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Alternative technologies for preservation of products of vegetable origin

Introduction

- Food manufacturers must ensure that their products comply with the following requirements:
 - Product safety
 - Product quality (freshness, high content of nutrients, antioxidants, etc.)
 - sensory acceptability and satisfaction during food consumption

Introduction

- Food manufacturers must ensure that their products comply with the following requirements:
 - the impact of food on health,
 - convenience and practicality,
 - reliability and sustainability,
 - application of ethical principles during production, food distribution and consumption

Introduction

- The efficiency of conservation technologies depends on:
- processing parameters,
- types and properties of food,
- the initial number of microorganisms in the food being preserved

Introduction

- Heat sterilization procedures are effective, but they cause a significant loss of thermolabile compounds and negatively affect the sensory, physico-chemical and nutritional properties of food.
- It is desirable to replace pasteurization and sterilization at high temperatures with mild processing procedures (temperature below 40 °C).

Introduction

- the possibilities of applying non-thermal (non-thermal) procedures that effectively act on the inactivation of microorganisms and enzymes and have a positive effect on the preservation and / or improvement of the qualitative characteristics of food products are investigated
- and other

The goal

- In this review, the authors want to present the different technologies used during food processing and canning, with special reference to future directions in the development and application of new procedures, which are effective for inactivation of microorganisms in food and minimally affect the composition, nutritional and sensory quality of product.

Radio frequency heating (RF)

- **Research and application** of RF during drying of products of plant origin (vegetables, spices, potato products, pasta and snack products, etc.).
- **Advantages:** good results during inactivation of microorganisms: processing of chopped red pepper (effect on *E. coli* O157: H7 and *S. enterica* serovar Typhimurium), processing of apple juice (effect on *E. coli*), green tea (effect on *E. coli*, *S. Typhimurium* and *L. monocytogenes*)
 - potentially promising technology
- **Limitations:** influence of salt, temperature, density, moisture content), frequency of applied alternating field, etc.

Microwave heating (MT)

- **preservative action:** effectively destroys microorganisms and inactivates enzymes in various foods
- **advantages of MT** compared to classic technologies:
 - heat treatment time,
 - safe handling, uniformity of heating,
 - easy maintenance and
 - ease of handling

Microwave heating (MT)

- **Use:** in the processes of drying, sterilization, pasteurization, tempering, thawing or baking of food products
- **Products:** apple juice, coconut milk, grape juice, sweet potatoes, water and more
- **Limitation:** effect on vitamins and other biologically important ingredients in food

High pressure (HHP)

- **Activity:** influence on the physical and sensory properties of the product, has a pronounced bacteriostatic effect
- **Advantages:** the medium for creating pressure is water, all food is processed simultaneously and equally, regardless of its size and shape, the product retains its original shape, reduces damage due to heat, shorter processing time, retention of freshness, texture and color, preservation vitamin C content, etc.

High pressure (HHP)

- **Application:** pressures between 100 MPa and 900 MPa, food processing time 5-20 minutes
- **Products:** fruit juices, seafood, meat, fruit and vegetable products, ready meals, salads and sauces, pet food
 - can be used during the processing of biological and pharmaceutical products.

Pulsating electric field (PEF)

- **Principle:** action of high voltage pulses (15–80 kV / cm) in a short time (μs -ms) on food products, moving between two electrodes
- **Action:** inactivates microorganisms due to the formation of cracks in cell membranes, the formation of free radicals, which induce oxidation and changes in cell structure, metabolic disorders, the formation of thermal energy and heating during the transformation of the induced current

Pulsating electric field (PEF)

- **Advantages:** very effective effect on microorganisms and enzymes, has a beneficial effect on prolonging the shelf life of the product with minimal changes in the physical and chemical properties of food, increases the yield in the production of fruit juices
- **Possibility for application:** water treatment, prevention of biocontamination in water, etc.

Radiation of food

- **Principle:**
- The energy of ionizing radiation translates atoms into an ionic state. The resulting ions react with other molecules and affect the formation of oxygen radicals, hydrogen radicals, hydroxyl radicals and hydrogen peroxide. The resulting radicals react with other molecules.
- Accelerated electrons destroy the genetic material of pathogenic microorganisms and thus prevent the development of vital reactions for microorganisms.
- Sources of ionizing radiation: X-ray, γ - and β -waves

Radiation of food

- **Effective:** effectively acts on the removal of pathogenic microorganisms from materials and surfaces in contact with food
- **Application:** Preservation of food products using ionizing radiation is approved in more than 50 countries worldwide
 - the radiation dose applied in a particular case depends on the type of product and the radiation source.
 - radiation doses below 10 kGy

Cold atmospheric plasma

- **Principle:** plasma production is based on the action of an electromagnetic field on a gas (usually O₂ or N₂), creating a mixture of electrons, ions, some atomic species, ultraviolet photons and charged particles, which react with the food substrate and transfer the released energy to target microorganisms.
- **Advantages:** findings at ambient temperature, generation of plasma in air or modified gases, developed technologies for the formation of spatially uniform and well-controlled cold plasma at atmospheric pressure

Cold atmospheric plasma

- **Action:** quickly and efficiently inactivates microorganisms, has a high efficiency in inactivation of pathogenic bacteria, bacteria that cause food spoilage, spores of pathogenic bacteria, yeast, mold, viruses and prions
- **Application:** a new disinfection procedure, applied in medicine, agriculture and food canning and processing
 - inactivation of microorganisms in food and packaging materials, alteration of surface hydrophobicity and structural characteristics of food, inactivation of enzymes in food, decomposition of pesticide residues present on fresh products and acceleration of grain germination

Conclusions

- Consumer requirements and industry response
- Replacing conventional procedures with new technologies
- The concept of "new technologies - alternative" refers to technologies that are already in use, and the possibility of developing completely new or combined applications of these technologies
- Alternative food preservation and processing technologies in the food industry promise to produce food that is safe and of high quality

Thanks for your attention

