



Antimicrobial Products: Who Needs Them?

by Philip Dickey

Turn on the TV or read any home-oriented magazine and you'll see them. Ads for all kinds of household products containing germ-killing ingredients are everywhere. Hand soap, dishwashing liquid, underwear, kitchen sponges, toothbrushes, toothpaste, mattresses, cutting boards, window cleaner, socks, cycling shorts, chop sticks, pencils, and now facial tissues are all being marketed for their ability to kill germs. It's been estimated that more than 700 antimicrobial-infused products are now available, including 76% of all liquid soaps. Consumers, driven by frightening stories of *E. coli* outbreaks, bizarre viruses, and drug-resistant germs are buying this stuff in the hopes that it will keep them safe (or their gym clothes from smelling). Do these products work or not? Does overuse of antimicrobial ingredients help breed supergerms? It's one of the most controversial topics in public health these days. Still, there are some common-sense approaches that most experts agree on.

Disinfectants, Antiseptics, and Antimicrobials

If you are confused by all the names and labels, you're not alone. *Antimicrobial* is the general term for any product or ingredient that kills or inhibits bacteria, viruses, or molds. *Antibacterials*, on the other hand, are only effective against bacteria. Until recently, the main kinds of home antimicrobial products were disinfectants and antiseptics. *Disinfectants* are products that kill micro-organisms (usually both bacteria and viruses) on surfaces like countertops or toilet seats. *Antiseptics* are products for use on the skin for cuts and scrapes. Now a third class of products is emerging as companies race to put antimicrobial ingredients into all sorts of products that did not used to have them. Most of the soaps and other household objects that boast germ-killing powers contain triclosan, an antibacterial agent that kills bacteria but has little or no effect on viruses. This distinction is important because most common household illnesses like colds and the flu are caused by viruses, so antibacterial ingredients will not prevent them from spreading.

Disinfectants, such as Lysol™ or chlorine bleach, are considered pesticides and are regulated by the EPA. EPA registration is beneficial because it ensures that the product actually does what it claims to do (if used properly). An ineffective disinfectant can be dangerous, since you cannot tell by looking if it is really working.

Personal-care products like hand soaps, toothpaste, and deodorants are regulated fairly loosely by the FDA. Antibacterial cutting boards, socks, sponges, and other goods are regulated by the Consumer Product Safety Commission but the EPA must grant permission for the use of an antimicrobial agent in these products. This chapter does not cover antiseptics or other antimicrobials used for medical purposes. Specific advice on medications should come from your health care provider, but the FDA recommends that homes should have an antiseptic handy just in case.

Antimicrobial Ingredients

Profiles of common ingredients used in antimicrobial products are shown in the sidebar on page 10. Most household disinfectants contain either chlorine bleach, alcohol, quaternary ammonium chlorides (called "quats"), pine oil, or phenolic compounds.



Just a few of the household products than may contain antimicrobial ingredients.

All of these ingredients can cause some health effects, and a disinfectant product is almost always more hazardous than a similar cleaner without the antimicrobial ingredient. Triclosan (5-chloro-2-(2,4-dichlorophenoxy)phenol) is the ingredient used in hand soaps and many other household items. Triclosan appears to be low in toxicity, but some people are alarmed by its structural similarities to the herbicide 2,4-D (2,4-dichlorophenoxyacetic acid) and 2,3,7,8-TCDD, the most toxic form of dioxin. They fear that this similarity could give rise to contamination of triclosan with dioxins, since dioxin contamination of 2,4-D and other chlorinated phenolic compounds has occurred. One recent study found that when triclosan in water was exposed to ultraviolet light, a type of dioxin was formed, though not the most toxic form. Concerns have also been raised over the discovery of triclosan in breast milk and the aquatic environment and the possibility that it may be an endocrine disruptor.

Good Bugs, Bad Bugs

To make sensible decisions about how to control micro-organisms, you need to know something about them. Some very nasty diseases are caused by bacteria and viruses, but most of the microbes around us are harmless and some are beneficial or necessary. Beneficial microbes found in the soil release nutrients for plants. Without the useful bacteria in our digestive tract, we wouldn't have the vitamin K that is needed for our blood to clot and stop bleeding when we are cut. Without bacteria, we wouldn't have wine, yogurt, blue cheese, soy sauce, or sourdough bread. What kind of world would that be?

