Solar Powered Decontaminator Design and Testing

Keirn, Alyssa (School: Rocky Mountain High School)

One in ten people in the world fall ill from foodborne pathogens each year. Of these, an estimated 420,000 die. Non-typhoidal salmonella is one of the most common types of bacteria responsible for foodborne illnesses (“World Health” 2015). In this project, a solar powered device was designed, built, and tested to decontaminate eggs, fruits, and vegetables of bacterial pathogens in locations where access to electricity and medicine are limited. It was hypothesized that the device would reduce the amount of salmonella on treated foods. The device generates ozone gas in a sealed chamber to oxidize and kill pathogens. The ozone is generated using a household air purifier, powered by rechargeable batteries. These batteries power the entire device, and are charged by a dual-axis, sun-tracking solar panel. The device is controlled by an inexpensive single board computer (Raspberry Pi 3). The optimal time interval for decontamination is calculated based on the humidity and temperature measured in the sealed chamber. A motorized roller can be utilized to rotate food to prevent any airtight seals being formed between the food and the tray. The device was tested at a BSL-2 laboratory on food items treated with Salmonella enterica serovar Enteritidis. Following exposure to ozone for 15 minutes, the average percentage of the S. enteritidis decreased by 93%, 59%, and 86% on the surface of kale, potatoes, and eggs, respectively. It was concluded that the device would be a worthwhile resource in off the grid locations to reduce bacterial foodborne illnesses.

Awards Won:

Second Award of $2,000