In Depth Look: Triclosan

Chemical: Triclosan

Names associated wtih it: Microban, Ciba® IRGASAN®, Biofresh

History:

Triclosan has been in existence for over 40 years. Invented by Ciba and approved by the FDA in 1969, it first appeared as an antibacterial in hand soaps in the 1970s. Prior to the 1990s, triclosan had been largely contained for use in hospital settings, but it has since flourished in appearance in everyday products, becoming a major player in the push towards bringing antibacterial and antimicrobial products into the home of the consumer. Products containing triclosan, boasting of its antibacterial properties, have popped up throughout the US and abroad, and have generated millions in revenue. “In Sweden in 1998 alone, 25% of the total amount of toothpaste sold contained triclosan, corresponding to around 2 tons of active ingredient" (1). Triclosan's presence hasn't ceased there. In a 2001 conference presentation at Tufts University School of Medicine, a student presented research that "seven years ago, only a few dozen products containing antibacterial agents were being marketed for the home. Now more than 700 are available" (2). That count is nearly nine years outdated, meaning the proliferation of these products on the market has only increased. Granted, not all 700+ at the time used triclosan as their active ingredient, but a considerable portion of antibacterial products then and now list it as their antibacterial agent. It is estimated that roughly two-thirds of liquid hand soaps on the market contain triclosan. Chances are, nearly every household in the country contains one product that has triclosan as an ingredient; and, at this point in time, nearly everyone comes in contact with a product containing triclosan on a near daily basis, though they may opt out of using it.

Uses:

Triclosan is used in a variety of products; the large portion of these products are personal hygiene and health and beauty products. A partial list of these products includes: hand soap, face soap, acne treatment, shaving gel, toothpaste, toothbrushes, mouthwash, deodorant, cosmetics, lipstick, bandages, hair combs, and first-aid sprays. Other products include athletic clothing, footwear, cutting boards, children's toys, dishsoap, laundry detergent, and plastics. Triclosan is added to these products solely for its antibacterial properties. “Over 95% of the uses of triclosan are in consumer products that are disposed of in residential drains" (3).

Kill Rate:

On average, triclosan kills 99%+ bacteria when used correctly. The marketed kill rate and actual kill rate vary depending on the product and the brand. It is labeled as an antibacterial, meaning it does not necessarily kill mold, mildew, or viruses like those that cause the flu and common cold. Triclosan kills bacteria through chemical means, not

physical means; it releases substances which cause toxic mutations of bacteria cells to occur. A 2005 study done by MN Girl Scouts "concluded household anti-bacterial soap kills 99.6 per cent of germs if used long enough — but regular soap kills 99.4 per cent of germs" (4). It should be noted that much of the population fails to wash their hands for the minimum recommendation of twenty seconds. Triclosan is regarded by the EPA as a pesticide and products containing the chemical must be registered with the EPA or FDA, depending on their purpose.

Effect on Humans:

Despite its prevalence on the modern market and its 40+ year history, little long-term research about the effects of triclosan on humans and the environment has been conducted. Many individual studies have been done by environmental groups, universities, students, and communities worldwide; these studies have produced results that suggest serious implications from the use of triclosan, but they give no definite picture about what the long-term impact of exposure to the pesticide may look like.

What does the research so far say? Much of it suggests that triclosan may eventually be doing more harm than good; yet, the makers of products containing triclosan stand by their products, as do the producers of the chemical itself. Additionally, neither the EPA or FDA has yet to come out with any major release on the negative impacts of the product, and continues to allow products containing it to released to the public. In 2008, the EPA completed its reregistration eligibility decision on triclosan, assuring it could stay on the market as a pesticide and ruling traces of it found in soil and water were not resulting primarily from its commercial use.

Of the studies completed on triclosan, perhaps the most frightening finding is the discovery of triclosan in human breast milk and urine, which suggests that triclosan is being absorbed into the body. Potentially, triclosan is entering the human body through residue left behind by toothpastes and from product remaining on hands after they've handled or used treated items, though neither have been definied as the exact cause of human ingestion/absorption. “A Swedish study found high levels [of] triclosan in three out of five human milk samples, indicating that triclosan does in fact get absorbed into the body, often in high quantities" (5). The same study found that triclosan was also present in human plasma in greater concentrations than those in breast milk. Naturally, the frightening aspect of this finding is the implication triclosan may be passed on to infants, possibly affecting their immune system from birth (in addition to any health impacts yet unknown about the chemical). A study completed by the National Center for Environmental Health Department of the CDC "detected concentrations of free plus conjugated species of triclosan in urine in 74.6% of the samples examined" (6). If you look at the statistics from both of these studies, the alarming realization is that both found triclosan -- a pesticide -- in the bodies of over 50% of subjects. On a final note about triclsoan's presence in the human body, research shows triclosan bioaccumulates in human tissue, meaning despite the removal of triclosan through the body in various modes of discharge, some remains stored in tissue.

Other studies have hinted at the health impacts on humans resulting from the presence of the chemical in the body. “Triclosan is linked to liver and inhalation toxicity,

and low levels of triclosan may disrupt thyroid function" (7). One study found that when triclosan is present in water supplies, the UV rays of the sun can react with it and cause a dioxin to form. “Dioxin can be highly carcinogenic and can cause health problems as severe as weakening of the immune system, decreased fertility, altered sex hormones, miscarriage, birth defects, and cancer” (8). On a bright note, it should be noted that the dioxin triclosan was discovered to mutate into was not the strongest possible.

