Syllabus
Course Program

Methods and Practice of Scientific Research of Organic Substances, Food Additive and Cosmetic Components

Specialty
G1 – Chemical Technology and Engineering

Institute
Institute of Chemical Technology and Engineering

Specialization
--

Department
Department of Organic synthesis and pharmaceutical technologies (184)

Educational program
Technologies of organic substances, food additives and cosmetic components

Course type
Mandatory,

Level of education
Second (master's level)

Form of study
Full-time

Semester
1

Language of instruction
English

Lecturers and course developers

Tetiana Falalieieva

Tetiana.Falalieieva@khpi.edu.ua

Academic degree PhD, associate professor, associate professor Department of Organic synthesis and pharmaceutical technologies/
Author of over 60 scientific and educational, and methodological publications. Scientific and pedagogical experience of 26 years. Leading lecturer on the courses: "Chemistry and Technology of Intermediates", "Chemistry and Technology of Synthetic Dyes and Phosphors", "Methods and Practice of Scientific Research in the Industry" for students of the chemistry specialty.

Serhii Petrov

Serhii.Petrov@khpi.edu.ua

Academic degree PhD, associate professor, professor Department of Organic synthesis and pharmaceutical technologies/
More than 50 publications, including 4 articles in scientific journals included in the Scopus scientometric database, 3 textbooks and 2 patents. Link to Google Academy: https://scholar.google.com/citations?user=iKPdMj8AAAAJ&hl . The main courses of the first (bachelor's) level disciplines are "Recycling and resource saving in the technologies of organic substances, food additives and cosmetics", "Modern equipment in the technology of organic substances, food additives and components of cosmetics".

Tetiana Ovsiannikova

Tetiana.Ovsiannikova@khpi.edu.ua
Academic degree PhD, associate professor, associate professor Department of Organic synthesis and pharmaceutical technologies.
Author of over 50 scientific and educational publications. Leading lecturer on the courses: "Fundamentals of Biochemistry of Food Additives and Cosmetics Production", "Quality Control of Cosmetics Production" and "Microbiology of Food Additives and Cosmetics Production" for chemistry students.

More about the lecturer on the department's website
https://web.kpi.kharkov.ua/pharmchem/uk/
https://web.kpi.kharkov.ua/pharmchem/en/

General information

Summary

The Course is one of the mandatory disciplines of a student of the master's degree. The subject of the course " Methods and Practice of Scientific Research of Organic Substances, Food Additive and Cosmetic Components" is aimed at the student's acquisition of knowledge and understanding of modern methods of synthesis and research of organic substances, food additives, components of cosmetic products. Understanding of practical methods of synthesis and application of organic substances as food additives and components of cosmetic products

Course objectives and goals

Formation of students' knowledge about fundamental and applied methods and practices of scientific research on the synthesis and application of organic substances used as food additives and components of cosmetics. Ability to use fundamental concepts and definitions in scientific research. Acquisition of skills for conducting scientific research..

Format of classes

Lectures, laboratory classes, practical classes, consultations, self-study. Final control in the form of an differentiated grading.

Competencies

Program competencies according to the educational program.
К1 The ability to generate new ideas (creativity).
К3 Ability to search, process and analyze information from various sources.

Learning outcomes

Program learning outcomes according to the educational program.
ПР1 Critically understand scientific concepts and modern theories of chemical processes and chemical engineering, and apply them in conducting scientific research and creating innovations.
ПР5 Communicate fluently in the state and foreign languages orally and in writing to discuss and present the results of professional activities, research and projects.
ПР7 To search for the necessary information on chemical technology, processes and equipment for the production of chemical substances and materials based on them in scientific and technical literature, patents, databases, and other sources, to systematize, analyze, and evaluate the relevant information.

Student workload

The total volume of the course is 120 hours (4 ECTS credits): lectures – 16 hours, laboratory classes – 16 hours, practical classes - 16 hours, self-study – 72 hours.

Course prerequisites

Previous disciplines required for successful completion of the course: "Chemistry and Technology of Food Additives and Cosmetic Components", "Chemistry and Technology of Aromatic Compounds", "Organic Chemistry".