What we need to do is protect the beneficial microbes and kill the bad ones when they threaten to spread disease. As Dr. Stuart Levy from the Tufts University School of Medicine has pointed out, this doesn't mean that we need to be at war with the microbial world. In fact, there is considerable evidence that some exposure to bacteria in the environment is actually beneficial because it helps the immune system develop. Some studies have shown an increase in allergies and asthma in people who were raised in an overly sterile environment. At this point it's only a hypothesis, but it may be that too much hygiene in the form of indiscriminant disinfection is harmful.

Where are the bad bugs most likely to be found? In the kitchen, it turns out. Surprisingly, kitchens often harbor more nasty germs than bathrooms do. That doesn't mean you should eat your meals in the bathroom, but you should give some thought to your kitchen practices. More about that later.

Super Bugs

Many public-health professionals fear that too much use of antimicrobials, especially in the uncontrolled home environment, may result in germs resistant to these chemicals. Resistance is a serious problem with antibiotics (drugs) that has arisen in part because of improper use of antibiotics by patients. Triclosan is thought to cause a similar resistance to develop because its mechanism of action is very specific and its use is becoming so widespread. In fact, resistance to triclosan has already been observed in the laboratory. (Chlorine bleach and alcohol do not cause resistance because they are so destructive to the cells.)

The concept is easy to understand. If a product doesn't kill all the germs, it's the susceptible ones that get killed first, leaving the hardier ones behind. These can multiply and eventually outnumber the susceptible bugs. The Council on Scientific Affairs of the American Medical Association concluded in 2000 that the use in consumer products of antimicrobials in which resistance has been seen should be discontinued unless data can conclusively show that this resistance has no impact on public health and that such products actually prevent infection.

Do You Really Need an Antimicrobial?

As a consumer, this is the question you need to ask. First of all, let's begin by dispelling the myth that you can have a germ-free home. You cannot maintain a sterile

Antimicrobial Ingredients

Alcohol. Usually ethanol or isopropanol. Found in aerosol disinfectants and rubbing alcohol. Low toxicity but extremely flammable. Ethanol exposure during pregnancy causes birth defects.

Chlorine bleach. Highly irritating if inhaled. Toxic if combined with other household products containing acids or ammonia. Corrosive to metal sinks and pipes.

Hydrogen peroxide. Oxidizer. Hazard depends on concentration. Highly biodegradable.

Quaternary ammonium chlorides ("Quats"). Highly concentrated products containing quats may cause skin or eye burns.

Pine oil. Strong odor not tolerated by some people. May cause skin irritation or sensitivity. Combustible.

Phenolics. Examples are chlorophenols or phenylphenols. Chlorinated phenols are toxic water pollutants and o-phenylphenol is a possible carcinogen.

Triclosan. Chlorinated phenolic compound. Rapidly increasing use in a wide variety of products (see text). May lead to resistant bacteria.

Recommendations

- ❖ Avoid household products containing triclosan. There is little evidence they are effective in homes and considerable concern about resistance. Triclosan does not kill viruses.
- ❖ Wash your hands frequently during the day with hot water and soap, especially before eating, after using the bathroom, and after contacting surfaces that might harbor a lot of germs.
- ❖ Keep your house clean using cleaning products without antimicrobials. Don't try to maintain a germ-free environment unless there is a particular medical reason to do so in your family. If so, consult your physician.
- ❖ Handle meat, fish, or poultry with care. Avoid cross-contaminating utensils, cutting boards, sponges, towels, or hands. Use one cutting board just for meat, fish, or poultry. Use only clean implements on food that will not be cooked before eating.
- ❖ Replace kitchen sponges frequently. Disinfect them weekly by boiling in water for at least three minutes or microwave for a minute or two (or both!). Launder dishrags in hot water every week. Keep sponges and rags as dry as possible.
- ❖ Use disinfectants only if they are really needed. Choose an EPA-registered product labeled for the type of use you need. Avoid products with the word DANGER on the label. Vinegar and borax are not disinfectants.
- ❖ If using a disinfectant, read and follow label directions to ensure that the product will be effective.
- ❖ Don't use aerosol disinfectants as air fresheners. You can't disinfect the air. Find the source of an unpleasant odor and deal with it appropriately.
- ❖ Keep an antiseptic in the home for cuts and scrapes.

