DIFFERENTIATION AND INTEGRATION IN NATURAL SCIENCE, IMPORTANCE OF FOOD PHYSICS, AS A PART OF FOOD SCIENCE AND APPLIED PHYSICS

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Abstract. The development and modification of the science, forming and establishment of new fields is a normal process, carried out in general by 2 ways: differentiation and integration. This trend of development is typical for the segments of natural science, as well, including e.g. physics, chemistry, biology.

Analysing some special fields of natural science the paper tries to find true answers to the following questions:

- what are the dominant parts of food science and applied physics?
- 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 sub science?
- what are the development trends of food physics (Quo Vadis Cibus Physicorum)?

DIFFERENTIATION AND INTEGRATION

Figure 1. shows the process of differentiation and integration in physics.

Differentiation in classical physics: mechanics (statics, dynamics) optics acoustics electricity and magnetism hydrodynamics aerodynamics astrophysics nuclear physics statistical physics

Differentiation in modern physics: quantum mechanics wave mechanics particle physics (e.g. neutron physics) solid state physics high energy (speed) physics cosmic physics atomic (nuclear) physics reactor physics laser physics


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Importance of food physics, as a part of food science and applied physics

Figure 1
Process of differentiation and integration in physics.

Figure 2
The food physics as a bridge between food science and applied physics


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FOOD PHYSICS AS A BRIDGE

Figure 2. shows the food physics as a bridge between food science and applied physics.

3 main topics of food physics:
- physical parameters of foodstuffs
- physical methods for investigation of foodstuffs
- physical methods for treatment and processing of foodstuffs

INTERDISCIPLINARY SCIENCES AND SOME OTHER FIELDS OF APPLIED PHYSICS

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, instrumenta- tion, automation, regulation, control and even robot-techniques is the same: physics.

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

Some other fields of applied physics:
- soil physics
- geophysics
- atmosphere physics
- climate physics
- chemical physics
- polimer physics
- radiation physics
- medical physics
- biophysics

TRENDS IN THE DEVELOPMENT OF FOOD PHYSICS (QUO VADIS CIBUS PHYSICORUM?)

Figure 3. shows the technology hill.

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
The technology hill

Nondestructive measurement 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

REFERENCES

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