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# Innovative Heating Processes in Food Production

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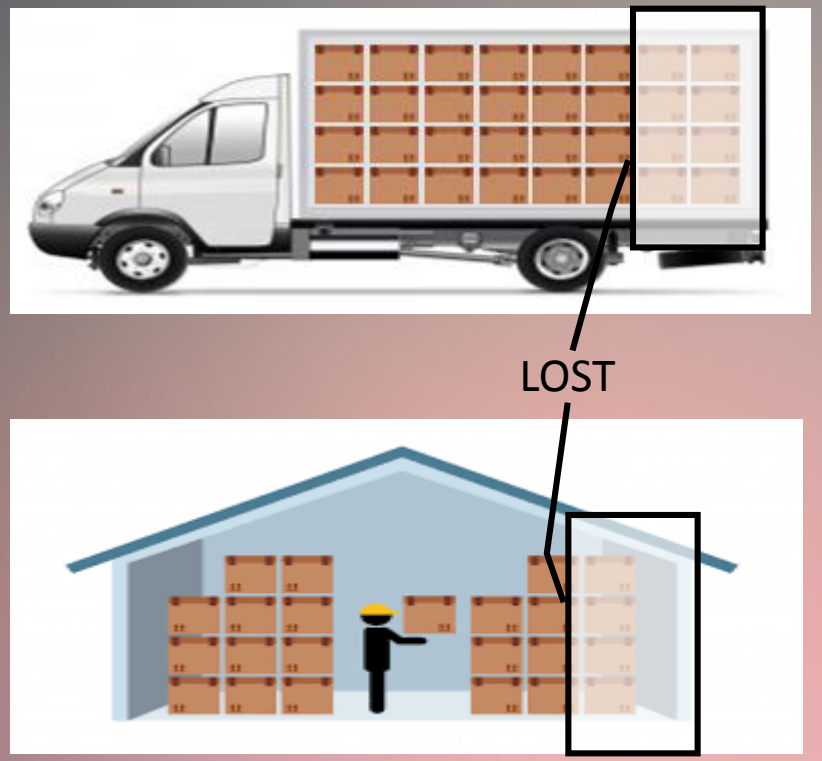
# Motivation

