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Ankit Patras
Tennessee State University

John Ricketts
Tennessee State University

Brahmaiah Pendyala
Tennessee State University

Sandria Godwin
Tennessee State University

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College of Agriculture
Food Science & Biosystems
Engineering Program
Fact Sheet No. FSBE-01-2020

UV-C LIGHT
ENSURING SAFETY AND QUALITY OF BEVERAGES

Ankit Patras, John Ricketts, Brahmaiah Pendyala, Sandria Godwin
College of Agriculture
Department of Agricultural and Environmental Sciences
Contact: 615-707-8436, apatras@tnstate.edu; 615-630-0526, jricket1@tnstate.edu

Introduction

The Laboratory of Food Safety and Process Engineering at TSU engages in research and education about novel pasteurization and sterilization technologies. Our mission is to generate and disseminate knowledge on improving the safety, quality and healthiness of foods and food ingredients. The goal of the program is to find processes that are significantly more sustainable and efficient, while producing products that are nutritious and safe for human consumption. Juices provide many important nutrients, but consuming untreated juices or other flavored beverages can pose health risks. When fruits and vegetables are fresh-squeezed or used raw, bacteria can end up in the juice or cider. Unless the produce or the juice/cider has been pasteurized or otherwise treated to destroy any harmful bacteria, the juice or beverage could be contaminated and potentially cause a foodborne illness.

Control measures for beverages are critical, and are likely to involve multiple measures to ensure safety. High temperatures are normally used to pasteurize beverages; however these high temperatures may cause significant changes to taste and/or nutritional value. As a result, alternative pasteurization or sterilization methods including ultraviolet (UV-C light) technology have increasingly been considered over the last few years.

Overall Benefits[1,2]

⇒ Safer beverages;

⇒ More nutritious and healthier products;

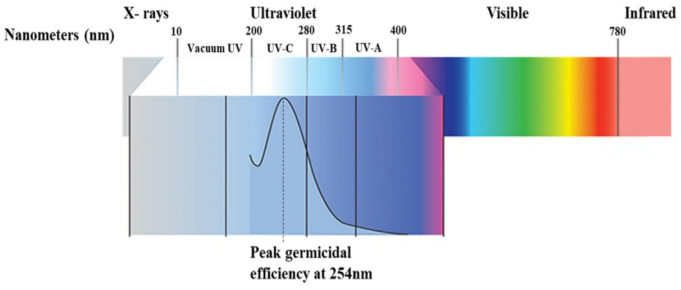
⇒ Better tasting products with more natural/raw characteristics;

⇒ Cheaper technology with a low carbon footprint;

⇒ Lower cost.

What is UV Light?

UV is part of the electromagnetic light spectrum. It can be subdivided based on its wavelength, as measured in nanometers. It is typically divided into near UV (200-380nm) and extreme or vacuum UV (10-200nm). UV is widely used to disinfect drinking water and wastewater. Recently it has been used to treat juices, dairy and non-dairy based beverages, including flavored water. UV Light was approved by the Food and Drug Administration under "Code of Federal Regulations" 21 CFR 179.39. Unlike thermal pasteurization, UV provides rapid, effective inactivation of microorganisms without impacting product quality.



Effect on nutrients

⇒ Excellent retention of vitamin C;

⇒ Most polyphenolic antioxidants retained;

⇒ Minimal loss of amino acid content.

Effect on sensory quality

⇒ Equivalent or better sensory quality than current pasteurization technology;

⇒ No loss in aromatic and flavor compounds;

⇒ Better overall attributes.

Effect on product safety

⇒ Inactivates most pathogens in beverages;

⇒ 99.999% reduction of *E. Coli*, *Listeria*, Salmonella, and *Cronobacter*;

⇒ Kills viruses and spores;

⇒ Reduced/removed mycotoxins.

Economic benefits

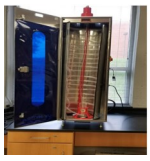
⇒ Cheaper than current technologies;

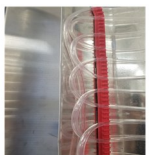
⇒ Lower operational cost;

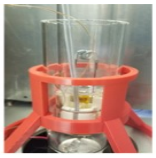
⇒ Reduced sanitation frequency;

⇒ Easily retrofitted into current production lines;

⇒ Lower carbon footprint.







[1]Pendyala, B., Patras, A., Gopisetty, V., Sasges M., Ramasamy, R (2020). Evaluation of UV-C Irradiation Treatments on Microbial Safety, Ascorbic Acid, and Volatile Aromatics Content of Watermelon Beverage. Food and Bioprocess Technology 13:101–111.

[2]Pendyala, B., Patras, A., Gopisetty, V., Sasges M., Balamurugan, S. (2019). Inactivation of Bacillus and Clostridium Spores in Coconut Water by Ultraviolet Light. Foodborne Pathogens and Disease 16 (10): 1-9.

Tennessee State University
Food Science & Biosystems Engineering Program, College of Agriculture
3500 John A. Merritt Blvd.
Nashville, TN 37209-1561

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