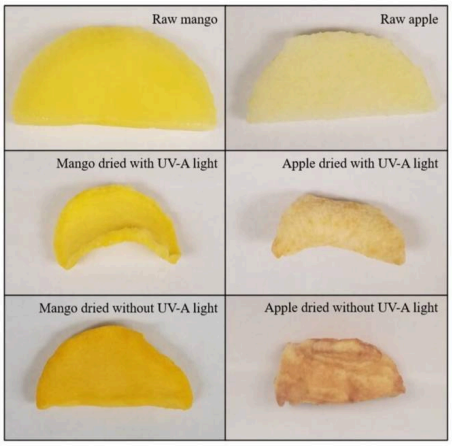
UV-A Light Dehydration of Foods

08/22/2025



UV-A Light Dehydration of Foods

Food and Agriculture

Abstract

Compared with conventional methods, dehydrating foods using UV-A light requires less energy and maintenance, decreases environmental impact, and minimizes degradation of food quality while remaining safe for human operation.

Problem

Conventional food drying methods often require high amounts of energy that may prompt degradation of the food quality and/or release chemicals or greenhouse gases into the environment. These methods are inefficient and costly.

Solution

A method of food dehydration using UV-A light in a closed chamber with a vacuum air flow source while using less energy, decreasing environmental and human impact, and preserving food color and nutrients without chemicals.

Value Proposition

UV-A light dehydration offers an efficient, low-cost, low-risk process that effectively eliminates pathogenic and spoilage microorganisms while yielding a food product superior in appearance and nutritional quality.

Benefit

Traditional food dehydration systems remove moisture from food materials using physical mechanisms such as evaporation, diffusion, and sublimation (e.g., hot-air drying, sun drying, osmotic drying, vacuum drying, and freeze-drying). Although these methods can be effective, they may require excessive amounts of time, capital, or energy. Excess energy usage may induce negative effects on both the food and the environment, such as enzymatic and nonenzymatic browning (caramelization), protein denaturation (which may diminish nutritional quality), loss of micronutrients (such as vitamins), pyrolysis, gelatinization of starch, uneven heating or overheating (which can lead to hardening or cracking), and emission of harmful greenhouse gases. The use of UV-C light has been shown to be low-cost and effective, but the FDA reports that exposure to UV-C radiation can cause serious health problems in humans, such as cataracts, severe burns, and skin cancer.

To improve upon existing food dehydration methods, USU researchers developed a method of food dehydration using UV-A light in a closed chamber with a vacuum air flow source, using an ideal combination of UV-A light intensity, input air conditions (relative humidity and temperature), and speed of air removal. An apparatus includes a light source configured to expose food in a chamber to UV-A light, an air flow source to provide a relative humidity of less than 50%, and a controller to remove food when it reaches the desired level of moisture. This method requires less energy than some traditional methods, which makes it more cost effective and easier to install, while preserving nutrients. In addition, UV-A light is considered the safest of UV rays which lowers risk for human use. Chemical additives required by other methods are eliminated by using this UV-A light method.

Food dehydration in general serves to prevent food spoilage, prolong shelf life, and reduce mass and volume, which in turn reduces space and costs for food storage and transportation. Researchers expect that

commercializing UV-A dehydration will improve upon these benefits by decreasing energy and chemical usage, reducing health risks and environmental impact, and lowering installation and maintenance costs, while preserving the nutrients and color of the food.

Market Application

This technology may be applied in the Food Processing Equipment market as a tool for dehydrating foods.

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Funding

This invention was made with government support under Grant No. 1021-09342 awarded by the US Department of Agriculture. The government has certain rights in the invention.

USU Reference No. C21038

Publications

- Microbial Inactivation on a Processed Cheese Surface by UV-A Light | ACS Food Science & Technology
- Novel sanitization approach based on synergistic action of UV-A light and benzoic acid: Inactivation mechanism and a potential application in washing fresh produce
- Antimicrobial Light-Activated Polypropylene Modified with Chitosan: Characterization and Reusability
- Zein-modified antimicrobial polypropylene_ Characterization and reusability upon UV-A light exposure

Intellectual Property

Non-Provisional Application 18/606,836 filed 3/15/2024, titled "UV-A Light Dehydration of Foods," Published 9/19/2024 as US20240306677A1