Solar Powered Ozone and UVC-Based Decontaminator

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Worldwide, 420,000 people die annually from foodborne illnesses. Almost 30% are children under the age of five. In this study, a portable, solar powered device was designed, built, and tested to decontaminate a variety of bacterial pathogens from foods and utensils in areas where access to easy cleaning methods or electricity is limited. It was hypothesized that the device would drastically reduce the number of both gram negative and gram positive bacteria on the surface of foods and other items. The device is controlled by a single board Raspberry Pi computer, utilizing a combination of UVC light and ozone gas in a sealed, reflective aluminum chamber to kill pathogens. It is powered by a lithium ion battery charged via a dual axis sun tracking solar panel. Reflectivity tests were run on the interior of the device to determine the most practical aluminum finish and minimum decontamination time. The device was tested in a BSL-2 laboratory using gram negative bacteria Salmonella enteritidis and gram positive bacteria Staphylococcus epidermidis. The device reduced the bacteria present on the surface of potatoes, kale, eggs, and forks by greater than 99% when compared to inoculated controls. Decontamination of bacteria inside of eggs was also tested with S. enteritidis, but the device had no effect. Field testing showed the device reliably and accurately tracked the sun and decontaminated 600 eggs with a full charge. It was concluded that the device could be a valuable tool in reducing foodborne illnesses in off the grid locations.

Awards Won:

University of Arizona: Renewal Tuition Scholarship

Arizona State University: Arizona State University Intel ISEF Scholarship

Third Award of $1,000