Fresh products

Concentrated and dried products



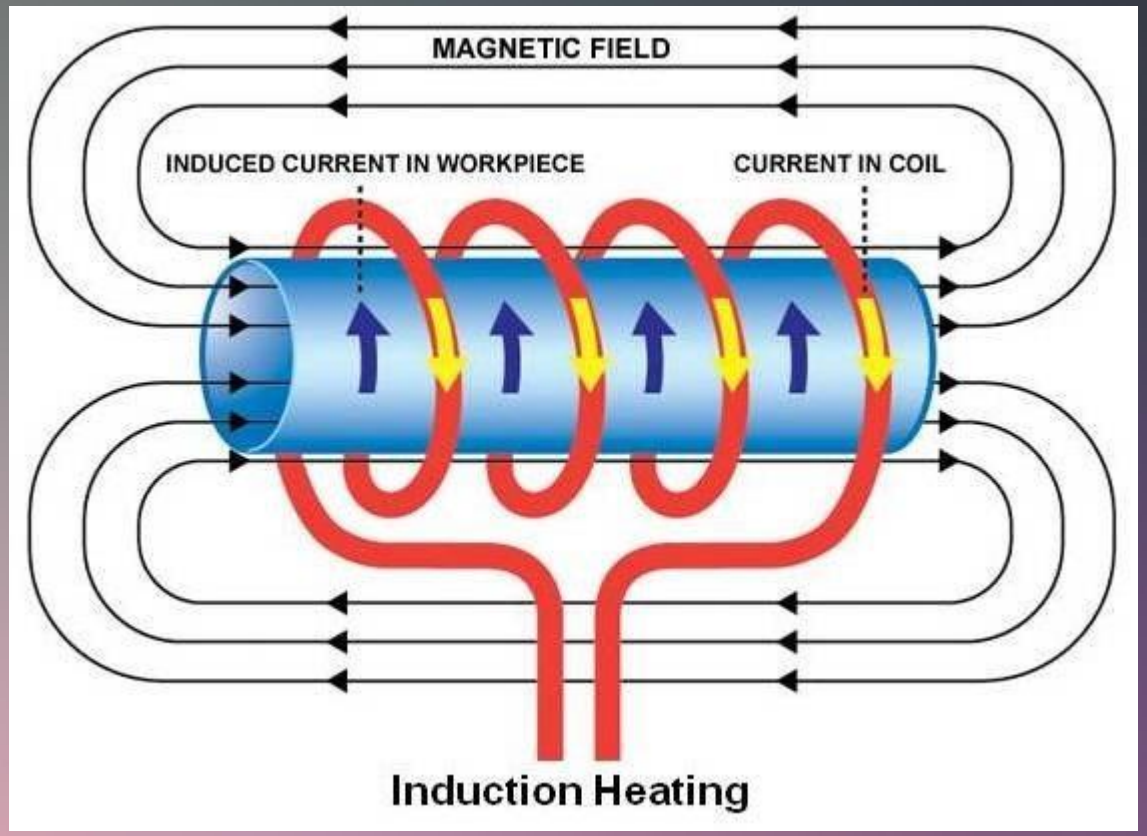

# Objectives

- explore the possibility of using alternative heating methods
- development and testing of the induction evaporator

# Induction heating

Induction heating is more efficient and economical, which generate heat by using electromagnetic field energy in materials (**Shields, 1969**). Today, the increasing use of induction heating can be explained by its main advantage - non-contact and practical inertia when transferring energy from an inductor and converting it into thermal energy.

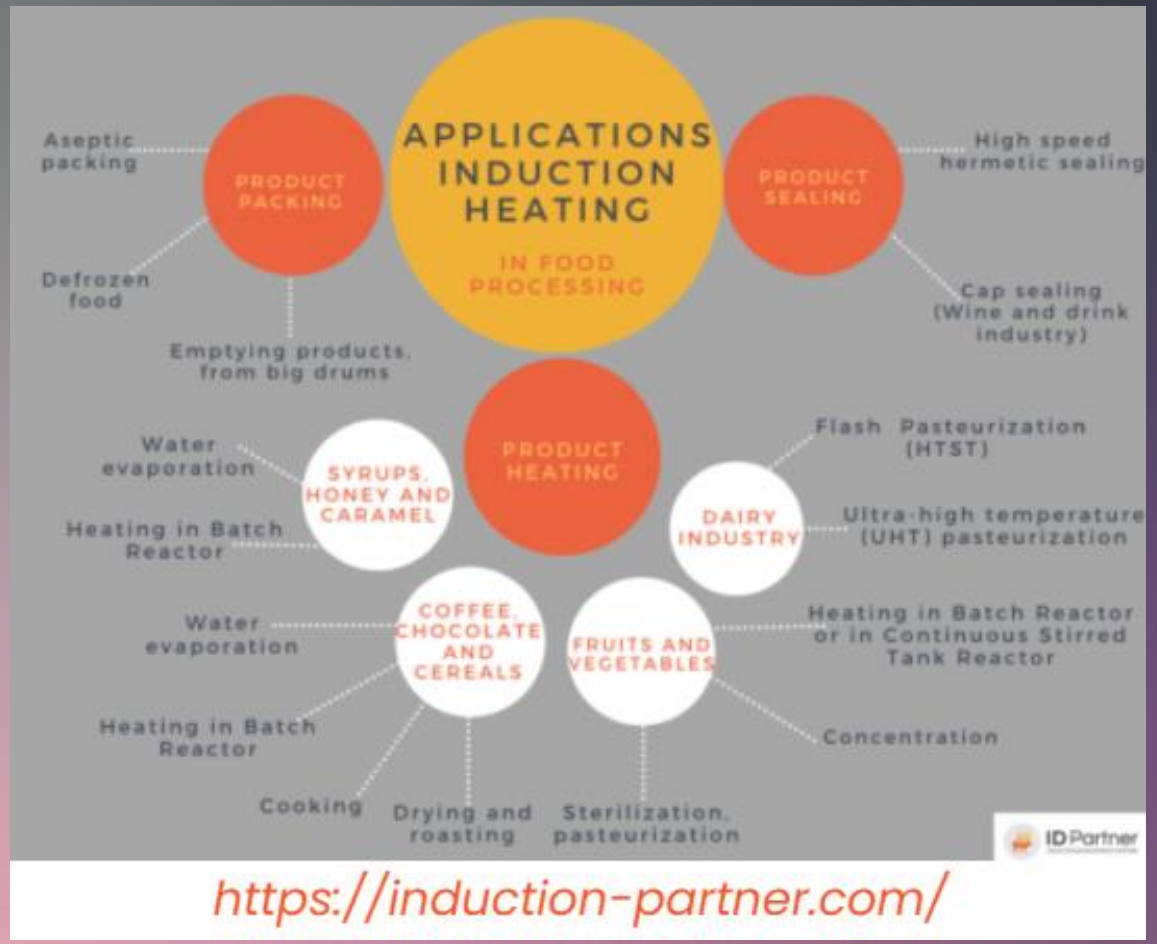
Induction heating is traditionally widely used in the metallurgical industry as a fast heating method that does not require direct contact with the product for heat transfer (**Rudnev et al., 2003**).



