

Sterilizing Masks with UVC Light

Since the COVID pandemic began, hospitals across the world are trying to conserve PPE and limit waste where possible. One method is to reuse facemasks after sterilizing them. This saves both money and resources in a nationwide mask shortage. The most common method of sterilization is to expose the mask to UVC light. This high energy light will destroy any bacteria or viruses on the surface of the mask, rendering the mask available for reuse by the original mask owner. This experiment will focus on the creation and testing of a UVC apparatus to house and sterilize the masks safely. The apparatus created will be a UVC light box, with walls and a lid that will shield the user from all radiation emitted from the bulbs within. The bulbs chosen were two 60 watt lamps approximately 8 inches long. The box was lined with aluminum foil to encourage reflection and minimize “shadows”, or areas subject to less exposure from the light. The circuit of a two-lamp fluorescent system must include a current regulating ballast. The ballast selected was specific to high wattage germicidal lamps. The box was built within budget and is easily operated while remaining completely safe for all users.

The second half of the experiment focuses on the amount of time the masks are exposed to a UVC source. Time intervals will be established starting at 1 minute and increase up to 10 minutes of exposure. The source will be two UVC 60 Watt lamps. To protect the experimenter, the UVC lamps will be enclosed in a light box. There will be no exposure to any experimenter at any time during this experiment. The experiment will involve using three different types of bacteria, each with different resistances to UV radiation. The bacteria will also vary in size and shape, which will affect the rate they absorb the UVC energy. The experiment will also involve three different mask types. Mask material plays a part in the efficacy of the radiation treatment. Due to the weaker nature of UVC radiation, bacteria not on the surface may be shielded from the full strength of the radiation. The masks used will be the standard surgical masks, a cloth mask, and an N95 mask. After exposure, the bacteria will be collected from the masks and counted. It is possible that during the exposure process, bacteria that reside under

the surface layer of the mask could be shielded from the UVC light. These bacteria will be counted during the collection process. It is expected that the 10 minutes exposure time will kill all bacteria on the mask.

If time permits, the entire experiment will be repeated using bacteriophages instead of bacteria. Phages are much smaller than bacteria and behave very similar to virus. They are usually harder to kill with radiation and the phage data can be used to estimate the survival rate of human virus on the mask. It is expected that the phages will survive longer when being exposed to the UVC light and the data will show how each different mask material performs when under the same conditions.