SYLLABUS
Fall semester 2024-2025 academic year
Educational program "7M07122-Nanomaterials and Nanotechnologies in Chemistry"

ID and name of course	Independent work of the student (IWS)	Number of credits			General number of credits	Independent work of the student under the guidance of a teacher (IWST)
		Lectures (L)	Practical classes (PC)	Lab. classes (LC)		
71706 The carbon nanostructured materials on the basis of vegetable raw materials	3	1,7	3,3	0	5	7

ACADEMIC INFORMATION ABOUT THE COURSE				
Learning Format	**Cycle, component**	**Lecture types**	**Types of practical classes**	**Form and platform final control**
Offline	CD, Elective	Information Lecture	practical	Oral/Online
Lecturer	PhD Auyelkhankyzy Moldir			
e-mail:	auyelkhankyzy@gmail.com			
Phone:	+77024111589			

ACADEMIC COURSE PRESENTATION		
Purpose of the course	**Expected Learning Outcomes (LO)***	**Indicators of LO achievement (ID)**
The purpose of the discipline: to form the ability to evaluate different types of biomass-derived carbon materials for various application area	1. Demonstrate the knowledge gained in the field of biomass-derived carbon materials	1.1. consider activated carbon materials based on vegetable raw materials
		1.2 discuss carbon aerogels based on vegetable raw materials
	2. Investigate the biomass-derived carbon materials	2.1. investigate activated carbon materials based on different raw materials
		2.2. investigate activated carbon aerogels based on different raw materials
	3. Demonstrate the knowledge gained in the field of application of biomass-derived carbon materials	3.1. study the application of biomass-derived carbon materials for supercapacitors and alkali metal ion-batteries
		3.2. study the application of biomass-derived carbon materials for removal of organic pollutants/ oils/ solvents and microbial fuel cell
	4. Develop the knowledge and skills gained in the field of preparation of articles and dissertations.	4.1. explain the construction of the dissertation
		4.2. explain the main steps of article preparation
	5. Analyze the knowledge gained in the field of critical analysis of choose raw materials for target application	5.1. compare different types of carbon nanostructured materials depending on raw materials
		5.2. evaluate the complex of the studied material application
Prerequisites	Organization and planning of scientific research, Academic writing.	
Postrequisites	Writing thesisis, articles and reviews.	
Learning Resources	**Main literatures:** 1. Zhu L., Wang Y., Wang Y., You L., Shen X., Li S. (2017) An environmentally friendly carbon aerogels derived from waste pomelo peels for the removal of organic pollutants/oils. Microporous and Mesoporous Materials, 241, 285–292. doi:10.1016/j.micr. 2. Cai T., Wang H., Jin C., Sun Q., Nie Y. (2017) Fabrication of nitrogen-doped porous electrically conductive carbon aerogel from waste cabbage for supercapacitors and oil/water separation. Journal of Materials Science: Materials in Electronics, 29(.	

	3. Wang Y., Zhu L., Zhu F., You L., Shen X., Li S. (2017) Removal of organic solvents/oils using carbon aerogels derived from waste durian shell. Journal of the Taiwan Institute of Chemical Engineers, 78:351–358. doi:10.1016/j.jtice.2017.06.037. 4. Li Y.-Q., Samad Y.A., Polychronopoulou K., Liao K. (2015) Lightweight and Highly Conductive Aerogel-like Carbon from Sugarcane with Superior Mechanical and EMI Shielding Properties. ACS Sustainable Chemistry & Engineering, 3(7):1419–1427, doi: 10.1021/acssuschemeng.5b00340. **Additional literatures:** 1. Zang L., Bu Z., Sun L., Zhang Y. (2016) Hollow carbon fiber sponges from crude catkins: an ultralow cost absorbent for oils and organic solvents. RSC Advances, 6(54):48715–48719. doi:10.1039/c6ra08183e. 2. E L., Sun J., Gan W., Wu Z., Xu Z., Xu L., Liu, S. (2021) N-doped cellulose-based carbon aerogels with a honeycomb-like structure for high-performance supercapacitors. Journal of Energy Storage, 38:102414. https://doi.org/10.1016/j.est.2021.102414. 3. Zhou H., Shu R., Guo F., Bai J., Zhan Y., Chen Y., Qian L. (2021) N-O-P co-doped porous carbon aerogel derived from low-cost biomass as electrode material for high-performance supercapacitors. Diamond & Related Materials 120:108614, doi:10.1016/j.diamond.2021.108614. **Internet resources** https://www.sciencedirect.com/topics/chemical-engineering/carbon-aerogel **Software** Microsoft word

