DESCRIPTION OF THE SAFE_19 MODULE IMPLEMENTED AS PART OF THE INTENSIVE FORM OF EDUCATION (IFoE)

<table>
<tr><td>Module Name</td><td colspan="4">Freeze-Dried Food Additives</td></tr>
<tr><td>Language of Instruction</td><td colspan="4">english</td></tr>
<tr><td>Module Purpose</td><td colspan="4">The aim of the module is to familiarize participants with the possibilities of using freeze-drying in the design of food additives (fruits, vegetables, herbs), to assess the impact of freeze-drying on the sensory, nutritional, and functional quality of these additives, to develop skills in selecting process parameters (freezing, sublimation drying, secondary drying) and packaging methods, to gain practical experience in conducting analyses such as water activity, moisture content, color, texture, and rehydration capacity, as well as to understand legal aspects (labelling, food additives, nutritional claims) and safety issues (HACCP, allergens).</td></tr>
<tr><td>Module Content</td><td colspan="4">The lecture covers the principles and methods of freeze-drying applied in food technology, including the processes of freezing, sublimation drying, and secondary drying, as well as the influence of process parameters on the quality and stability of freeze-dried food additives. Various types of raw materials used for freeze-drying (fruits, vegetables, herbs), their functional properties, and potential applications in different food product groups are presented. The lecture also addresses issues related to packaging, storage, and legal aspects concerning freeze-dried food additives.
Practical classes include the preparation and freeze-drying of selected raw materials using specialized laboratory equipment, evaluation of the quality of the obtained products (determination of moisture content, water activity, color, texture, and rehydration capacity), and the preparation of a research report with interpretation of the obtained results.</td></tr>
<tr><td rowspan="2">Description of learning outcomes</td><td>Effect Symbol</td><td>Effect Name Methods</td><td>Verification and Documentation</td><td>Reference to Directional Effect Set</td></tr>
<tr><td colspan="4">KNOWLEDGE (graduate knows and understands)</td></tr>
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	W1	Knows and understands the principles of freeze-drying processes, including the stages of freezing, sublimation drying, and secondary drying, as well as their impact on the quality and stability of food in the context of modern technologies and sustainable development.	Graded assessment, written test, assessment report, archiving of assessment papers.	SAFE_W02
	W2	Knows the methods of analysis and evaluation of quality parameters of freeze-dried products (water activity, color, texture, rehydration), as well as the fundamentals of risk assessment, quality evaluation, and innovativeness of technological solutions.	Graded assessment, written test, assessment report, archiving of assessment papers.	SAFE_W03
	SKILLS (graduate can)			

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	U1	Is able to select appropriate freeze-drying process parameters for a given raw material, operate laboratory equipment, and interpret the influence of technological parameters on the properties of the final product.	Graded assessment, written test, assessment report, archiving of final assignments.	SAFE_U02
	U2	Is able to prepare a research report and a presentation of results, as well as justify the proposed technological solutions in a substantive discussion.	Class report.	SAFE_U04
	SOCIAL COMPETENCES (graduate is ready to)			
	K1	Is ready to critically assess their own knowledge and actions in the design and production of freeze-dried additives, taking into account their impact on the environment, human health, and food safety.	Participation in speeches and discussions	SAFE_K02
Module crediting method	Tests with a grade			
ECTS credit balance (total, developing practical skills, from classes conducted using distance	Number of contact hours/ECTS points		Number of non-contact hours/ECTS points	
	Lectures (hours 1 ECTS points 0.04) Classes (hours 2 ECTS points 0.08)		Reading literature (hours 1 ECTS points 0.04) Preparing for credit (hours 1 ECTS points 0.04)	

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learning methods and techniques)	**Total contact hours 3 hr. 0,12 pt. ECTS**	**Total non-contact hours 2 hr. 0,08 pt. ECTS**
Staffing	dr inż. Beata Biernacka, Prof. dr hab. Dariusz Dziki	
Information on the infrastructure ensuring the implementation of learning outcomes	The lecture room is equipped with a multimedia projector and computer equipment enabling the presentation of theoretical content. The food technology laboratory is equipped with a laboratory and pilot-scale freeze-dryer, a low-temperature freezer, and analytical instruments for product quality assessment, including a water activity meter, moisture analyzer, colorimeter, and texture analyzer, which allow for testing the parameters of freeze-dried additives and preparing research reports. The lecture room and laboratory are accessible to persons with disabilities.	
Planned teaching methods	The lecture is conducted in the form of a multimedia presentation, while laboratory classes are carried out in the unit's laboratory using the available equipment.	
Recommended reading list	Ciurzyńska, A., Lenart, A. (2020). Liofilizacja żywności – proces, właściwości i zastosowania. Warszawa: Wydawnictwo SGGW. Ratti, C. (2001). Hot air and freeze-drying of high-value foods: a review. Journal of Food Engineering, 49(4), 311–319. Ciurzyńska, A., & Lenart, A. (2011). Influence of drying method on physical properties, total phenolics and antioxidant capacity of dried apples. International Journal of Food Science & Technology, 46(10), 2101–2107. Brennan, J. G. (red.) (2016). Food Processing Handbook. 2nd Edition. Wiley-VCH. (rozdziały: Drying and Dehydration Processes). Hui, Y. H. (red.) (2012). Handbook of Food Preservation. 2nd Edition. CRC Press. (rozdziały: Freeze-Drying, Quality and Shelf-life). Sun, D.-W. (red.) (2010). Emerging Technologies for Food Processing. Academic Press. (rozdziały: Freeze Drying and Novel Dehydration Technologies).	

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