



Course project on chemical basics technological processes

work program of the academic discipline (syllabus)

Details of the academic discipline

Level of higher education	<i>First (bachelor's)</i>
Branch of knowledge	<i>16 Chemical and Bioengineering</i>
Speciality	<i>161 Chemical Technology and Engineering</i>
Educational program	<i>Industrial ecology and resource efficient cleaner technologies</i>
Status of discipline	<i>Selective</i>
Form of training	<i>full-time(day)/evening(evening)/part-time/remote/mixed</i>
Year of preparation, semester	<i>2nd year, fall semester</i>
Volume of discipline	<i>1,5 credits (45 hours)</i>
Semester control	<i>Test</i>
Schedule of classes	<i>45 hours of independent work</i>
Language of instruction	<i>Ukrainian</i>
Information about kerivnik course / teachers Lecturer:	PhD, professor Valerii Barbash, https://eco-paper.kpi.ua/pro-kafedru/vykladachi/barbash-valerij-anatolijovich.html
Course placement	https://campus.kpi.ua/tutor/index.php?mode=mob&show&irid

Program of discipline

1. Description of the discipline, its purpose, subject of study and learning results

One of the factors of increasing the level of competitiveness of Ukrainian enterprises is the improvement of the quality of their products due to the introduction of new and modernization of existing technological processes. This is facilitated by the understanding of the chemical foundations of the technological processes of physical, chemical and physico-chemical operations carried out with the aim of transforming raw materials, in particular plant raw materials and products of their processing into consumer goods, by specialists of specialty 161 "chemical technologies and engineering". In the chemical-technological processes of obtaining cellulose from plant raw materials, a complex of chemical reactions with its components, in particular with lignin, takes place - the process of delignification. The process of delignification of vegetable raw materials is carried out using different chemical reagents under different temperature and time conditions according to the optimal values of technological parameters - concentration and ratio of components, temperature, duration, hydromodulus, pressure, use of catalysts. At the same time, it is necessary to carry out the technological process in a resource-efficient manner, that is, according to the complex processing of raw materials with the maximum yield of the target products and with the extraction of all ingredients, with minimal expenditure of energy, capital and labor resources, with a high intensity of technological processes that do not disturb the ecological balance in the surrounding natural environment.

The subject of the discipline "Course project on the chemical foundations of technological processes" consists in systematizing knowledge and providing practical skills during the assimilation of the chemical foundations of the processes of transformation of plant raw materials into cellulose-containing products, in particular in the process of delignification of plant raw materials; general characteristics of the world pulp and paper industry and its individual advanced countries; chemistry of technological processes of cellulose production by various methods of delignification of plant raw materials (sulfite, bisulfite, neutral-sulfite, sodium, sulfate, organosolvent).

The purpose of the discipline "Course project on the chemical foundations of technological processes" consists in the formation in students of the basics of theoretical knowledge about the flow of chemical and technological processes, necessary for qualified management of technological processes of pulp and paper production and chemical processing of plant raw materials, in the training of specialists in the field of chemical technologies and engineering, able to solve professional problems in practical situations on the basis of acquired theoretical knowledge, in particular, to form the following competencies in students:

- ability to apply knowledge in practical situations (C 02)
- the ability to use the provisions and methods of the discipline to solve professional problems, to determine directions for the processing of plant raw materials (C 09);
- the ability to determine the directions of use of plant and pulp, design and implement their processing technologies (C 19);

According to the requirements of the program of the academic discipline, after learning the credit module, students must demonstrate the following **learning outcomes**:

- correctly use the terminology and basic concepts of chemistry, chemical technologies, processes and equipment for the production of chemical substances and materials based on them in professional activities (PO 02);
- determine the quality characteristics of plant raw materials, semi-finished products and finished products (PO 16);
- to make independent decisions at a specific place of work under real production conditions in the process of performing various duties (PR 21).

