MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SUMY NATIONAL AGRARIAN UNIVERSITY

Food Technology Department

«Approved by»

Head of the Food Technology Department

«25» серпня 2020 р.
(F. Pertsevoy)

WORK PROGRAM OF THE DISCIPLINE (SYLLABUS)

SCIENTIFIC BASES OF FOOD INDUSTRY WASTE-FREE TECHNOLOGIES

Specialty: 181 «Food Technologies»

Educational program: Food Technologies

Faculty: Food Technologies

2020 - 2021 academic year

Work program on discipline «**Scientific bases of food industry waste-free technologies**» for students in specialty **181 «Food Technologies»**

Developers:
D. Bidiuk, Ph.D., Assistant Professor, Department of Food Technology

The work program is approved at the meeting of ***Food Technology Department***.

Protocol from June «25» 2020 № 16

Head of Department _____ **(F. Pertsevoy)**
(signature)

Agreed:

Guarantor of the educational program _____ (F. Pertsevoy)

Dean of the Food Technology Faculty _____ (O. Melnyk)

Methodist of the Department of Education
Quality, Licensing and Accreditation _____ _____

Registered in electronic database: date: 28.08. 2020

1. Description of the discipline

<table>
<tr><td rowspan="2">Name of indicators</td><td rowspan="2">Industry knowledge and direction of training, education level</td><td colspan="2">Characteristics of the discipline</td></tr>
<tr><td>full-time education</td><td>external form of education</td></tr>
<tr><td>Credits - 5</td><td>Branch of knowledge:
18 "Production and Technology"</td><td colspan="2">Normative</td></tr>
<tr><td>Modules - 2</td><td rowspan="8">Specialty:
181 "Food Technology"</td><td colspan="2">Year of training:</td></tr>
<tr><td>Content module - 4</td><td>2020-2021 th</td><td></td></tr>
<tr><td rowspan="2">Individual task: -</td><td colspan="2">Course</td></tr>
<tr><td>-</td><td>1</td></tr>
<tr><td colspan="2">Semester</td></tr>
<tr><td>Total hours - 150</td><td>-</td><td>1st</td></tr>
<tr><td colspan="2">Lectures</td></tr>
<tr><td rowspan="9">A weekly hours for full-time:
classroom -
self-learning -</td><td>-</td><td>8 hours.</td></tr>
<tr><td colspan="2">Practical, seminar</td></tr>
<tr><td>-</td><td>-</td></tr>
<tr><td rowspan="2">Educational degree:
Master</td><td colspan="2">Laboratory</td></tr>
<tr><td>-</td><td>10 hours.</td></tr>
<tr><td colspan="2">Individual work</td></tr>
<tr><td>-</td><td>132 hours.</td></tr>
<tr><td colspan="2">Individual tasks: -
-</td></tr>
<tr><td colspan="2">Type of control:
exam</td></tr>
</table>

Note.
The ratio of the number of hours of classroom classes to individual work is (%): -

2. The purpose and objectives of the discipline

Purpose: to get acquainted with the latest research and practice in the field of waste-free resource-saving technologies of food products, areas of processing and disposal of food waste and by-products of the food industry into valuable products, taking into account global environmental requirements.

Objectives: to provide an idea of modern technologies for the extraction of valuable biologically active substances from food by-products, acquaintance with the optimization of food processing technologies to minimize food waste, food by-products, consider their use to create useful products with added value of food and non-food purposes , to review food waste issues, to consider ways to dispose of food waste, by-products of the food industry, taking into account global environmental standards and as a means to achieve sustainable development goals.

Learning outcomes of the discipline (LOD):

As a result of studying the discipline the student will be able to demonstrate:

- **knowledge** of waste-free technologies in the conditions of existing food industry enterprises and restaurants, the use of new methods of canning and storage of food, the use of bioplastics for packaging raw materials, semi-finished and finished products;

- knowledge of the latest trends in the field of waste-free resource-saving technologies of food products, areas of processing and disposal of food waste and by-products of the food industry into valuable products;

- knowledge of modern methods of processing food raw materials and waste, the latest technologies for the extraction of valuable biologically active substances from by-products of the food industry;

- knowledge of areas of optimization of food processing technologies to minimize the generation of food waste, by-products of the food industry, ways to use them to create useful products for food and non-food purposes, problems related to food waste;

- **ability** to demonstrate initiative and ingenuity in the development and implementation of technical and technological innovations. Be able to independently make non-standard decisions of a creative nature, take responsibility for them, generate new ideas and implement them in practice, demonstrate the ability to adapt;

- ability to choose and apply the most suitable methods of mathematical modeling and optimization in the development of scientific and technical projects in the field of food technology;

- ability to develop and improve technologies of food production, design the composition of food products, develop technologies for storage and preservation of semi-finished and finished products;

- ability to develop and implement innovative technological solutions to solve existing problems and further development of food technology, to reproduce the results of research and testing in the production conditions of real enterprises, to develop foreign economic relations of food industry and restaurants;

- ability to evaluate the properties of food waste and by-products of the food industry, extraction of valuable biologically active substances, scientifically substantiate and experimentally confirm the technology of new food products using food waste, by-products of the food industry.

