Are Ultraviolet Sanitizer Lights Worth It?

Introduction:

In a post-covid world, sanitation is a much more recognized and important topic. With this increased attention and commercialization, comes the need for convenience and efficiency. There is no better example of this than UV Sanitizers, which weave bottles and phone cleaners being built under the promise of a 99.9% cleansed surface in around 10 minutes. We put this to the test, exposing sealed petri dishes containing common bacteria (Non pathogens containing variants of E. Coli, Staph, and bacteria collected from a school table) into a $50 phone cleaner for 0, 5, 10, 15, and 30 minutes. After that, we put it in an incubator for 24 hours for E Coli, 48 for Staph, and 72 for common table bacteria, giving ample time for bacteria to grow.

Hypothesis:

UV-C sanitizer will kill all bacteria when exposed for 10 minutes and longer. This is because of the proven research of UV lights as Sanitizers.

Procedure Plan:

The procedure we used in this experiment is as follows:

1. Inoculate the plates
   a. Using a sterile swab on a plate of E-coli and transferring it to a separate plate
   b. Using an inoculating loop we transfer the Staph Epidermidis bacteria onto a plate
   c. Swab a common use table using a sterile swab and inoculate the plate with the swabbed bacteria
2. Expose the plates to the UV sanitizing light for the 6 intervals, 5, 10, 15, 20, 30
3. Transfer the plates into the incubator at 37 degrees celsius
4. After a waiting period of 24 hours for E Coli, 48 for Staph, and 72 for Common Bacteria, observe the plates and see whether the plates have grown or not

E. Coli

E. Coli's growth was not affected by any of the time intervals of UV sanitation. Through comparing the different time cycles, we can see that there isn't a noticeable difference between the control and 30 minute cycle

Staph. E.

Staph's growth was not affected by any of the time intervals of UV sanitation, as seen by comparing the control and the 30 minute cycle

Common Table Bacteria

The common table bacteria control had 69 visible colonies after the 72 hour period. After the 10 minute cycle, there were 22 visible colonies. After the 30 minute cycle there were 0 visible colonies, showing that the UV Light successfully sanitized the common bacteria

However the light had no effect on the E Coli or Staph, which can be far more serious than the common bacteria that many of us are exposed to everyday

Minutes Exposed	E. Coli	Staph. E	Common Table
0	+	+	+ 69 Colonies
5	+	+	N/A
10	+	+	+ 22 Colonies
15	+	+	N/A
30	+	+	N/A

Conclusion:

Our data showed that both E. Coli and Staph exposed to the UV-C phone cleaner for the designated cleansing time of 10 minutes had no noticeable effect on either bacteria's growth. We think this because the 0, 5, 15, and 30 minute plates' growth once incubated 24 and 48 hours (time adjusted for the tests growth time) looked identical to the 10 minute plate. However, the tabletop bacteria was noticeably affected by the UV-C, with progressively less growth until 30 minutes of exposure, which resulted in no visible growth after 72 hours (adjusted for growth time).

We can help explain the UV-C's relationship with tested bacteria by looking at UV waves itself. There are 3 types of UV wavelengths (UV-A, B, and C), with wavelengths of 200-300 nanometers making it considered UV-C, and harmful to microorganisms. UV-C is a form of "ionizing radiation", which means that it has enough energy to ionize, or remove an electron from an atom/molecule, similar to radiation poisoning in humans. This process, when taken to a cellular scale, can alter key functions in the cell, like the DNA, which can outright kill the cell or prevent cell division. Knowing this, certain UV-C wavelengths are more effective against certain types of cells, and although we were unable to find the specific wavelength of our specific model, we can figure that the wavelength was one not as effective