Features of the course, teaching and learning methods, and technologies

Training takes place in the classrooms and laboratories of the department, in offline and online format in Microsoft 365. In lecture classes, the following methods are used to activate the educational and cognitive activity of students when studying the discipline.
Explanatory and illustrative method or informational-receptive. Students acquire knowledge in a "ready-made" form, listening to a lecture, or from educational (or methodological) literature, or using an online manual. Students perceive and comprehend facts, assessments, conclusions and remain within the framework of reproductive (reproducing) thinking. This method is most widely used to transmit a significant amount of information. It can be used to present and assimilate facts, approaches, assessments, conclusions.
Reproductive method. Application of what has been learned based on a sample or rule. Students' activities are algorithmic, that is, they comply with instructions, orders, rules - in situations similar to the presented sample. Various exercises, practical work, programmed control, and various forms of self-control are used. The method contributes to the formation of knowledge, skills and abilities in students, forms the basic mental operations (analysis, synthesis, generalization, transfer, classification.
Problem-based learning method. The teacher poses a problem, forms a cognitive task, and then, revealing a system of evidence, comparing different approaches, shows a way to solve the task. Students become witnesses and accomplices of scientific research, perceive, realize and remember the ready-made information, follow the logic of evidence, the movement of the teacher's thought.
Partial search or heuristic method. Its essence is in organizing an active search for solutions to cognitive tasks posed by the teacher either under the guidance of the teacher or on the basis of heuristic programs and instructions. The thinking process is gradually directed and controlled by the teacher or the students themselves on the basis of work on tasks and textbooks.
"Peer to peer". The peer-to-peer principle puts the teacher in the same position as his students. In There is no place for orders and punishments in this type of learning, students check each other's work on an equal footing with the teacher, learn and teach. In this method, it is effective to involve senior students in the educational process of junior students. They can, on the same level as the teacher, conduct lectures and practical work and participate in the discussion and checking of work, be leaders in the laboratory room or auditorium and present a positive example of learning for junior applicants.
Control of students' knowledge and skills (current and final) in the discipline is carried out in accordance with the credit system of organizing the educational process. The student's rating for mastering the discipline is determined on a 100-point scale.
The final (overall) grade of the course of the educational discipline is the sum of the rating marks (points) received for individual evaluated forms of educational activity. Attending lectures and active inclusion in the discussion of the lecture material, current testing of the level of mastery of theoretical material during classroom lessons and independent work and assessment (points) for completing an individual task.

Program of the course

Academic classes

Lectures

Topics of the lectures	Hours
Topic 1. Introduction ... Types of sources of scientific information. Search for information about the research object. Organic Chemistry Portal. ChemSpider Synthetic Pages. Organic Synthesis.	2
Topic 2. Features of ...	2

Computer synthesis as part of chemoinformatics. Empirical approach to computer synthesis. Computer programs that implement the empirical approach to computer synthesis.	
Topic 3. Definition of the research object	2
Topic 4. Basic techniques of organic synthesis	2
Topic 5. Methods of increasing and decreasing the carbon chain	2
Topic 6. Methods for the formation of cyclic organic structures	2
Topic 7. Methods of rearrangement with bond breaking in the molecule and recombination of the formed fragments.	2
Topic 8. Practice of implementing scientific research results	2
Total hours	**16**

Workshops

If applicable

Topics for workshops/seminars	Hours	Weighting coefficients *a*
Topic 1. Introduction ... Formal-Logical Approach to Molecular Interconversion.	2	0,5
Topic 2. Features of ... COMputer-ASsisted organic Synthesis .	2	1,5
Topic 3. Design of new types of organic reactions. Interactive Generation of Organic Reaction. ARGENT. SYMBEQ.	2	1
Topic 4. Rules for drawing up schemes for the synthesis of organic substances.	2	1
Topic 5. Aromatization processes of organic substances.	2	1
Topic 6. Introduction of new functional substituents into the molecule of aromatic compounds.	2	1
Topic 7. Methods for transforming functional groups of aromatic compounds.	2	1
Topic 8. Methods of rearrangement with bond breaking in the molecule and recombination of the formed fragments.	2	1
Total hours	**16**	$\sum_{i=1}^{n} a_i$

Laboratory classes

If applicable

Topics for laboratory classes	Hours	Weighting coefficients *a*
Topic 1. Introduction ... Elaboration of Reaction for Organic Synthesis	2	0,5
Topic 2. Features of ... Topological Synthesis desing by Computer Application	2	1,5
Topic 3. Formal-Logical Approach to Molecular Interconversion	2	1

Topic 4. Synthesis of benzoic acid	2	1
Topic 5. Synthesis of urotropin	2	1
Topic 6. Synthesis of azo dye	2	1
Topic 7. Obtaining menthol essential oil	2	1
Topic 8. Research on surfactants	2	1
Total hours	**16**	$\sum_{i=1}^{n} a_i$=1

Self-study

Self-study includes independent work on theoretical materials and completion of individual assignments (if any).

Work on theoretical materials

Topics for self-study	Hours
Topic 1. Emulsifiers. Classification, application, micelle formation. Stabilization of emulsions	8
Topic 2. Features of ... Thickeners. Raw. Classification, application.	8
Topic 3. Modern perfume ingredients and compositions.	8
Topic 4. Fragrances. Raw materials, properties, properties, applications	8
Total hours	**32**

Topics for individual assignments

If applicable

Information about individual assignments (if any): essay, computational and graphical work, calculation work, control work, course work (project). Basic requirements for completion (scope, deadlines, etc.).