3. The program of the discipline

(Is being tested)

Module 1.

Content module 1. Achievements in bioprocessing of food waste

Topic 1. By-products of the food industry and their use. Food industry wastes and by-products for industrial use. By-products from the grain processing industry. Fruit and vegetable by-products. By-products of meat and poultry processing industry. By-products of seafood processing. By-products of the dairy industry

Topic 2. Bioprocessing of waste from beef, pork, chicken and eggs. Various by-products and wastes from beef and pork processing. By-products and wastes generated from the processing of chicken and eggs. Proteins and peptides derived from by-products of chicken waste processing. Valorization of beef and pork meat processing waste. Valorization of egg waste.

Topic 3. Achievements in milk fractionation. Products of milk protein processing. Products of processing of milk fats. Products of milk sugar processing.

Topic 4. Bioprocessing of waste in the beverage industry. Coffee processing. By-products and wastes from coffee processing. Disposal of coffee by-products and waste. Tea processing and production. Tea by-products and wastes and their disposal. Fruit juice and soft

drinks. Alcohol. Beer production. By-products and wastes of the brewing industry and their use. Wine production.

Topic 5. By-products of fruit processing. Phenolic compounds as a functional food. Fruit sources of by-products. Agro-industrial by-products. Foods rich in fiber. Hemicellulose. Pectins. Value-added goods from by-products of fruit processing.

Topic 6. By-products with added value of the sugar processing industry. Pulp and paper production. Production of agglomerated products from bagasse. Alcohols. Animal feed. Acids. Pectins. Functional products and nutraceuticals. Biodegradable plastics and biopolymers. Foods and flavors. Bio-filters.

Content module 2. Modern technologies for extraction of valuable biologically active substances from by-products of the food industry

Topic 7. Dietary fiber, dietary peptides and dietary essential fatty acids from by-products of the food industry. Dietary fiber from food. Food proteins and peptides from food by-products. Dietary essential fatty acids

Topic 8. Prebiotics and dietary fiber from food. Oligosaccharides from food by-products. Polysaccharides from food and agricultural by-products.

Topic 9. Extraction and utilization of biologically active compounds from agricultural waste. Methods of isolation, purification and encapsulation of bioactive compounds from agricultural and food waste. Extraction, characterization and use of biologically active substances from waste from the wine industry. Extraction, isolation and utilization of biologically active compounds from fresh vegetables and fruits. Extraction, isolation and utilization of biologically active compounds from wastes of fruit juice production. Valorization of wastes and by-products of agro-food industry using fermentation processes and enzyme treatments. Utilization of bioactive compounds obtained from food industry waste

Module 2

Content module 3. Utilization of by-products of the food industry

Topic 10. Disposal of plant waste. Biogas and electricity production from vegetable waste. Extraction of biologically active compounds from plant waste. Methods of extraction of biologically active compounds. Dietary fiber from vegetable waste. Resistant starch from vegetable waste. Vegetable waste as compost. Biofuels and biochar from vegetable waste. Fish food from vegetable waste. Aquaponics using plant waste. Waste as animal feed. Activated carbon from vegetable waste. Biodegradable plastic. Vegetable waste as substrates in the production of citric acid

Topic 11. The use of by-products of the food industry as biofertilizers and biopesticides. The concept of food by-products processing. Plant food by-products and their importance as biofertilizers. The importance of plant foods as biopesticides.

Content module 4. Regulatory issues of food waste disposal

Topic 12. Regulatory and legal issues of food waste disposal. Possible mitigation measures for the processing of food waste. Impact of waste disposal on the environment and human health. The need for legislative and regulatory recommendations. The concept of policy, legislation, code of conduct and rules for food waste disposal. Predominant legislation and regulatory guidelines for food waste disposal. Amendments and scope of new rules for food waste disposal are possible. Use of the latest achievements in food waste disposal.

