SYLLABUS

REGARDING THE QUALIFICATION CYCLE FROM 2024/2025 TO 2027/2028

Academic year 2026/2027

1. BASIC COURSE/MODULE INFORMATION

Course/Module title	**Biochemical basis of food fermentation processes**
Course/Module code *	
Faculty (name of the unit offering the field of study)	Faculty of Technology and Life Sciences
Name of the unit running the course	Faculty of Technology and Life Sciences Institute of Food Technology and Nutrition Laboratory of Analytical Biochemistry
Field of study	Food Technology and Human Nutrition
Qualification level	Studies of the 1st level
Profile	General academic
Study mode	Stationary
Year and semester of studies	Year III, semester 5
Course type	Specialty / Fermentation processes in food production
Language of instruction	Polish (English if necessary)
Coordinator	Prof. dr hab. Izabela Sadowska-Bartosz
Course instructor	Prof. dr hab. Izabela Sadowska-Bartosz

* - as agreed at the faculty

1.1.Learning format – number of hours and ECTS credits

Semester (no.)	Lectures	Classes	Colloquia	Lab classes	Seminars	Practical classes	Internships	others	**ECTS credits**
5	10			15					2

1.2. Course delivery methods

x conducted in a traditional way

-involving distance education methods and techniques

1.3. Course/Module assessment

PASS WITH A GRADE

2.PREREQUISITES

Knowledge of basis biochemical processes, basic organic chemistry and microbiology and general food technology.

3. OBJECTIVES, LEARNING OUTCOMES, COURSE CONTENT, AND INSTRUCTIONAL METHODS

3.1. Course/Module objectives

O1	Understanding of biochemical basis of chosen fermentation processes in food technology.
O2	Getting knowledge about problems concerning production of fermented food of plant and animal origin.
O3	Getting acquainted with fermented food of plant and animal origin.

3.2 COURSE/MODULE LEARNING OUTCOMES

Learning Outcome	The description of the learning outcome defined for the course/module	Relation to the degree programme outcomes
LO_01	Student knows the occurrence and properties of compounds being substrates for the fermentation processes, and properties of fermentation intermediates and products.	K_W01
LO_02	Student knows and understands biochemical reactions underlying the basis of fermentation processes.	K_W02
LO_03	Student can determine qualitatively and quantitatively substrates, products and by-products of fermentation, as well as the rate and yield of fermentation.	K_U08
LO_04	Student is ready to recognize the importance of scientific knowledge in solving practical problems of ferementation and ask for advice of experts in cases of difficulties in the independent solving of these problems.	K_K02

3.3 Course content

A. Lectures

Content outline
Biochemical basis of chosen fermentation processes in food technology. Properties of fermentation substrates, intermediates and products.
Lactic acid fermentation: bacteria of lactic acid fermentation, homo- and heterofermentation; heterofermentative bacteria of lactic acid fermentation; bacteriocins; production of fermentated buttermilk. Lactic acid fermentation as a basis of production of pickled vegetables.
Biochemical basis of alcoholic fermentation; bioreagents in alcoholic fermenttion; utilization of sugars by the yeast; fermentation of wort; why the yeast produce fusel alcohols?; secondary fermentation (beer maturation); production of low alcohol beer and alcohol-free beer; technologies of fermentation and beer maturation using immobilized cells. Colloidal and biological stabilization of beer. Characterization of fermentative capacities of the brewer's

yeast, methods of estimation of their activity. Genetic and environmental basis of the flocculation process. Methods of propagation of the brewer's yeast. By-products of alcoholic fermentation.
Raw materials, bioreagents (wine yeast) and supplements used in the winemaking; Technology of production of white and red wines (stages, technical and technological solutions); Biosynthesis of organic acids: acetic acid and citric acid.
The product of the simultaneous alcoholic, lactic and acetic fermentation carried out by the co-culture of yeast and bacteria - kombucha; yeast present in the kombucha biofilm; bacteria present in the kombucha biofilm. Interactions between kombucha microorganisms. Some biological activities of kombucha in vivo. Potential toxicity of kombucha.
Fermented plant-based food. Fermented beverages of plant origin (cereals and vegetables). Fermented oriental foods (kimchi, miso, tempeh, tofu). Health-promoting value of fermented food of plant origin.
Fermented food of animal origin. Selection of microorganisms and fermentation processes in the meat industry.