Academic course policy	The academic policy of the course is determined by the Academic Policy and the Policy of Academic Integrity of Al-Farabi Kazakh National University. Documents are available on the main page of IS Univer. **Integration of science and education.** The research work of students, undergraduates and doctoral students is a deepening of the educational process. It is organized directly at the departments, laboratories, scientific and design departments of the university, in student scientific and technical associations. Independent work of students at all levels of education is aimed at developing research skills and competencies based on obtaining new knowledge using modern research and information technologies. A research university teacher integrates the results of scientific activities into the topics of lectures and seminars (practical) classes, laboratory classes and into the tasks of the IWST, IWS, which are reflected in the syllabus and are responsible for the relevance of the topics of training sessions and assignments. **Attendance.** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course. Failure to meet deadlines results in loss of points. **Academic honesty.** Practical/laboratory classes, IWS develop the student's independence, critical thinking, and creativity. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of completing tasks are unacceptable. Compliance with academic honesty during the period of theoretical training and at exams, in addition to the main policies, is regulated by the "Rules for the final control" , "Instructions for the final control of the autumn / spring semester of the current academic year" , "Regulations on checking students' text documents for borrowings". Documents are available on the main page of IS Univer. **Basic principles of inclusive education.** The educational environment of the university is conceived as a safe place where there is always support and equal attitude from the teacher to all students and students to each other, regardless of gender, race / ethnicity, religious beliefs, socio-economic status, physical health of the student, etc. All people need the support and friendship of peers and fellow students. For all students, progress is more about what they can do than what they can't. Diversity enhances all aspects of life. All students, especially those with disabilities, can receive counseling assistance by phone/ e-mail +77024111589, *auyelkhankyzy@gmail.com* or via video link in Zoom https://us05web.zoom.us/j/89918899128?pwd=hiD7VljTukf5ZHfbhntfUFzUDZzdqA.1 **Integration MOOC (massive open online course).** In the case of integrating MOOC into the course, all students need to register for MOOC. The deadlines for passing MOOC modules must be strictly observed in accordance with the course study schedule. **ATTENTION!** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course, as well as in the MOOC. Failure to meet deadlines results in loss of points.

INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT

Score-rating letter system of assessment of accounting for educational achievements				**Assessment Methods**
Grade	**Digital equivalent points**	**points, % content**	**Assessment according to the traditional system**	**Criteria-based assessment** is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment. **Formative assessment is** a type of assessment that is carried out in the course of daily learning activities. It is the current measure
A	4.0 _	95-100	Great	
A-	3.67	90-94		

B+	3.33	85-89	Fine	of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed. **Summative assessment** - type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course. Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated.
B	3.0	80-84		**Formative and summative assessment** / **Points % content**
B-	2.67	75-79		Activity at lectures / 0
C+	2.33	70-74		Work in practical classes / 35
C	2.0	65-69	Satisfactorily	Independent work / 25
C-	1.67	60-64		Design and creative activity / 0
D+	1.33	55-59		Final control (exam) / 40
D	1.0	50-54		TOTAL / 100
FX	0.5	25-49	Unsatisfactory	
F	0	0-24		