4. The structure of the discipline

Names of content modules and topics	Number of hours											
	Full-time						Part-time					
		including						including				
	Total	Lectures	Practical	Lab. work	Individual	Ind. work	Total	Lectures	Practical	Lab. work	Individual	Ind. work
Module 1												
Content module 1. Achievements in bioprocessing of food waste												
Topic 1. By-products of the food industry and their use.							14	2		2		10
Topic 2. Bioprocessing of waste from beef, pork, chicken and eggs.							14			2		12
Topic 3. Achievements in milk fractionation.							12					12
Topic 4. Bioprocessing of waste in the beverage industry.							14			2		12
Topic 5. By-products of fruit processing.							14			2		12
Topic 6. By-products with added value of the sugar processing industry.							12					12
Together on the content module 1							*80*	*2*		*8*		*70*
Content module 2. Modern technologies for extraction of valuable biologically active substances from by-products of the food industry												
Topic 7. Dietary fiber, dietary peptides and dietary essential fatty acids from by-products of the food industry.							10					10
Topic 8. Prebiotics and dietary fiber from food.							10					10
Topic 9. Extraction and utilization of biologically active compounds from agricultural waste.							12	2				10
Together on the content module 2							*32*	*2*				*30*
Module 2												
Content module 3. Disposal of food by-products												
Topic 10. Disposal of plant waste.							14	2		2		10
Topic 11. The use of by-products of the food							12					12

industry as biofertilizers and biopesticides.												
Together on the content module 3							*26*	*2*		*2*		*22*
Content module 4. Regulatory issues of food waste disposal												
Topic 12. Regulatory and legal issues of food waste disposal.							12	2				10
Together on the content module 4							*12*	*2*				*10*
Total							*150*	*8*		*10*		*132*

5. Topics and plan of lectures

№ i/s	Topic name and plan	Number of hours
1	**Topic 1. By-products of the food industry and their use.** Food industry wastes and by-products for industrial use. By-products of meat and poultry processing industry. By-products of the dairy industry	2
2	**Topic 9. Extraction and utilization of biologically active compounds from agricultural waste.** Methods of isolation, purification and encapsulation of bioactive compounds from agricultural and food waste. Extraction, characterization and use of biologically active substances from waste from the wine industry. Extraction, isolation and utilization of biologically active compounds from fresh vegetables and fruits.	2
3	**Topic 10. Disposal of plant waste.** Biogas and electricity production from vegetable waste. Extraction of biologically active compounds from plant waste. Methods of extraction of biologically active compounds. Dietary fiber from vegetable waste. Resistant starch from vegetable waste.	2
4	**Topic 12. Regulatory and legal issues of food waste disposal.** Possible mitigation measures for food waste processing. Impact of waste disposal on the environment and human health. The need for legislative and regulatory recommendations. The concept of policy, legislation, code of conduct and rules for food waste disposal.	2
	Total	**8**

6. Topics of laboratory work

№ i/s	Name topics	Number of hours
1	Study of organoleptic, physicochemical and functional-technological indicators of by-products of the food industry	2
2	The use of by-products of the meat industry in food technology	2
3	The use of waste coffee cake in bioplastic technologies	2
4	Obtaining extracts from citrus fruits and their use in the technology of dessert products and beverages	2
5	Study of the process of composting food waste	2
	At once	**10**

7. Individual work

№ i/s	Topic title and list of questions	Number of hours
1	**Topic 1. By-products of the food industry and their use.** By-products from the grain processing industry. Fruit and vegetable by-products. By-products of seafood processing.	10
2	**Topic 2. Bioprocessing of waste from beef, pork, chicken and eggs.** Various by-products and wastes from beef and pork processing. By-products and wastes generated from the processing of chicken and eggs. Proteins and peptides derived from by-products of chicken waste processing. Valorization of beef and pork meat processing waste. Valorization of egg waste.	12
3	**Topic 3. Achievements in milk fractionation.** Products of milk protein processing. Products of processing of milk fats. Products of milk sugar processing.	12
4	**Topic 4. Bioprocessing of waste in the beverage industry.** Coffee processing. By-products and wastes from coffee processing. Disposal of coffee by-products and waste. Tea processing and production. Tea by-products and wastes and their disposal. Fruit juice and soft drinks. Alcohol. Beer production. By-products and wastes of the brewing industry and their use. Wine production.	12
5	**Topic 5. By-products of fruit processing**. Phenolic compounds as a functional food. Fruit sources of by-products. Agro-industrial by-products. Foods rich in fiber. Hemicellulose. Pectins. Value-added goods from by-products of fruit processing.	12
6	**Topic 6. By-products with added value of the sugar processing industry.** Pulp and paper production. Production of agglomerated products from bagasse. Alcohols. Animal feed. Acids. Pectins. Functional products and nutraceuticals. Biodegradable plastics and biopolymers. Foods and flavors. Bio-filters.	12
7	**Topic 7. Dietary fiber, dietary peptides and dietary essential fatty acids from by-products of the food industry.** Dietary fiber from food. Food proteins and peptides from food by-products. Dietary essential fatty acids	10
8	**Topic 8. Prebiotics and dietary fiber from food.** Oligosaccharides from food by-products. Polysaccharides from food and agricultural by-products.	10
9	**Topic 9. Extraction and utilization of biologically active compounds from agricultural waste.** Extraction, isolation and utilization of biologically active compounds from wastes of fruit juice production. Valorization of wastes and by-products of agro-food industry using fermentation processes and enzyme treatments. Utilization of bioactive compounds obtained from food industry waste	10
10	**Topic 10. Disposal of plant waste.** Vegetable waste as compost. Biofuels and biochar from vegetable waste. Fish food from vegetable waste. Aquaponics using plant waste. Waste as animal feed. Activated carbon from vegetable waste. Biodegradable plastic. Vegetable waste as substrates in the production of citric acid	10
11	**Topic 11. The use of by-products of the food industry as biofertilizers and biopesticides.** The concept of food by-products processing. Plant food by-products and their importance as biofertilizers. The importance of plant foods as biopesticides.	12
12	**Topic 12. Regulatory and legal issues of food waste disposal.** Predominant legislation and regulatory guidelines for food waste disposal. Amendments and scope of new rules for food waste disposal are possible. Use of the latest achievements in food waste disposal.	10
	At once	**132**