B. Laboratory classes

Content outline
The content of phenolic compounds depending on the fermentation time of kombucha. Effect of fermentation time on the antioxidant activity of kombucha (inhibition of lipid peroxidation).
Effect of fermentation time on the antioxidant activity of kombucha (scavenging of ABTS* and DPPH, FRAP).
Kinetics of the alcoholic fermentation process.
Inhibitors of glycolysis and fermentation.
Alcoholic fermentation using polysaccharides as substrates.

3.4 Methods of Instruction

Lecture: a lecture supported by a multimedia presentation.
Laboratory classes: group work, performing experiments, interpretation of source texts, case analysis and discussion, solving tasks.

4. Assessment techniques and criteria

4.1 Methods of evaluating learning outcomes

Learning outcome	Methods of assessment of learning outcomes (e.g. test, oral exam, written exam, project, report, observation during classes)	Learning format (lectures, classes, ...)
LO-01	Report on the implementation of experiments, observation during classes.	classes
LO-02	Observation during classes, test.	lecture, classes
LO-03	Report on the implementation of experiments, observation during classes.	classes
LO-04	Observation during classes, test.	lecture, classes

4.2 Course assessment criteria

The condition for completing the course is achieving all the assumed learning outcomes. Completion of laboratory exercises: final grade based on the grades of 2 final tests. Activity during classes and reports on individual thematic blocks carried out during classes will also be taken into account. Credit for the lecture: Credit with grade: assessment on the basis of the test in the form of open and closed questions covering the material from the lecture part. The condition for completing the course is achieving all the assumed learning outcomes. The number of points obtained is decisive for the positive evaluation): satisfactory, 51%; satisfactory plus, 65%; good, 75%; good plus, 85%; very good, 90%.

5. Total student workload needed to achieve the intended learning outcomes – number of hours and ECTS credits

Activity	Number of hours
Scheduled course contact hours	25/0,83
Other contact hours involving the teacher (consultation hours, examinations)	5/0,17
Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.)	30/1,0
Total number of hours	60
Total number of ECTS credits	2

* One ECTS point corresponds to 25-30 hours of total student workload

6. Internships related to the course/module

Number of hours	
Internship regulations and procedures	

7. Instructional materials

Compulsory literature: 1. Fermentation Microbiology and Biotechnology. Third Edition. 3, illustrated, revised ed. CRC Press; 2011; 2. Prajapati JB, and Nair BM. The History of Fermented Foods. Handbook of Fermented Functional Foods, edited by Farnworth ER, 2nd ed., CRC Press, 2017, pp. 1–22; 3. Barnett JA. Beginnings of microbiology and biochemistry: the contribution of yeast research. Microbiology. 2003;149(3):557-67; 4. Barnett JA. A history of research on yeasts 2: Louis Pasteur and his contemporaries, 1850–1880. Yeast. 2000;16(8):755–771;

5. Buchner E. Cell-free Fermentation. nobelprize.org; December 11, 1907, (https://www.nobelprize.org/uploads/2018/06/buchner-lecture.pdf);
6. Szewczyk KW. Bilansowanie i kinetyka procesów biochemicznych, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005;
7. Berg J.M., Tymoczko J.L., Stryer L., 2008. Biochemia. Wyd. Nauk. PWN.

Complementary literature:

1. Solomons NW. Fermentation, fermented foods and lactose intolerance. Eur J Clin Nutr. 2002;56 Suppl 4:S50-5**;**

2. Lei H, Xu H, Feng L, Yu Z, Zhao H, Zhao M. Fermentation performance of lager yeast in high gravity beer fermentations with different sugar supplementations. J Biosci Bioeng. 2016;122(5):583-588**;**

3. Villarreal-Soto SA, Beaufort S, Bouajila J, Souchard JP, Taillandier P. Understanding Kombucha Tea Fermentation: A Review. J Food Sci. 2018;83(3):580-588**;**

4. de Miranda JF, Ruiz LF, Silva CB, Uekane TM, Silva KA, Gonzalez AGM, Fernandes FF, Lima AR. Kombucha: A review of substrates, regulations, composition, and biological properties. J Food Sci. 2022;87(2):503-527.

Approved by the Head of the Department or an authorised person