Calendar (schedule) for the implementation of the content of the course

A week	Topic name	Number of hours	Max. ball
	MODULE 1 BIOMASS-DERIVED ACTIVATED CARBON MATERIALS		
1	**L 1.** Nanomaterials. Carbon nanostructured materials. Properties.	1	
	PC 1. Carbon nanostructured materials	2	10
2	**L 2** Activated carbon materials based on rice husk	1	
	PC 2. High-capacity activated carbon material from rice husk by a facile method	2	10
	IWST 1. Consultation on IWS 1		
3	**L 3.** Cost-effective carbon materials based on rice husk	1	
	PC 3. Cost-effective porous carbon materials synthesized by carbonizing rice husk and K_2CO_3 activation	2	10
	IWST 2. IWS 1. Writing mini-review: Biomass-derived carbon materials		30
4	**L 4.** Activated carbon materials based on coconut shell	1	
	PC 4. Fabrication and characterization of coconut shell activated carbon using variation chemical activation	2	10
	IWST 3. Consultation on IWS 2		
5	**L 5.** Highly porous activated carbon materials from fibres of oil palm	1	
	PC 5. Urea nitrogenated mesoporous activated carbon derived from oil palm	2	10
	MODULE 2 BIOMASS-DERIVED CARBON AEROGELS		
6	**L 6.** Biomass-derived porous carbon materials	1	
	PC 6. Cellulose, graphene and graphene-cellulose composite aerogels and their application in water treatment Cellulose based aerogels. Production of cellulose based aerogels. Application of cellulose based aerogels in water treatment	2	10
7	**L 7** Carbon aerogels derived from waste pomelo peels	1	
	PC 7. An environmentally friendly carbon aerogels derived from waste pomelo peels	2	10
Midterm control 1			**100**
8	**L 8.** Carbon aerogel based on wood	1	
	PC 8. Wood-derived lightweight and elastic carbon aerogel	2	7
	IWST 4. IWS 2. Writing mini-review: Biomass-derived carbon aerogels		22
9	**L 9.** Carbon aerogel derived from sugarcane	1	
	PC 9. Highly conductive aerogel-like carbon from sugarcane	2	7

10	**L 10.** Carbon aerogel from waste cabbage	1	
	PC 10. Nitrogen-doped porous electrically conductive carbon aerogel from waste cabbage	2	7
	IWST 5. Consultation on IWS 3		
MODULE 3 APPLICATION OF BIOMASS-DERIVED POROUS CARBON MATERIALS			
11	**L 11.** Application of carbon aerogels as electrode materials for high-performance supercapacitors	1	
	PC 11. N-doped cellulose-based carbon aerogels with a honeycomb-like structure for high-performance supercapacitors	2	7
12	**L 12.** Application of carbon aerogels for the removal of organic pollutants/oils	1	
	PC 12. Carbon aerogels derived from waste pomelo peels for the removal of organic pollutants/oils/solvents	2	7
13	**L 13.** Activated carbon materials application in microbial fuel cell	1	
	PC 13. A novel proton exchange membrane developed from clay and activated T carbon derived from coconut shell	2	7
14	**L 14.** Application of anode materials for alkali metal ion-batteries	1	
	PC 14. Biomass-derived hierarchical N, P codoped porous 3D-carbon framework@TiO_2 hybrids as advanced anode for lithium ion batteries	2	7
	IWST 6. IWS 3 Writing mini-review: Application of biomass-derived carbon materials		22
15	**L 15.** Application of anode materials for alkali metal ion-batteries	1	
	PC 15. N-doped three-dimensional porous carbon materials derived from bagasse biomass as an anode material for K-ion batteries	2	7
	IWST 7. Consultation on examination issues		
Midterm control 2			**100**
Final control (exam)			**100**
TOTAL for course			**100**

