S. today.

Since 1985 we have accumulated a large database using the tuberculosis bacteria and the virus known as poliovirus 1 (Mahoney strain) in tests performed in triplicate on well over 200 different disinfectant formulations from around the world. We now know that only high ethyl alcohol formulations (≥70% ethyl alcohol by volume or 58% by weight) can perform the kill needed in the presence of human proteins such as blood, saliva, crevicular fluid, suppuration (pus), etc, which are ALWAYS PRESENT ON SURFACES IN CLINICAL SETTINGS due to aerosols, spatter, spills, and body contact that occur during every treatment.

However, 70% ethyl alcohol is *NOT* the whole story. To kill in the presence of fresh human whole blood, the formulation requires a specific grade of ethyl alcohol plus surfactants and other trace ingredients to retard evaporation, facilitate even spreading, and aid protein wetting. Our testing of over 200 commercial formulations has identified 3 that are able to kill in the presence of the human proteins enumerated above, penetrate, and kill the organisms trapped within (BioSURF, GermXtra*, and Lysol III). Use of just any 70% ethyl alcohol alone does NOT have the same kill potential.