UV Light Treatment For Pathogen Reduction in Food Products

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***Abstract*—Our Project Report reviews the status and scope of ultraviolet (UV) light technology in the food processing industry for control of foodborne pathogens and spoilage organisms for food safety and shelf life extension. Recent years have seen a great number of instances when ultraviolet (UV) radiation was used in the preservation process of all sorts of foods. When used properly, UV treatment can be a competitive procedure in the case of foodstuffs where the large surface area allows for UV rays to penetrate the entire volume of the substance. Incorrectly applied treatment may change the composition of foods. On the other hand, UV treatment can be a useful tool for food safety because of the photosensitivity of fungal toxins. Finally, recommendations are made for the future direction of UV application research in the food processing industry.**

***Index Terms*—keywords, UV Light, preservation, shelf life, pathogens, photosensitivity**

I. Introduction

It is well established that pathogenic microorganisms associated with whole or fresh-cut produce can cause disease outbreaks, thereby demonstrating the need for improved mitigation efforts to reduce risks associated with these products. UV light is an effective disinfectant and increases the shelf life of foods, it excludes the use of chemicals and heat to get rid of the pathogenic microorganisms(Sastry et al. 2008) with being economically feasible and requiring low maintenance.

Ultraviolet (UV) radiation is a non-ionizing radiation, it's spectrum covers the wavelength range of 100–400 nm. There are three regions of UV light within the electromagnetic spectrum, UVA (315-400 nm), UVB (280-315 nm), and UVC (100-280 nm). UV radiation exhibits germicidal properties. It effectively deactivates the DNA of bacteria and other pathogens, due to which they lose the ability to multiply and cause diseases.

II. Experimental Setup

UV Disinfection of Liquid Foods: The efficiency of UV radiation to regulate pathogens in apple cider has been the main focus of recent studies (Hanes et al. 2002; Wright et al. 2000; Basaran et al. 2004). Wright and colleagues inoculated apple cider with a cocktail of five Escherichia coli O157:H7 strains to an approximate level of 106 CFU/ml and placed the stained apple cider in thin films through the Cider10uv model (Ideal Horizons, Poultney, VT) UV disinfection unit through UV radiation at 254 nm (Wright et al. 2000). The flow rates ranged from 60 to 90 l/h to generate UV doses between 9.4 and 61 mJ/cm2 . The mean log reduction was 3.8 log CFU/ml (Wright et al. 2000). Reinemann et al. (2006) achieved 3-log reduction of natural flora in raw cow milk with UV dose of 1.5 J/ml using UV reactors pure version 1 and 2 in their laboratory. These reactors contain low-pressure mercury UV lamp inside the quartz glass sleeve and this enclosed in a stainless steel chamber.

UV Treatment of Fresh Produce: Lu et al. (1991) studied the effect of low levels of UV radiation (130- 4000 mJ/cm2) on the shelf life of peaches and tomatoes, and reported reduced post-harvest rots and delayed ripening. Bialka and Demirci (2007) reported using UV treatments for decontamination of E. coli and Salmonella enterica on blueberries. After 60 s of pulsed UV treatment, they reported a maximum reduction of 4.3 and 2.9 log CFU/g for Salmonella and E. coli respectively. Pulsed UV is more expensive than continuous-wave UV. The low initial cost of continuous-wave UV as well as the lack of extensive safety equipment may benefit those with little capital to invest, which applies to most commercial blueberry packinghouses.

III. Inferences

Applying UV light of various energy and wavelengths for various durations and at varying temperatures yielded no significant changes in the organoleptic properties of the treated and untreated fruit juices. It has also established that UV treatment was not sufficient to destroy the microorganisms, particularly when the initial total microbial count was extremely high. (Health Canada,2004). In general, using UV light treatment for food has been found not to cause any adverse effects, especially if UV light is applied in moderate amounts (Krishnamurthy 2006). UV is a promising technology of surface decontamination because it is safe and does not leave any residual effect in treated food products. In addition to being germicidal, UV treatments have been found to induce desirable changes in health constituents of fruits and vegetables such as increased antioxidant capacity and increased shelf life (Wang et al., 2009). UV systems are affordable as they require low initial investment and a lower operating cost of treatment (Yaun et al. 2004).

IV. Conclusion

Promising opportunity exists for adopting ultraviolet processing in small or large scale food and dairy processing industry. With potential for offering superior organoleptic qualities of food products at lower initial investment and operating costs, we foresee a great success for adoption of UV processing technology by the food processing industry.

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