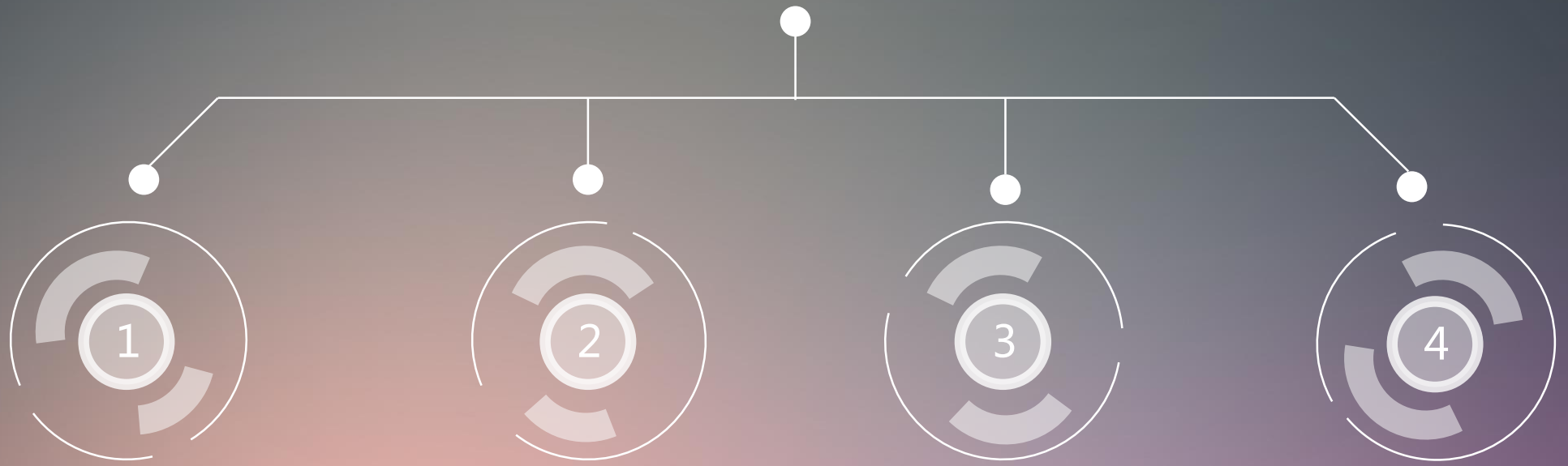
# Induction heating in food industry

Modern advances in power electronics, control methods and design of induction heating components, have allowed the development of highly reliable and economical systems, making this technology available and ubiquitous (**Lucia et al., 2013**).

However, the application of this technology in the food industry is still at an early stage. In particular, the optimal designs have not yet been determined, various design and operational parameters of induction heating apparatuses for use in the processes of drying, pasteurization, sterilization and frying of food products have not been sufficiently studied (**El-Mashad, Pan, 2017**).



