Surface pasteurisation with infrared heating

How does it work?

Primary objective
Fast and energy efficient surface pasteurisation of solid foods.

Working principle
When using Infrared (IR) radiation, with a short penetration depth, almost all energy is converted to heat at the surface of the food. IR radiation does not destroy microorganisms directly, but by increasing the surface temperature microorganisms are destroyed by conventional thermal mechanisms. In most solid foods internal heat conduction is poor and IR can therefore be used to increase the surface temperature enough for desirable microorganism reduction without causing substantial increase in interior temperature. A holding time may be applied to ensure sufficient microbial reduction. IR treated products can be directly fed to a packaging machine. Products may also be surface pasteurised after packaging. The effectiveness of infrared surface pasteurisation is comparable to other methods (4,7).

Images
Additional effects
IR may cause surface browning of the products, for example in meat products (4,5).

Important process parameters
IR intensity, IR wavelength (longer wavelength has short penetration depth and most of the energy is converted to heat at the surface. Shorter wavelength give a fast heat transfer and has a longer penetration depth which allows reduction of microorganisms located below the surface), temperature, processing time (9).

Important product parameters
Food composition and geometry, food surface characteristisics (emissivity), heat conductivity in the food, IR penetration depth, microbial flora, water activity (aw) – a reduction in aw increase the heat resistance of microorganisms (9).

What can it be used for?

Products
Solid foods such as ready-to-eat meat products, nuts, almonds, baked products such as sponge cake and bread, spices, shell eggs, fruits and vegetables.

Operations
Surface pasteurisation of solid foods.
Solutions for short comings

Contamination of foods by spoilage or pathogen bacteria is a severe problem. For example in the production of ready-to-eat meat products, microorganisms may be completely inactivated during production, but post-processing recontamination often occurs. Recontamination primarily occurs on the surface area and superficial heating is a good way to destroy contaminating microorganisms without unnecessary heating of the whole product (4).

With conventional surface pasteurisation methods a heating medium is needed, such as hot air, hot water or steam. A lot of energy is needed to warm up the heating medium. If heat transfer is slow the pasteurisation time will be long, possibly exposing the product to unnecessary long heating times. Hot water pasteurisation implies risks with contaminated heating water and waste water management (8,10). For fruits and vegetables, detergents and disinfectants are commonly added to the pasteurisation water (11). Steam pasteurisation increases the moisture content in the product, causing quality problems in some products (1). IR, on the other hand, is a fast and energy efficient heating method. Shorter pasteurisation times reduce the risk of over-processing of the product. No heating medium is needed, avoiding risks with contaminated water and eliminates the need for chemicals.

What can it NOT be used for?

Products

Products that need bulk pasteurisation, since IR pasteurisation mainly is an advantage for surface pasteurisation.

Operations

IR pasteurisation is good when a high temperature at the surface is needed. The penetration depth is low, and if it is desired to heat deeper into the products other methods may be preferable.

Other limitations

Depending on the geometry of the food, the IR lamps have to be carefully placed in order to achieve uniform heating, and to avoid burning of the surface. Due to shadow not all surface is treated. The time to reach the desired pasteurisation temperature can be very short using IR. Holding times may be needed to inactivate microorganisms.

Risks or hazards

Observe safety regulations when using infrared ovens. Exposure to infrared radiation can produce heat damages and may give chronic adverse effects on the eyes and skin.

Implementation

Maturity

IR heating is a mature industrial technology and has been widely used in many industrial applications.

Modularity

IR equipment can be inserted in an existing production line. In-package surface pasteurisation is possible for some products.

Consumer aspects

IR heating has been used in the restaurant business for the last 25 years. However, consumers may be sceptic towards IR heating, as it sometimes is assumed to be the same as irradiation of foods, which may be regarded as negative due to assumed health effects (2,6).

Legal aspects

EU legislation: directive 2004/40/EC exposure to electromagnetic fields (protection of workers).

Environmental aspects

IR surface pasteurisation is more energy efficient than conventional methods. IR can be a substitute to chemicals used for example in surface pasteurisation of fruits and vegetables.
Facilities that might be interesting for you

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<td>Video observation system for market research and product development tasks - Keki</td>
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Further Information

Institutes

SP, KU Leuven MeBioS

Companies

Ircon

References


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