home environment with normal efforts. Disinfectants kill germs on surfaces temporarily, but cannot provide long-lasting disinfection. There are a few situations where disinfectants may occasionally be needed, but there are many others where they aren't. Disinfecting the toilet bowl is surely an exercise in futility. Another one is using a spray disinfectant as a room deodorizer. You can't disinfect the air this way. If something smells funny, find the source and clean it up. Some people use pine oil or other disinfectants just because the smell makes them feel comfortable that things are clean. It's hard to change old habits, but if you spend much time outdoors, you know that clean air doesn't smell like a disinfectant.

Disinfectants used to be routinely recommended for cleaning up mold or mildew. However, thinking on this is changing, and many experts no longer recommend disinfecting for this purpose. Bleach requires a long contact time and usually makes materials wetter, which can actually encourage mold growth. The most important thing is to find and correct the source of that problem, usually a leak or ventilation problem, and replace damaged materials. Wet building materials and furnishings must be dried within 24-48 hours. Once surfaces are kept dry, the mold cannot grow.

When might you really need a disinfectant? One example is to clean up a sewer overflow in the basement. Another case is special health problems in the home that involve highly susceptible individuals or require cleaning up contaminated material. If such conditions exist, consult your physician for advice. For most other home uses, simple cleaning with soap or detergent and clean water should suffice if done frequently and thoroughly. In the kitchen, however, there is no margin for error.

If you cut meat, poultry, or fish, you must address the issue of possible contamination of the cutting board. Whether you use a disinfectant to do that is a personal choice. Another method is to use a separate cutting board for these foods and clean it thoroughly after each use, preferably in a dishwasher. Never use that cutting board for foods that will be eaten raw, and never use the same knife without first washing it. Can a treated cutting board or a dishwashing liquid with triclosan protect you? Treated cutting boards (and other kitchen objects) are required to carry a warning stating "This product does not protect users or others against food-borne bacteria." Doesn't exactly inspire confidence. It's better to have two cutting boards. Plastic or other non-wood boards can go in the dishwasher, and can also be disinfected with a bleach solution, but microwaving them does nothing. Wooden boards, on the other hand, can be microwaved (if they are small enough), but they cannot be disinfected with bleach because the bleach reacts with the wood and loses its potency. My choice: wood for vegetables, non-wood for meat, and the kitchen sponge never touches the board used for meat.

Speaking of sponges, kitchen sponges and dishrags are among the most bacteria-laden places in your whole house. An alternative to treated sponges is to replace sponges often, wring them out after use, and avoid cross-contamination. I like the idea someone suggested to me of using a new sponge in the kitchen for a week, then cutting off one corner and relegating it to non-food use. Finally, when two corners have been cut off, you can clean the toilet seat with it. Another common suggestion is to microwave sponges for a minute or two to disinfect them. Good idea, but avoid any cold spots in your oven. *Cook's Illustrated* magazine (Jan/Feb 2003) found that boiling a sponge for three minutes followed by microwaving reduced the bacteria count the most and was twice as effective as soaking in a bleach solution. Surprisingly, putting the sponge through the dishwasher was much less effective. Any of these practices was far better than simply washing the sponge in soap and hot water.

Triclosan is an antibacterial agent only and has little effect against virus-borne illness, so don't expect your treated hand soap to protect you from colds or the flu any more than ordinary soap does. A study of 238 households in Manhattan found that there was no significant difference between routine health symptoms in households using antibacterial products for cleaning, laundry, and hand washing and households using nonantibacterial products.

Use of triclosan in toothpaste is primarily intended to control gingivitis, swollen or bleeding gums resulting from bacteria and tartar. I'd suggest talking to your dentist. And

treated socks or underwear? The idea here is to prevent (actually delay is closer to the truth) the formation of odors. You can wear them for weeks. Give me a break—even if it works it's still disgusting. Throw them in the wash.