# MAIN ADVANTAGES




Economical and fast heating

Increasing labor productivity

Improving working conditions

Product quality improvement

# Methodology

Model:

- an induction evaporator

Indicators:

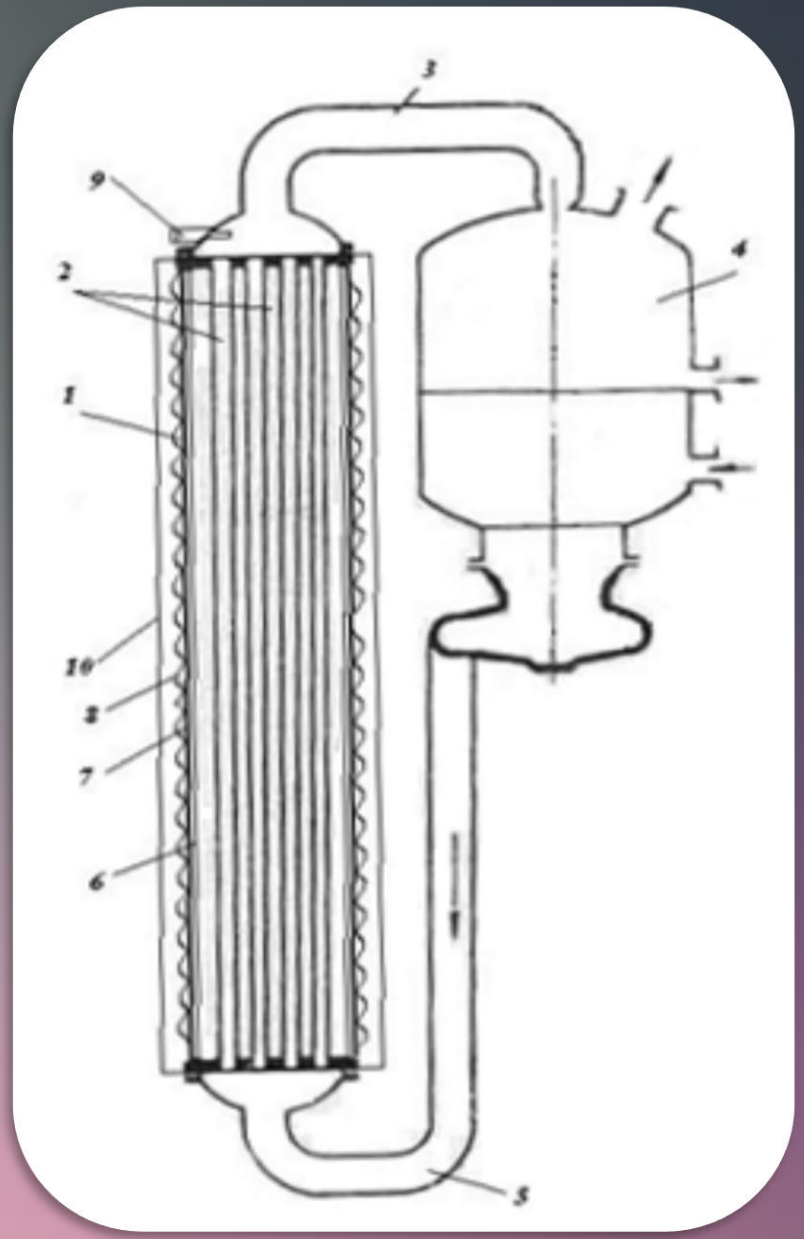
- the temperature in the test room,
- the influence of lighting,
- the stability of the power supply (220 volts - 1 phase),
- the temperature of the product
- time.

Methods:

- descriptive analysis
- logical statistical analysis

# Induction evaporator

1 - inductor,
2 - heating plates,
3 - upper outlet pipe,
4 - pumping unit,
5 - lower discharge pipe,
6 - frame,
7 - heat insulators,
8 - electrical winding,
10 - housing,
9 - thermostat.
Total power of the inductor is 3.6 kW,
The voltage is 220 V.



# Results

The specific energy consumption for evaporation of 1 kg of water is 0.63 kW, and the evaporation rate is 4.5 l/h.

The effectiveness of the developed induction evaporator has been confirmed.

It is recommended for implementation in the production of concentrated food products (tomato paste, condensed milk) and other thermal technological processes.

**National patents** on the use of induction heating in the food industry, in particular for pasteurization of milk, evaporation of liquid products, drying of fruits, vegetables and dairy products.

# Conclusion



The use of induction heating in the food industry is a green innovation that saves resources and improves productivity and efficiency. Its main advantages are ensuring the required product quality, fast heating, easy control, non-contact heat generation.

The introduction of the technical solutions proposed above into production practice will reduce the duration of the production process and capital costs, and save the energy resources of the enterprise. Induction heating technology will achieve the goals of sustainable development of the food industry.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