Topics for individual assignments

Topic 1. Propose a method for obtaining and using a food additive
Topic 2. ... Propose a method for obtaining and using organic substances
Topic 3. Analyze scientific sources of information and propose a modern cosmetic component for production
Topic 4. **Free choice of the student**
Total hours **40**

Non-formal education

Non-formal education includes professional courses/training, civic education, online education, professional internships, etc. The recognition of learning outcomes acquired in non-formal education applies to both mandatory and elective academic courses/educational components. The elements of non-formal education recommended in the syllabus can be recognized through a simplified procedure without additional validation of the results (without creation of a subject committee).

Provide a list of recommended professional courses/training, internships, etc. (if available).

Recommended training courses, internships

1. Online course «…»
https://www....
2. Webinar «…»
https://www....

Literature, training materials, and information resources

A list of sources of information and materials formatted in accordance with the standards. It's possible to split the list into sections, e.g. Main literature and Additional materials, etc.

Main literature

1. Techniques in Organic Chemistry http://orga.blog.unq.edu.ar/wp-content/uploads/sites/72/2016/08/Techniky-organickej-chemie.pdf
2. Regulation (EC) No 1333/2008 of the European Parliament and of the Council. https://www.kmu.gov.ua/storage/app/sites/1/55-GOEEI/es-13332008.pdf.
3. Chazelas E., Deschasaux M., Srour B. and other. Food additives: distribution and co occurrence in 126,000 food products of the French market. Scientific reports. 2020. N. 10. P. 1-15. DOI: 10.1038/s41598-020-60948-w

Additional materials

1. Mirzaeia H., Shakerib A., Rashidie B., Jalilia A., Banikazemic Z., Sahebkar A. Phytosomal curcumin: A review of pharmacokinetic, experimental and clinical studies. Biomedicine & Pharmacotherapy. V. 85. 2017. P. 102-112. DOI: 10.1016/j.biopha.2016.11.098
2. Garcia-Fuentes A.R., Wirtz S., Vos E., Verhagen H. Short Review of Sulphites as Food Additives. European Journal of Nutrition & Food Safety. 2015. 5(2). P. 113-120.
3. Moslemi M. Reviewing the recent advances in application of pectin for technical and health promotion purposes: From laboratory to market. Carbohydrate Polymers. 2021. V. 254. 117324. https://doi.org/10.1016/j.carbpol.2020.117324.

Information resources
1. Journal of the American Chemical Society;
2. Canadian Journal of Chemistry;
3. Chemical and Pharmaceutical Bulletin;
4. Synthetic Communications;
5. Journal of Heterocyclic Chemistry;
6. Journal of Medicinal Chemistry;
7. The Journal of Organic Chemistry;
8. Organic Syntheses;
9. Synthesis;
10. Chemistry Letters;
11. Tetrahedron;
12. Tetrahedron Letters

Grading system

The final grade for the educational component is determined by the lecturer and is based on topics, types of activities, etc., in accordance with the syllabus. It is an integrated assessment of the results of all types of student learning activities. The final grade should reflect all the grades for the different parts of the educational process, taking into account their weighting coefficients *k*:

Continuous assessment (during workshops, seminars, laboratory classes) k_1	Control works (if any), k_2	Individual assignment (if any), k_3	Final assessment (for courses with exams), k_4
0,4	---	0,6	--

The sum of the coefficients must be equal to one: $k_1 + k_2 + k_3 + k_4 = 1$. The weighting coefficients for the final assessment are decided by the course developer..
The final grade is calculated using the following formula:

$$G = C \cdot k_1 + K \cdot k_2 + I \cdot k_3 + E \cdot k_4$$

where: C – weighted average score for the continuous assessment
I – individual assignment grade
K – weighted average score for the continuous assessment
E – final assessment (exam) grade

$$C = \frac{C_1 \cdot a_1 + C_2 \cdot a_2 + \ldots + C_n \cdot a_n}{\sum_{i=1}^{n} a_i}$$

де: a_i - weighting coefficient for each workshop (seminar) or laboratory class.

$$K = \frac{K_1 \cdot b_1 + K_2 \cdot b_2 + \ldots + K_m \cdot b_m}{\sum_{i=1}^{m} b_i}$$

де: b_i - weighting coefficient for each control work.

The assessments for each component (C, K, I, etc.) are based on a 100-point scale in line with the provisions of the "Criteria and System for Assessing Knowledge and Skills, and Rating of Higher Education Students" of the National Technical University "Kharkiv Polytechnic Institute."

The final grade is finalized as the calculated value of G, rounded up to the nearest integer.

Grading scale

Total points	National	ECTS
90–100	Excellent	A
82–89	Good	B
75–81	Good	C
64–74	Satisfactory	D
60–63	Satisfactory	E
35–59	Unsatisfactory (requires additional learning)	FX
1–34	Unsatisfactory (requires repetition of the course)	F

Norms of academic integrity and course policy

Students must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management.
Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU "KhPI" are available on the website: http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/

Approval

Approved by	28.08.2025	**Head of the department** Oksasna STRILETS
	28.08.2025	**Guarantor of the educational program** Tetiana FALALIEIEVA