February 10, 2021

RE: Alternative Disinfectants

During the height of the pandemic, when traditional quat disinfectants were in short supply, there was an immediate need to find alternate disinfectant actives. In addition, because so much more disinfectant was being used, there was also a demand for safer disinfectants that could be used in such areas as schools, retail stores and office buildings. This bulletin will address two active ingredients, citric acid and thymol.

Back in 2014, the San Francisco Department of the Environment did an analysis of "Safer Products and Practices for Disinfecting and Sanitizing Surfaces." Their criteria were to find products that were both safer for the user and safer for the environment. The following chart shows the relative environmental and health risk of a range of disinfectant active ingredients:

ACTIVE INGREDIENT	CANCER	REPRODUCTIVE TOXICITY	ASTHMA	SKIN SENSITIZATION	AQUATIC TOXICITY	PERSISTENCE
Caprylic Acid	NO	NO	NO	NO	MED ACUTE	LOW
Citric Acid	NO	NO	NO	NO	NONE	LOW
Hydrogen Peroxide	NO	NO	NO	NO	HIGH ACUTE	LOW
Lactic Acid	NO	NO	NO	NO	NONE	LOW
Ortho-Phenylphenol (OPP)	KNOWN	SUSPECTED	NO	NO	VERY HIGH ACUTE	LOW
Peroxyacetic Acid (PAA)	NO	NO	YES	NO	VERY HIGH ACUTE	LOW
Pine Oil	NO	NO	NO	YES	NONE	LOW
Silver	NO	NO	NO	NO	HIGH ACUTE	VERY HIGH
Sodium Hypochlorite	NO	NO	YES	NO	VERY HIGH ACUTE	LOW
Thymol	NO	NO	NO	YES	HIGH ACUTE	LOW

As you can see, citric and lactic acid have the best health and environmental profile of any of the disinfectant active ingredients.

Thymol disinfectant use has increased significantly during this time. Thymol is thyme oil naturally derived from the thyme plant. Bioesque™ Botanical Disinfectant, Benefect® Botanical Disinfectant and Thymox® Disinfectant Spray all contain thymol. Since it is natural and botanical, it grew in popularity with users. However, just because it is natural does not necessarily mean it

is safe for the user or the environment. As you can see from the above chart, thymol is identified as having high acute aquatic toxicity. Acute aquatic toxicity is the property of the disinfectant to harm an organism in a short-term water exposure. Also, again from the chart, thymol is a skin sensitizer. A skin sensitizer is a substance that will induce an allergic response following skin contact.

Further confirmation of the effects of thymol was presented in California Department of Health's "Healthy Cleaning and Asthma-Safer Schools: A How-To Guide". One part of this article (page 28) attempted to find disinfectants that were safer for asthma sufferers.

TABLE 2: DISINFECTANTS–ASTHMA-SAFER INGREDIENTS AND INGREDIENTS THAT MAY CAUSE ASTHMA

Asthma-Safer Ingredients	Ingredients That May Cause Asthma*
Hydrogen Peroxide	Bleach
Lactic Acid	Glutaraldehyde
Citric Acid	Peracetic Acid (Peroxyacetic Acid)
Ethyl Alcohol	Quaternary Ammonium Compounds (also found on the label or Safety Data Sheet (SDS) under many other names such as Alkyl Dimethyl Benzyl Ammonium Chloride, Benzalkonium Chloride, Lauryl Dimethyl Benzyl Ammonium Chloride, Didecyl Dimethyl Ammonium Chloride, and other similar sounding names)
Isopropyl Alcohol	Sodium Hypochlorite (Chlorine Bleach)
	Thymol (Suspected Asthmagen)**

The article further states, "Thymol is a skin sensitizer (It can cause skin allergies). Skin sensitizers are often respiratory sensitizers, meaning they are often asthmagens. Thymol comes from the thyme plant, and thyme is an asthmagen. Because of these associations, thymol is viewed as a suspected asthmagen. Thymol is also a terpene that can react with ozone to form formaldehyde, which is a carcinogen and asthmagen. In addition, thymol did not pass the Design for the Environment Antimicrobial Pesticide Pilot Project criteria to be considered a safe disinfectant."

Citric acid, by contrast, has both excellent environmental health and safety profiles. Citric acid, derived from lemon juice, is not a skin sensitizer, and it is not even a suspected asthmagen or carcinogen. It was the first active ingredient to be approved in EPA's Design for the Environment Antimicrobial Pesticide Pilot project, criteria to be considered a safe disinfectant.

Betco's GE Fight Bac™ is a citric acid-based disinfectant that scores 0 for every category on the Hazardous Materials Identification System (HMIS) scale. The product also is in the lowest EPA toxicity category of any disinfectant and, under normal use, requires no personal protective equipment*. Also, the product is highly efficacious, killing 27 organisms, including Hepatitis B and C, canine parvo viruses and is tuberculocidal. GE Fight Bac is on EPA's List N, Disinfectants for Coronavirus (COVID-19).

GE Fight Bac RTU Disinfectant is available in quarts, gallons, 5-gallon pails, 55-gallon drums and 275-gallon disposable totes. GE Fight Bac Wipes are available in buckets of 500 and 1,500 wipes.

*PPE assessment should be performed in the specific environment where product is being used. Factors such as air ventilation, individual's chemical sensitivity and application method will affect PPE recommendations.