Student independent work (IWS) assessment policy

IWS 1. Biomass-derived carbon materials

Score / Criterion	General rubric for grading IWS				
	«Excellent»	«Good»	«Satisfactory»	«Unsatisfactory»	
	90-100 %	70-89 %	50-69 %	25-49 %	0-24 %
Requirements for articles that will be used as resources	If students choose article or articles that fully disclose the topic, and it/they will be published during the last five years.	If student work with one article that reveals the topic and was published in the last 7-9 years.	If student work with one article that partially reveals the topic and was published in the last 7-9 years.	If the article that opens the topic, but is selected, is from the last positive year.	If the selected article is from the last two decades, it covers the topic.
Description of biomass-derived carbon materials	Description of biomass-derived carbon materials should be covered all section, such as raw materials, synthesis method, investigation methods, application area. Conclusion should be written completely.	Description of biomass-derived carbon materials covered partially and missing some sections, such as raw materials, synthesis method, investigation methods, application area. Conclusion should be written.	Description of biomass-derived carbon materials covered some sections, such as raw materials, synthesis method, investigation methods, application area. Conclusion wrote partially.	Description of biomass-derived carbon materials covered partially and missing some sections, such as raw materials, synthesis method, investigation methods, application area. Conclusion wrote partially.	Description of biomass-derived carbon materials covered partially and missing some sections, such as raw materials, synthesis method, investigation methods, application area. No conclusion.
Reference should be writing the following order	*Xu V. (2020) Sliver defect formation in single crystal Ni-based superalloy castings. Materials & Design, 196:109138*	*Xu V. Sliver defect formation in single crystal Ni-based superalloy castings. Materials & Design, 2022, 196:109138*	*V. Xu. Sliver defect formation in single crystal Ni-based superalloy castings. Materials & Design, 2022, 196:109138*	*V. Xu. Sliver defect formation in single crystal Ni-based superalloy castings. Materials & Design, 2022, Vol. 196. p. 109138*	*V. Xu. Sliver defect formation in single crystal Ni-based superalloy castings. Materials & Design, 2022, Vol. 196, 109138 pp*

IWS 2. Biomass-derived carbon aerogels

Score / Criterion	General rubric for grading IWS				
	«Excellent»	«Good»	«Satisfactory»	«Unsatisfactory»	
	90-100 %	70-89 %	50-69 %	25-49 %	0-24 %
Requirements for articles that will be used as resources	If students choose article or articles that fully disclose the topic, and it/they will be published during the last five years.	If student work with one article that reveals the topic and was published in the last 7-9 years.	If student work with one article that partially reveals the topic and was published in the last 7-9 years.	If the article that opens the topic, but is selected, is from the last positive year.	If the selected article is from the last two decades, it covers the topic.
Description of biomass-derived carbon aerogels	Description of biomass-derived carbon aerogels should be covered all section, such as raw materials, synthesis method, investigation methods, application area. Conclusion should be written completely.	Description of biomass-derived carbon aerogels covered partially and missing some sections, such as raw materials, synthesis method, investigation methods, application area. Conclusion should be written.	Description of biomass-derived carbon aerogels covered some sections, such as raw materials, synthesis method, investigation methods, application area. Conclusion wrote partially.	Description of biomass-derived carbon aerogels covered partially and missing some sections, such as raw materials, synthesis method, investigation methods, application area. Conclusion wrote partially.	Description of biomass-derived carbon aerogels covered partially and missing some sections, such as raw materials, synthesis method, investigation methods, application area. No conclusion.
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IWS 3. Application of biomass-derived carbon materials

Score / Criterion	General rubric for grading IWS				
	«Excellent»	«Good»	«Satisfactory»	«Unsatisfactory»	
	90-100 %	70-89 %	50-69 %	25-49 %	0-24 %
Requirements for articles that will be used as resources	If students choose article or articles that fully disclose the topic, and it/they will be published during the last five years.	If student work with one article that reveals the topic and was published in the last 7-9 years.	If student work with one article that partially reveals the topic and was published in the last 7-9 years.	If the article that opens the topic, but is selected, is from the last positive year.	If the selected article is from the last two decades, it covers the topic.
Description of application of biomass-derived carbon materials	Description of application of biomass-derived carbon materials should be covered different types of carbon materials, their properties, and application area. Table should be collected different types of carbon materials, their	Description of application of biomass-derived carbon materials should be covered different types of carbon materials, their properties, and application area. Table should be collected different types of carbon materials, their properties, and	Description of application of biomass-derived carbon materials should be covered different types of carbon materials, their properties, and application area. Table should be collected different types of carbon materials, their properties, and application area. Conclusion wrote partially.	Description of application of biomass-derived carbon materials should be covered different types of carbon materials, their properties, and application area. Conclusion wrote partially.	Description of application of biomass-derived carbon materials should be covered different types of carbon materials, their properties, and application area. No conclusion.

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Dean _____ **A.K. Galeyeva**

Chair of the Academic Committee
on the Quality of Teaching and Learning _____ **A.U. Bektemissova**

Head of Department _____ **M.I. Tulepov**

Lecturer _____ **M. Auyelkhankyzy**