(Table 5.2) Course unit description

Study program: Chemistry
Type and level of studies: Master academic studies
Course unit: Food biochemistry and biotechnology
Teacher in charge: Vladimir Mihailović
Language of instruction: English
ECTS: 5
Prerequisites: Enrolled semester
Semester: Summer semester
Course unit objective The objective of the course is to provide students with an understanding of biochemical processes occurring during the processing, storage, and consumption of food, as well as the role of enzymes and biotechnology in the production and preservation of food quality. Special attention is given to biochemical mechanisms of fermentation, enzymatic transformations, browning reactions, and food safety and functionality, including modern trends in the food industry.
Learning outcomes of Course unit Upon completion of the course, students will be familiar with biochemical processes occurring in food during storage, preparation, and processing. They will be able to apply knowledge of enzymes in the production of fermented products such as cheese, yogurt, beer, wine, and fermented meats. Students will analyze biochemical changes in raw and processed foods of both animal and plant origin. They will recognize the significance of food biotechnology and innovations in the development of functional, organic, and "novel" foods. Students will understand the importance of biochemical analyses in determining food quality and safety, apply knowledge about additives, probiotics, functional and biologically active substances in food, and identify allergens, toxins, and microbiological risks in food.
Course unit contents *Theoretical classes:* Introduction to food biochemistry. Overview of analytical techniques in food biochemistry. Plants and animal proteins in food. Natural sweet substances and synthetic/artificial sweeteners as food components. Biochemistry of food processing. Browning reactions in food (enzymatic and non-enzymatic). Pigment formation during food processing. Melanoidin-Maillard polymers. Caramelization. Oxidation of ascorbic acid. Biochemical changes in raw foods (meat, milk, cereals, fruits, and vegetables). Oxidative processes in fats and oils and the role of antioxidants in food. Enzymes and biotechnology in food. Application of enzymes in the processing of milk, meat, vegetables, and alcoholic beverages. Fermentation biotechnology (beer, cheese, alcoholic beverages). Biochemical basis of alcoholic fermentation and production of alcoholic beverages, beer, and wine. Biochemistry of cereal processing – bakery products. Fermented dairy products and cheese. Biochemical changes during food spoilage. Food safety and allergens. Regulatory framework and quality control standards. Hazard Analysis and Critical Control Points (HACCP). Microbiological food safety. Biological and chemical methods of food preservation, additives as food components. Biogenic amines in food. Food biotechnology and modern food development trends. Encapsulation of raw materials and active substances. *Practical classes:* Carbohydrates in food products (determination of crude fiber by the Kirschner-Hanak method, sugars by the Luff-Schoorl method, and starch by the Ewers method). Physicochemical quality parameters of honey. Quality parameters of oils and fats. Lipid oxidation inhibition. Examination of factors and methods for preventing enzymatic browning of food. Lactic acid and alcoholic fermentation in food production, application of kombucha in beverage production. Determination of total colored and

tannin substances in red wines. Microbiological production of vitamins. Spectrophotometric determination of caffeine content in energy drinks and teas. Determination of phenolic compounds and antioxidants in plant foods.

Literature

1. B. K. Simpson, M.L.L. Nollet, F. Toldrá, S., Benjakul, G. Paliyath, Y.H. Hui, *Food Biochemistry and Food Processing*, 2nd edition, Blackwwll Publising, USA, 2012.
2. N. A. M. Eskin, *Biochemistry of Foods*, 3th edition, Academic Press, New York and London, 1990.
3. H.L. Byong, *Fundamentals of Food Biotechnology*, 2nd edition, JohnWiley & Sons, Ltd, 2015.
4. R.J. Whitehurst, B.A. Law, *Enzymes in Food Technology*, Sheffield Academic Press, 2002.

Number of active teaching hours				
Lectures: 2	Practice: 2	Other forms of classes:	Independent work:	Other classes:

Teaching methods

Lectures, consultations, seminars, laboratory exercises.

Examination methods (maximum 100 points)

Exam prerequisites	**No. of points**	**Final exam**	**No. of points**
Practical classes	10	Written examination	30
Tests		Oral examination	30
Homework	10	Other	
Seminars	20		
Project			

Grading system

Grade	**No. of points**	**Description**
10	>= 91	Excellent
9	81-90	Exceptionally good
8	71-80	Very good
7	61-70	Good
6	51-60	Passing
5	<=50	Failing