2. Prerequisites and requisition of disciplines (place in the structural and logical scheme of training according to the relevant educational program)

The study of the academic discipline "Chemistry of plant polymers" is preceded by academic disciplines such as: "General and inorganic chemistry", "Organic chemistry", "Chemistry of high molecular compounds", it provides the disciplines "Technology of production of cellulose ethers and esters", "Technology of pulp", "Chemical methods of analysis of raw materials, products and waste water of pulp and paper production", "Paper and cardboard technology". The educational discipline belongs to the cycle of professional training (selective educational components from the departmental Catalogues).

3. Contents of the discipline

Completion of the course project on the chemical foundations of technological processes involves 45 hours of independent work on the following topics.

Topic 1. Characteristics of the pulp and paper industry of the world and Ukraine. Purpose, types of cardboard and paper products, economic and environmental problems of the industry.

Topic 2. Overview of the pulp and paper industry enterprises of different countries of the world (USA, Canada, Finland, Sweden, China, Brazil, Germany, Russia, Poland, etc.) according to the assignment option for the course project with the establishment of the number of industry enterprises in the country, their capacity, types of products, raw materials, economic indicators and main consumers of products.

Topic 3. Chemistry of the technological process of cellulose production with one method of delignification of plant raw materials (sulfite, bisulfite, neutral-sulfite, sodium, sulfate, organosolvent).

Topic 4. Calculation of the level of consumption of paper and cardboard per capita of a country in the world (according to the task option for the course project for the last 10-20 years. Show graphically the changes in the level of consumption of paper and cardboard per capita of this country in comparison with the world average value of this indicator and the level consumption of paper and cardboard per capita of the population of Ukraine.

Topic 5. Calculation of the forest cover index of one of the regions of Ukraine according to the assignment option for the course project

4. Training materials and resources

Basic literature

1. Barbash V.A., Deikun I.M. Chemistry of plant polymers. Education manual. 2nd edition, revised. and additional - Kyiv: Caravela, 2018 – 440 p.
2. Barbash V.A., Deikun I.M. Chemistry of plant polymers. Education Guide/Kyiv: Edelweiss, 2014. 437p.
3. Hetmanchuk Y.P., Bratychak M.M. Chemistry and technology of polymers. Lviv: "Beskid Bit" Publishing House, 2006. — 496 p.

Additional literature

5. Primakov S.P., Barbash V.A., Cheryopkina R.I. Production of sulfated cellulose and pulp bleaching. Study guide K.. ECMO, 2011. - 290 p.
6. VV Nyzhnyk Physical chemistry of polymers: textbook / VV Nyzhnyk, T. Yu., Nyzhnyk; MES - Kyiv: Phytosocial Center, 2009. – 424 p.
7. Yu.V. Mygalina, O.P. Kozar. Basics of chemistry and physico-chemistry of polymers. Textbook. — K: Condor, 2010.— 325 p.

Information resources on the Internet

1. <https://vlp.com.ua/node/4352>
2. <https://library.sspu.edu.ua/wp-content/uploads/2018/04/38.pdf>
3. <https://uk.wikipedia.org/wiki>
4. https://uk.upwiki.one/wiki/Pulp_and_paper_industry

Educational context

5. Methods of mastering the discipline (educational component)

Students' independent work

Students' independent work consists of 45 hours of studying materials and completing the tasks of the course project, including preparation for the defense of the course project and assessment.

The main task of students' independent work is to master the theoretical bases and principles of the action of chemical reagents on the structure of a lignin unit in the processes of delignification of plant raw materials and materials of the discipline that are not included in the list of lectures, practical and laboratory classes in the disciplines "Chemistry of plant polymers" and "Chemistry of delignification plant raw materials". In the process of independent work within the academic discipline, students should learn to independently analyze the acquired new knowledge and compare it with scientific and reference literature.

Topic 1. Characteristics of the pulp and paper industry of the world and Ukraine. Purpose, types of cardboard and paper products, economic and environmental problems of the industry.