Perhaps the most pressing issues associated with triclosan and the impact it has on the health of humans is the topic of antibiotic resistance and the creation of superbugs. In brief, since triclosan eliminates bacteria by disintegrating cell membranes, but not physically destroying the cells themselves, the remaining bacteria develop a resistance to triclosan. Students at Tufts University School of Medicine found that "to achieve a 90% death rate, wild-type *E. coli* required exposure to 150 µg/mL of triclosan in soap for 2 hours at 37 C°" (9). As bacteria mutate and the strongest survive, they learn how to fight antibiotics and adapt. The fear is that antibacterials, like triclosan, are helping bacteria become resistant to antibiotics prescribed by doctors, lowering their benefits and rendering them useless in the fight against some diseases. One study conducted by Loyola University "examined the effects of triclosan on microbial function and have established that sediments below waste water treatment plants contain triclosan resistant bacteria" (10), suggesting triclosan's effectiveness may eventually be threatened. For more information on this topic, please see the relating article on antibacterial/antimicrobial resistance.

Effect on the Environment:

As stated earlier, roughly 95% of triclosan products are ultimately washed down the drain. They are then headed toward wastewater treatment plants, and, eventually, our lakes and rivers. Of primary concern is triclosan's toxicity to aquatic ecosystems. Once triclosan residue is present in fish, it has the opportunity to enter the food chain through wild animals and humans. Just as triclosan was found to bioaccumulate in humans, the same was found true for fish. "According to a literature review by the Danish Environmental Protection Agency, triclosan... [has] bioaccumulation factors of 3,700 to 8,400 [in fish]" (11). The triclosan one person washed down the drain can potentially end up on a dinner plate for someone else. Again, there has not been enough comprehensive research done on triclosan to conclude with certainty that this is happening or may happen in the future; at the same time, it is a concept to be aware of.

According to an article by Beyond Pesticides, “accumulation of the pesticide in waterways and soil has been shown to threaten ecosystems and produce residues in fish and possibly food crops. A U.S. Geological Survey (USGS) study found that triclosan is one of the most detected chemicals in U.S. waterways and at some of the highest concentrations. Triclosan has been found to be highly toxic to different types of algae, keystone organisms for complex aquatic ecosystems” (12). The results of a June 2000 USGS study conducted in Boulder Creek, CO can be found here: http://toxics.usgs.gov/highlights/pharm_watershed/boulder_pharm_site.html (13). What is potentially disturbing about these findings is the sharp spike in triclosan found in the

water after it meets a wastewater treatment plant. Triclosan's presence goes from being hardly detected to reaching over 150 ng/L.

A 1999-2000 study by the USGS found triclosan in 57% of 139 U.S. waterways vulnerable to agricultural and/or urban activities (14). Another study conducted in Atlanta in 1999 by scientists at the USGS and CDC found "that some chemicals found in commercial household products survice WPCP treatment" (15), including triclosan. Conducted during a three month period during periods of low-flow, triclosan was found in all twelve municipal treated effluent discharge sites and three finished drinking water samples. However, the study did go on to note that "all chemicals detected had concentrations in the low ppb range."

Conclusion:

Initiatives by activists around the world have been made to ban triclosan where it is not necessary. Norway's national consumer council and food safety authority called for a ban on triclosan back in early 2005. Recently, supermarkets in the UK have banned triclosan from their shelves in the form of laundry detergents. The EPA and FDA, however, still approve it for use in the United States as long as products are registered with their respective agency. While there may be strong suspicions that triclosan may cause health problems down the road for humans, its relatively short life on the consumer market has yielded no abundant studies to confirm or deny it. Similarily, while multiple studies have found triclosan in our precious natural water supplies and the tissue of the fish that call these lakes and rivers home, it is unclear to what extent triclosan is harming aquatic ecosystems. For now, triclosan will continue to be one of the market's hottest antibacterial agents; the choice to use or not use products containing triclosan lies in the hands of the consumer (assuming, of course, they know what is in the soap and other products they use at the office, public restrooms, restaurants, etc.).

References:

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(6) Antonia M. Calafat, Xiaoyun Ye, Lee-Yang Wong, John A. Reidy, Larry L. Needham, Division of Laboratory Sciences, National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, Georgia "Urinary Concentrations of Triclosan in the U.S.: Discussion" http://www.medscape.com/viewarticle/571457_4

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(9) Stuart B. Levy, Tufts University School of Medicine, Boston, MA "Antibacterial Housebold Products: Cause for Concern" *Emerging Infections Diseases*, Vol. 7, No. 3 Supplement, June 2001

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(11) "Environmental Emergence of Triclosan" January 2006 White Paper prepared by the Emerging Contaminants Workgroup of the Santa Clara Basin Watershed Management Initiative http://docs.google.com/viewer?a=v&q=cache:TqVVJtWbonIJ:www.scbwmi.org/PDFs/WMI_Triclosan_FinalJan06.pdf+triclosan+europe&hl=en&gl=us&pid=bl&srcid=ADGEEShnxWsanCM8tpNPHcmETtTYzX_PK-0J4ZjHz_KmWfDhF9adWjy8gno0gAyxjD3hqG9n13WDrk2cAcXiOp_rqPOWRFUgiDOKa6X70GZELRs7Sp1OCAV46uPexKHluva21Vj7jxUs&sig=AHIEtbS26Ampn_b-wrp1OgF74VV8sJvMsw

(12) 2010 Beyond Pesticides “Take Action: Tell FDA That Triclosan is too Hazardous to the Environment”

(13) http://toxics.usgs.gov/highlights/pharm_watershed/boulder_pharm_site.html

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(15) GET SOURCE INFO - ARTICLE ON USGS AND CDC STUDY IN ATL

http://www.ncbi.nlm.nih.gov/pubmed/17007908