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*Is food physics the science of the XXI century?*

## **Is food physics the science of the XXI century?**

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### **Keywords:**

Food physics

**Abstract.** The development and modification of the science, forming and establishment of rather new fields is a normal process, carried out dominantly by 2 ways: differentiation and integration. This phenomenon of development is typical also for food physics. As integration: food science and physics and as differentiation: within food science and within applied physics.

The lecture deals with the following topics?

- the most important parts of food science and applied physics
- why is food physics a bridge between applied physics and food science?
- what are the factors, influencing the development of food physics?
- is food physics an interdisciplinary subsience? if yes, what are the connections with food analysis, measurement technique, agrophysics, biophysics, food technology, nutrition science?
- what are the development trends of food physics? (quo vadis Cibus Physicorum?)
- development in up-to-date science, problems of the future, answers from the field of food physics?
- is it true, that without high level of knowledge in physics the food engineers can not fulfill the expectations of modern food processing technologies?

### **INTRODUCTION**

The development and modification of the science, forming and establishment of rather new fields is a normal process, carried out dominantly by 2 ways: differentiation and integration.

This phenomenon of development is typical also for food physics.

As integration: food science and physics.  
As differentiation: within food science and within applied physics.

### **TOPICS**

The paper deals with the following topics:

- the most important parts of food science and applied physics

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- why is food physics a bridge between applied physics and food science?
- factors, influencing the development of food physics, radiation methods and techniques
- is food physics an interdisciplinary subsience? if yes, what are the connections with food analysis, measurement technique, agrophysics, biophysics, food technology, nutrition science?
- what are the development trends of food physics? (Quo Vadis Cibus Physicorum?)
- development in up-to-date science, problems of the future, answers from the field of food physics
- is it true, that without high level of knowledge in physics the food engineers can not fulfill the expectations of modern food processing technologies?

#### PARTS OF FOOD SCIENCE AND APPLIED PHYSICS

Food science: food chemistry, food physics, food microbiology, food technology, food machinery and unit operations applied physics: agrophysics, biophysics, food physics, radiation physics, medical physics.

#### FOOD PHYSICS AS A BRIDGE BETWEEN APPLIED PHYSICS AND FOOD SCIENCE

Food physics has 3 main topics:

- physical parameters of foodstuffs
- physical methods for investigation of foodstuffs
- physical methods for treatment and processing of foodstuffs

#### RADIATION METHODS AND TECHNIQUES IN THE AGRO-FOOD SECTOR

- Ionizing radiation techniques and technologies (gamma-sources, X-ray equipments, accelerators, reactors)
- Non-ionizing radiation techniques (light-technique, IR, UV, Laser, SYNERGOLUX: UV+ozone, polarized light)
- Radiostimulation
- Radiomutation
- Food and feed irradiation
- Isotope techniques, tracer techniques
- Radio-analytical techniques (e. g. AA, XRF)
- Measurement techniques (quantity, level, thickness etc.)
- Radiometrical control of the food chain
- Radioecological measurements

#### INTERDISCIPLINARY SCIENCES

The term „food physics” is not known enough in spite of the fact, that the constituent words (food and physics) have been used for thousands of years in the history of mankind. Food physics is a part of applied physics, but belongs to the food sciences, as well.

Food physics is a new field of science, rather special, but typically interdisciplinary science. If we use the term in wider interpretation, food physics will cover a significant part of the R+D activity of food industry, because the base of measurement techniques, mechanisation, instrumentation, automation, regulation, control and even robot-techniques is the same: physics.

Food physics deals with the physical properties of food, food ingredients and

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their measurement. Physical properties of food play a key role in all fields where modern technological processes are applied for the generation of food raw materials and the production and processing of food.

The determination of physical properties of food and related products is a requisite for planning, production engineering and automation processes in today's food industry, as well as in quality control activities.

#### CONNECTIONS

Food physics has several close connections with other sciences and subsiences, including e.g. food analysis, food quality control, food technology, nutrition.

#### FOOD ANALYSIS

Physical methods are suitable for determination of the composition (e.g. protein content, water content) or physical parameters (e.g. viscosity, radioactivity).

#### MODERN FOOD TECHNOLOGIES

- dehydration
- freezing
- lyophilization
- high pressure
- ohmic processing
- pulsing electrical fields
- magnetic fields
- nondestructive techniques (e.g. NIR-NIT, NMR, PAS)

#### HOW TO HELP FOR NUTRITION SCIENCE?

- food quality control, quality assurance

- determination of macro components (e.g. NIR/NIT, NMR, PAS)
- determination of micro components (e.g. INAA, XRF)
- to produce safe, sterile food (no microbial contamination) e.g. with irradiation or heat treatment or high pressure technology
- to improve the sensory properties of foodstuffs with physical treatments
- improvement of food processing technology, minimal processing, combination of different technologies, microvave, nanofiltration etc.
- development of robot technologies for food production

#### QUO VADIS CIBUS PHYSICORUM? TRENDS AND MODERN NONDESTRUCTIVE TECHNIQUES

- NIR-NIT spectrometry for determination of main components
- NMR techniques for rapid fat /oil measurements
- INAA techniques for determination of elements
- DSC method for study of different processes in foodstuffs (e.g. heat denaturation of proteins)
- XRF techniques for measurement of elements
- Rheometry (viscosimetry, plastometry, penetrometry, fructometry) for texture and consistence analysis
- PROBLEMS OF THE FUTURE, ANSWERS FROM THE FIELD OF FOOD PHYSICS

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- food physics is able to solve some problems e.g. on the fields of:
- Production of safe food with high quality
- Water-management, purification of water (RO)
- Waste-management, recirculation technologies (green chemistry)
- Environmental protection, ecology (measurement – decision – action – result)

IS IT TRUE, THAT WITHOUT HIGH LEVEL OF KNOWLEDGE IN PHYSICS THE FOOD ENGINEERS CAN NOT FULFILL THE EXPECTATIONS OF MODERN FOOD PROCESSING TECHNOLOGIES?

Yes, it is. They need good knowledge in basic physics, food physics, electrotechnics, measurement techniques, control and automatization, instrumental food analysis, experiment planning and process control. Yes, if we consider the expectations in modern food processing:

- Decrease the microbial contamination, disinfection
- Increase the storability
- Improve the sensory properties
- Apply of environment-friendly and economical technique

### CONCLUSIONS

Physics is a basic subject, fundament to understand food science, unit operations, food technology, measurement technique, automation.

It is evident, that without high level of knowledge in physics the food technologists and engineers can not fulfill the expectations of modern food processing.

In other words: without this knowlege they can not take part successfully in

innovation, R+D activity, creation of new technological lines, even in the everyday processing of food products using up-to-date technologies.

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