8. Teaching methods

Lectures, work with scientific literature, including in a foreign language, use of multimedia technologies, demonstration of video materials, brainstorming, competitions, simulation teaching methods, use of training and control tests.

9. Evaluation methods

Formative assessment: in each lesson students receive descriptive feedback. According to the results of the first module - written work that gives students an idea of the level of their progress.

Summative assessment is aimed at assessing the extent to which students have achieved the planned learning outcomes through the evaluation of presentations, the implementation of written tasks.

Evaluation on a 100-point scale (distribution of points in section 10).

8. Distribution of points received by students on the test

Current testing and individual work												Independent	Together for modules and independent work	Certification	Sum
Content module 1 - 36 points						Content module 2 - 18 points			Content module 3 - 11 points		Content module 3 - 5 points				
T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	15	85 (70+15)	15	100
6	6	6	6	6	6	6	6	6	6	5	5				

Assessment scale: national and ECTS

The sum of points for all types of educational activities	Rating ECTS	Score on a national scale	
		for the exam	for offset
90-100	A	perfectly	credited
82-89	B	good	
75-81	C		
69-74	D	satisfactorily	
60-68	E		
35-59	FX	unsatisfactory with the possibility of reassembly	not credited with the possibility of re-assembly
1-34	F	unsatisfactory with mandatory re-study of the discipline	not enrolled with mandatory re-study of the discipline

9. Recommended literature

1. Food processing by-products and their utilization / edited by Dr. Anil Kumar Anal. First edition. - 2018 by John Wiley & Sons Ltd, 592 P.

2. Utilisation of bioactive compounds from agricultural and food waste / editor: Quan V. Vuong. - 2017 by CRC Press. 414 P.

3. Food Bioconversion. Handbook of Food Bioengineering, Volume 2 / Edited by Alexandru, Mihai Grumezescu, Alina Maria Holban. 1-st edition. 2017 - Academic Press. 550 P.

4. Chandrasekaran, M. (Editor) ; Nout, M.J.R. (Editor) ; Sarkar, P.K. (Editor). / Valorization of food processing by-products. Boca Raton, FL : CRC, 2012. 836 p. (Fermented Foods and Beverages).

5. Utilization of By-Products and Treatment of Waste in the Food Industry. Editors: Oreopoulou, Vasso, Russ, Winfried (Eds.). 2007 Springer Science + Business Media, LLC.

6. Integrated Processing Technologies for Food and Agricultural By-Products. Zhongli Pan Ruihong Zhang Steven Zicari. 1st Edition. 2019 - Academic Press. 452 P.

10. Information resources

1. Food Waste and Byproducts: An Opportunity to Minimize Malnutrition and Hunger in Developing Countries [Electronic resource] / Access mode: https://www.frontiersin.org/articles/10.3389/fsufs.2018.00052/full

2. Review: Food Industry By-Products used as a Functional Food Ingredients [Electronic resource] / Access mode: https://www.longdom.org/open-access/review-food-industry-byproducts-used-as-a-functional-food-ingredients-2252-5211-1000248.pdf

3. Agro-Food Byproducts as a New Source of Natural Food Additives [Electronic resource] / Access mode: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6471601/

4. Utilization of food processing by-products [Electronic resource] / Access mode: https://www.hilarispublisher.com/proceedings/utilization-of-food-processing-byproducts-8455.html

5. Valorization of Food Processing By-Products [Electronic resource] / Access mode: https://www.semanticscholar.org/paper/Valorization-of-Food-Processing-By-Products-Chandrasekaran/f936da50bcdf015a83201e398faabc6f2db857ea

6. Food Byproducts as Sustainable Ingredients for Innovative and Healthy Dairy Foods [Electronic resource] / Access mode: https://pubmed.ncbi.nlm.nih.gov/30249001/