Literature: [2, p. 7-28; 3, p. 31-52]

Topic 2. Overview of the pulp and paper industry enterprises of different countries of the world (USA, Canada, Finland, Sweden, China, Brazil, Germany, Russia, Poland, others) according to the assignment option for the course project with the establishment of the number of industry enterprises in the country, their capacity, types of products, raw materials, economic indicators and main consumers of products.

Literature: [Internet]

Topic 3. Chemistry of the technological process of cellulose production with one method of delignification of plant raw materials (sulfite, bisulfite, neutral-sulfite, sodium, sulfate, organosolvent)

Literature: [1, c. 290-336]

Topic 4. Calculation of the level of consumption of paper and cardboard per capita of a country in the world (according to the task option for the course project for the last 10-20 years. Show graphically the changes in the level of consumption of paper and cardboard per capita of this country in comparison with the world average value of this indicator and the level consumption of paper and cardboard per capita of the population of Ukraine.

Literature: [2, c. 11-16; Internet]

Topic 5. Calculation of the forest cover index of one of the regions of Ukraine according to the assignment option for the course project

Literature: [1, c. 57-73; Internet]

No s/p	Name of the topic submitted for self-study	hours
1	Topic 1. Characteristics of the pulp and paper industry of the world and Ukraine. Purpose, types of cardboard and paper products, economic and environmental problems of the industry. Literature: [2, p. 7-28; 3, p. 31-52]	4
2	Topic 2. Overview of the pulp and paper industry enterprises of different countries of the world (USA, Canada, Finland, Sweden, China, Brazil, Germany, Russia, Poland, others) according to the assignment option for the course project with the establishment of the number of industry enterprises in the country, their capacity, types of products, raw materials, economic indicators and main consumers of products. Literature: [Internet]	8
3	Topic 3. Chemistry of the technological process of cellulose production with one method of delignification of plant raw materials (sulfite, bisulfite, neutral-sulfite, sodium, sulfate, organosolvent) Literature: [1, c. 290-336]	12
4	Topic 4. Calculation of the level of consumption of paper and cardboard per capita of a country in the world (according to the task option for the course project for the last 10-20 years. Show graphically the changes in the level of consumption of paper and cardboard per capita of this country in comparison with the world average value of this indicator and the level consumption of paper and cardboard per capita of the population of Ukraine. Literature: [2, c. 11-16; Internet]	6

5	Topic 5. Calculation of the forest cover index of one of the regions of Ukraine according to the assignment option for the course project <i>Literature: [1, c. 57-73; Internet]</i>	5
7	Completion of the course project and preparation for the test	7
	Protection of the course project. Test	3
	In total	45

Politics and context

7. Policy of discipline (educational component)

Rules for attending classes and behavior in classes

Attending classes is a mandatory component of assessment. Students are obliged to take an active part in the educational process, not to be late for classes and not to miss them without a good reason, not to interfere with the teacher to conduct classes, not to be distracted by actions that are not related to the educational process.

Rules for assigning incentive and penalty points

- *encouraging points can be credited by the teacher only for the performance of creative works in the discipline or additional passage of online specialized courses with the receipt of the appropriate certificate.*

However, their amount cannot exceed 25% of the rating scale. Penalty points within the discipline are not provided.

Deadline and overlay policy

In case of debts in the discipline or any force majeure circumstances, graduate students should contact the teacher through accessible (provided by the teacher) communication channels to solve problematic issues and coordinate the algorithm of actions for working out.

Academic Integrity Policy

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the absence of references when using printed and electronic materials, quotes, opinions of other authors. Invalid hints and write-offs when writing tests, conducting classes; passing the credit for another graduate student; copying of materials protected by the copyright system without the permission of the author of the work.

The policies and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" <https://kpi.ua/code>.

Policy of academic behavior and ethics

Students should be tolerant, respect the opinion of others, object to formulate in the correct form, constructively maintain feedback in the classroom.

The norms of ethical behavior of students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" <https://kpi.ua/code>.

