Independent Lab Testing Of Blue Wave Technology

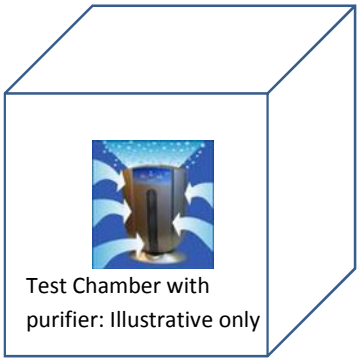
There are only a few laboratories in the U.S. recognized to provide independent testing of air purification products. The data from these independent laboratories can be used to make supportable marketing claims that pass scrutiny with the FDA, FTC, EPA and State of California as required. Intertek is one such nationally recognized laboratory.

In the spring of 2011, Blue Wave International engaged Intertek to perform microbiological performance testing of its BluWave™ Air Treatment System against bacteria and fungi. The full report of that testing is available upon request.

Summary of Results

The BluWave™ Air Treatment System was placed into the center of a 411 ft^2 room and exposed to common household microbial air contaminants. In one test, *Penicillium citrinum* (a fungus) was used, and in another test, *Staphylococcus epidermis* (a bacterium) was used. These two microorganisms represent common household, air-borne contaminants emanating from decaying fruits and cheeses (*Penicillium*) and from human skin cells (*Staphylococcus*), respectively.

After the room was contaminated with one of the microbes, the BluWave™ Air Treatment System was started. Air from the room would pass through the BluWave™ Air Treatment System at 4.5 cubic feet per minute. The reduction of each microbial contaminant was monitored over 4 hours and compared to the removal of that contaminant that naturally occurs by settling.


Test Chamber with purifier: Illustrative only

The reduction of the each contaminant attributed to the BluWave™ Air Treatment System is shown in the table below. Within 4 hours, each contaminant was reduced by over 90% of its original contamination level.

Percent reduction of Microorganisms

Contaminant	0 min.	30 min.	60 min.	90 min.	180 min.	210 min.	240 min.
Staphylococcus epidermis	0	31	50.6	60.3	79.5	86.5	93.4
Penicillium citrinum	0	28	47.4	61.2	---	---	92.7

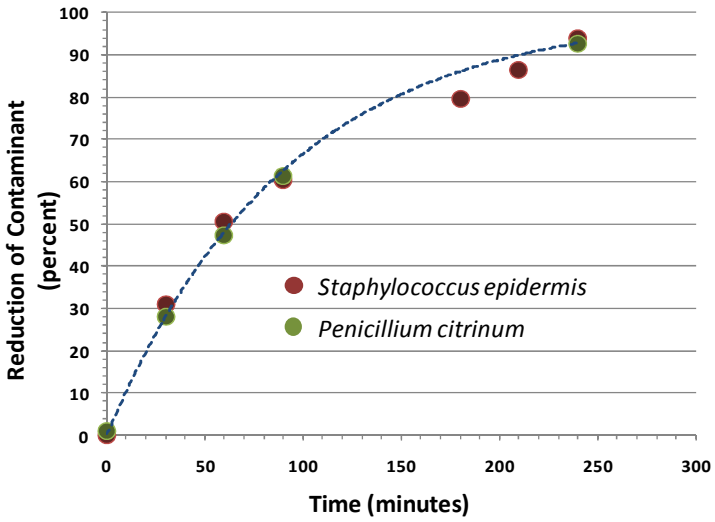
Most importantly, the efficiency of contaminant removal precisely mirrors the total amount of air treated within the 4 hour period. At 4.5 cubic feet per minute, logic dictates that the entire volume of air in the room would be treated in only,

$$\frac{411\ ft^3}{4.5\ ft^3/minute} = 91.3 \text{ minutes}$$

In reality, because the clean air from the unit is returned back into the same air space containing contaminated air, any air treatment process takes longer. (Compare and contrast placing the cleaned air into a separate room versus returning back into the space with the contamination). Fortunately, this engineering problem has long been understood (see e.g. www.engineeringtoolbox.com) and has been applied to many situations where cleaned air or water is 'recycled' back into an existing volume of un-cleaned air or water. To determine the expected percent reduction (P) of a contaminant in a room of volume V, at any time t, treated with an air purifier processing air at a flow rate of Q, starting with an initial contamination level of C, involves solving the following expression:

$$P = 100 - C\,(2.71828)^{-Qt/V}$$

which results in the blue dotted line (----) in the graph below. Also on the graph are the actual measured percent reductions of each microorganism as a function of treatment time. The data is a near perfect match, meaning that the observed reduction in both microorganisms matches up to the amount of air treated. In other words, there was 100% destruction of the microorganisms that passed through the BluWave unit.



Technology Synergy Demonstrated

The above result emphatically demonstrates the potency of the BluWave technology, but equally importantly, it demonstrates the synergy that exists. How does it demonstrate synergy? The UV lamp power used in the BluWave Air Treatment system is less than 12 watts. This amount of UV energy is not sufficient, in and of itself, to destroy the very tough *Penicillium citrinum* mold spores, which require a UV dose at least 7 times greater (Source: Lin and Li, *Control Effectiveness of Ultraviolet Germicidal Irradiation on Bioaerosols*, *Aerosol Science and Technology* 36: 474–478, 2002). Penicillium was selected because it is perhaps one of the most difficult organism to destroy that can be found in a household environment (about 25 times more difficult to destroy than Salmonella typhi, the organisn responsible for Typhoid fever). The combination of BluWave's 6 air purifying technologies enhances the potency of the system to a level at least 7 times greater than UV alone. The ability to achieve the above results means that the BluWave Air Treatment system is at least as potent as any UV only system 7 times its size.