All antimicrobials require a certain concentration and contact time to be effective. If directions are not followed exactly, the product may not function as intended. For example, chlorine bleach requires about 30 minutes of contact time to kill bacteria and is not effective if the surface is dirty—it must be cleaned first, then disinfected. The worst possible situation is to have consumers using disinfectants and antimicrobials when they aren't really needed, and then using them incorrectly on top of that. The proliferation of germicidal products can foster a false sense of security based on unrealistic expectations, such as thinking that antibacterials kill viruses.

Scientists are divided as to the extent that disinfectants and antimicrobial products are routinely needed in the home, as well as whether the huge increase in triclosan use represents a threat of bacterial resistance. I prefer to trust the conclusions of government or independent researchers who don't have a financial interest in the results. If you are interested, look at the articles listed in the box below entitled "For More Information." A more complete list of references is available on request.

Alternative Antimicrobials

A number of common household substances like vinegar and borax are often suggested in books and articles as "alternative" disinfectants, "non-toxic" disinfectants, or "mild" (do they mean ineffective?) disinfectants. Beware. Neither of these substances is registered as a disinfectant with the EPA. Although I have seen vague references to proof of their effectiveness, I have never been able to track these references down, and there are a number of published studies indicating the contrary. Use them as cleaners if you like, but don't depend on them to disinfect.

Similarly, several plant oils (tea tree oil, grapefruit seed extract) are often described as disinfectants, and there are some commercial products based on these ingredients. Unless you find an EPA registration number on the bottle, do not assume that these products can disinfect household surfaces. There is a registered product based on thymol (from thyme oil) as an active ingredient: Sol-U-Guard™ by Melaleuca.

Hydrogen peroxide actually can be a disinfectant, and a number of products based on it exist, though most are not available to consumers. One that you can buy is H₂Orange₂, a combination of hydrogen peroxide and orange oil. H₂Orange₂ is a low-toxicity product, but citrus oils may not be acceptable to some people with chemical sensitivities. I believe that hydrogen peroxide is one of the safest disinfectants available, provided the concentration is not more than about 3%, what you can buy as an over-the-counter antiseptic. (Note: concentrated hydrogen peroxide is a potent oxidizer and is extremely dangerous!) Can you use ordinary hydrogen peroxide from the medicine cabinet as a disinfectant? I'd advise against it, since you don't have any label instructions for that use. Better to stick with a registered product. ■

For More Information

Hartman, S. "Antibacterials and Disinfectants: Are They Necessary?" www.checcnet.org/healthhouse/education/articles-detail.asp?Main_ID=121

Levy, Stuart B. "Antibacterial Household Products: Cause for Concern." www.cdc.gov/ncidod/eid/vol7no3_supp/levy.htm

Reynolds, T. "Are Antimicrobial Goods for Consumers Worth the Cost?" *Annals of Internal Medicine*, Volume 127 Issue 6, 15 September 1997, Pages 497-498. www.annals.org/cgi/content/full/127/6/497

U.S. EPA. Mold Resources web page. www.epa.gov/mold/moldresources.html#Basic%20Mold%20Cleanup

U.S. EPA. "A Brief Guide to Mold, Moisture, and Your Home." www.epa.gov/mold/moldguide.html

Mold Cleanup

"The use of a chemical or biocide that kills organisms such as mold (chlorine bleach, for example) is not recommended as a routine practice during mold cleanup. There may be instances, however, when professional judgment may indicate its use (for example, when immune-compromised individuals are present). In most cases, it is not possible or desirable to sterilize an area; a background level of mold spores will remain - these spores will not grow if the moisture problem has been resolved."—U.S. EPA *A Brief Guide to Mold, Moisture, and your Home*
For details on mold cleanup, go to www.epa.gov/mold/moldguide.html

Disposal of Antimicrobials

Household disinfectants can generally be used up or disposed of in the same way as comparable cleaning products. Do not dispose of large quantities or concentrated disinfectants down the drain. Flammable or corrosive disinfectants are accepted at most household hazardous waste (HHW) disposal sites. Commercial or hospital-grade disinfectants or large amounts may require special disposal. Do not mix disinfectants or cleaners. Transport to the HHW facilities in their original containers, sealed and upright. For further questions contact your local health department, sewer and/or solid waste agencies.

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