FOOD DISINFECTION SYSTEM USING ULTRAVIOLET GERMICIDAL RADIATION

PATENTED TECHNOLOGY

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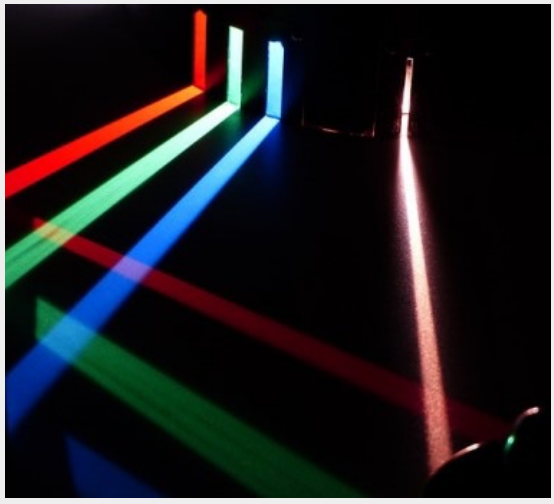
ABSTRACT

A research group at the University of Alicante has recently developed the technology for the use of ultraviolet (UV) germicidal radiation in the disinfection of foods. Disinfection of liquid foods such as milk and fruit juices is usually carried out by means of thermal treatments or by using chemicals. The formers often induce changes in the organoleptic properties as well as in the nutrient value of the food whereas the latters may lead to the presence of non-desired by-products or residues in the treated products.

The developed technology is based on the irradiation of food, and food ingredients with UV radiation in the germicidal wavelength range (i.e. 200-300 nm) using low-cost instrumentation. This is a clean treatment that allows the elimination of pathogens present in food without comprising its quality. Researchers have been working with different UV sources and instrumental designs in order to optimize the results for different foods such as vegetable milks and grape juice.



INTRODUCTION

The Analytical Chemistry, Nutrition and Food Sciences Department of the University of Alicante is working in the food characterization, food production, treatment and conservation areas. Research topics covered include:

- Chemical and Nutritional Food Analysis.
- Biodegradable Food Packaging.
- Active Packaging Systems.
- Food Quality Control.
- Design of Fast Disinfection Systems for Food and Food Processing Installations.

The study of the traditional food disinfection treatments and the search for more efficient and environmentally friendly approaches are being investigated by the research group from the applied and theoretical point of views. In this context the use of UV radiation is widely spread in other areas like waste water treatment.

TECHNICAL DESCRIPTION

The developed technology can be used to remove biological contamination in all stages of food production, from raw materials to the finished product and equipment and instrumentation used. To this end UV radiation of the germicidal wavelength range (i.e. 200-280 nm) is used.

This UV radiation is lethal to most types of microorganisms (bacteria, viruses, protozoa, moulds, yeasts and algae).

The irradiation of microorganisms produces a photochemical cross-linking of constituents of their DNA or RNA (especially thiamine or uracil bases) within the strains of DNA or RNA and with other constituent polymers such as proteins, leading to death or inactivation of the microorganism.

Technical issues are easily summarized. A source of UV germicidal radiation and an ad-hoc designed device to evenly distribute the radiation on the material to be disinfected are the only requirements.

An optimization of the operation conditions (such as time exposure and distance from the irradiation source) is usually needed in order to obtain the best results keeping the quality of the elaborated product at the highest level.

In addition, the researchers have developed this technique for disinfection of liquid foods as well as the surface of solid foods.

ADVANTAGES AND INNOVATIVE ASPECTS

ADVANTAGES

- Low cost technology.
- Chemicals are not used and hence no chemical by-products are generated in the finished product.
- Disinfected materials are not heated.
- Uses non-ionizing radiation hence not residual radioactivity is delivered to the product.
- Effective to remove most microorganisms.
- Can be used for liquid and solid materials.
- Quality characteristics are preserved.
- UV-C radiation sources are easily available at a reduced cost.
- Light Emitting Diode (LED) technology can also be used with a considerable reduction of the environmental impact of the technique.
- Low energy needs.

• Combination with a less aggressive thermal treatment can be also easily implemented.

INNOVATIVE ASPECTS

• Non transparent liquid foods, having low UV radiation penetaration depth, are fully sterilized.

• It is an alternative to thermal processes because it provides similar results being less aggressive to the product characteristics.

• Superficial disinfection of solid surfaces can be accomplished.

• Low cost and effective technology.

• UV disinfection can be implemented anyway in the production process.

CURRENT STATE OF DEVELOPMENT

Researchers at the University have been working on this technology for several years. They have developed several prototypes tested with different opaque liquids. This technology has already been implemented in manufacturing companies with a high degree of satisfaction.

The knowledge developed is available to food producing companies. An advisory service is offered and the developments of specific solutions for each case are provided.

MARKET APPLICATIONS

All types of food processing industry. In addition, this technology can be used in any process requiring a stage of microbiological disinfection such as in water treatment or in the sterilization of medical supplies.

Application of ultraviolet light can also be an alternative option to the usual use of sulphites for the control of microorganisms in wine production.

COLLABORATION SOUGHT

Companies interested in incorporating this technology for industrial applications. This research group provides advice on the possibilities provided by this technology in the manufacturing process. Research project proposals are also welcome.

RESEARCH GROUP PROFILE

The group is made up of 22 members and offers the following research capabilities:

- Polymeric materials sample preparation.
- Thermal, structural and surface characterization of polymeric materials.
- Additive determinations in polymers.
- Polymers degradation and stability evaluation.
- Development and characterization of biodegradable polymers for food packaging.
- Poly(lactic acid) based bio-nanocomposites development.
- Chemical migration assays on food packaging materials.
- Active packaging development using natural additives
- Development of additives for polymers based on vegetable oils.
- Development of sample introduction systems for ICP-AES and ICP MS
- High Performance Liquid Chromatography – Inductively Coupled Plasma Hyphenation (HPLC-ICP-AES, HPLC-ICP-MS).
- High Temperature Liquid Chromatography (HTLC) development.
- Petroleum products and biofuels analysis.
- Pharmaceutical products analysis.
- Food analysis.
- Water analysis.

- Organometallic compounds speciation.

- Food disinfection systems.

In the last five years the group has been involved in over fifty research projects financed by public and private resources. Results obtained have been published in high impact index scientific journals.

MARKET APPLICATION (6)

Agri-food and Fisheries
Biology
Molecular Biology and Biotechnology
Pollution and Environmental Impact
Medicine and Health
Water Resources