8. Types of control and rating system for evaluating learning outcomes (RCOs)

Distribution of educational time by types of classes and tasks in the discipline according to the working curriculum:

Semester	School time		Distribution of training hours				Control measures		
	credits	acad. H.	Lecture	Practical	Lab. Rob..	SRS	FDM	PP	Semester control
3	1,5	45	-	-	-	45	-	-	Test

The rating system for evaluating learning outcomes (RSO) of a student from the discipline "Course project on the chemical foundations of technological processes" is made according to the RSO-2 type and has two components:

- **initial** – characterizes the quality of the explanatory note, textual and graphic (illustrative) material: compliance with the established course project implementation schedule, modernity and justification of the decisions made, correct application of analysis and calculation methods, quality of design, compliance with the requirements of regulatory documents, quality of graphic material and compliance with requirements standards, etc.

The size of the starting component is equal to 50 points;

- **defense component** – characterizes the quality of the defense of the course project: the quality of the report, the degree of mastery of the material, the degree of substantiation of the decisions made, the ability to defend one's opinion, answers to questions, etc.

System of rating (weighted) points and evaluation criteria

characteristics of the starting component and the protection component

Rating points and criteria for evaluating the characteristics of the starting component are defined below:

Weight score - 8. Weight factor - 6.25. The maximum number of points for the preparation and design of the course project is equal to: 8 points x 6.25 = 50 points

Points	Completeness and signs of response
1	compliance with the established schedule for the implementation of sections of the course project with the sending of course project materials to the teacher for review
1	completeness of answers to the teacher's questions during consultations
1	modernity and justification of the decisions made
1	the correct application of methods of analysis and calculation availability of substantiated conclusions;
1	availability of substantiated conclusions;
1	fulfillment of the requirements of regulatory documents
1	the quality of the design of the textual material of the explanatory note
1	the quality of design of graphic (illustrative) material
8	The maximum amount of weighted points for the preparation of a course project

The rating points and criteria for evaluating the characteristics of the protection component are defined below:

The weighting point is 5. The weighting factor is 10. The maximum number of points for the course project defense is: 5 points x 10 = 50 points

Балу	Completeness and features of the protection component
1	quality of report (presentation)
1	degree of mastery of the material; modernity and justification of the decisions made

1	<i>the ability to defend one's opinion, the correct application of methods of analysis and calculation</i>
1	<i>clear answers to questions during the defense of project</i>
1	<i>compliance with the established course project defense schedule</i>
5	<i>The maximum sum of the weighted point of the defense of the course project</i>

Calculation of the rating scale (R).

The rating scale of the discipline (R) is 100 points and is formed as the sum of the **starting component of the scale (Rs)**, received by the student as a result of the preparation and design of the course project, and the **defense component (Rd)** of the rating.

The size of the starting scale (Rs) of the Rs rating is 50 points, and the size of Rd = 50 points. Thus, the rating scale for the discipline is: $R = R_s + R_d = 50 + 50 = 100$ points.

According to the results of academic work in the first 7 weeks, a student can score 20 points. At the first certification (8th week), the student receives "credited" if his current rating is at least 10 points. According to the results of 13 weeks of study, the student must score 40 points. At the second certification (14th week), the student receives "credited" if his current rating is at least 20 points.

A necessary condition for admission to credit is regular positive results in the course project implementation process (sending course project materials to the teacher for review), answers at consultations, as well as a starting rating (Rs) of at least 40% of Rs, i.e. 20 points.

Semester control is credit. In order for a student to receive a passing grade, the sum of earned rating points R is converted according to the table:

Number of points	Evaluation
95...100	excellent
85...94	very good
75...84	good
65...74	satisfactory
60...64	enough
RD < 60	unsatisfactory
Unfulfilled conditions of admission	are not admitted

Work program of the academic discipline (syllabus):

Compiled by professor, Ph.D. Barbash Valerii Anatoliyovich

Approved by the ___ETRP___ department (protocol No. _14_ from _06.08.2022_)

Agreed by the ECF Methodical Commission (protocol No. _10_ from _24.06. 2022_)