COURSE DESCRIPTION

Natural compounds with industrial applications

Academic year 2025-2026

1. Programme-related data

1.1. Higher Education Institution	Babes-Bolyai University, Cluj-Napoca
1.2. Faculty	Chemistry and Chemical Engineering
1.3. Department	Doctoral School of Chemistry
1.4. Field	Chemistry
1.5. Level of study	Doctoral
1.6. Degree programme / Qualification	Doctoral training/PhD in Chemistry
1.7. Form of education	IF

2. Course-related data

2.1. Course title	Natural compounds with industrial applications			Course code	SDC-19-06
2.2. Course coordinator	Prof. Dr. Ing. Habil. Luminița David				
2.3. Seminar coordinator	Prof. Dr. Ing. Habil. Luminița David				
2.4. Year of study	I	2.5. Semester	2	2.6. Type of assessment	Exam
2.7. Course status	Optional			2.8. Course type	Specialisation subject

3. Total estimated time (hours per semester of teaching activities)

3.1. Number of hours per week	**3**	of which: 3.2. course	**2**	3.3. seminar/ laboratory/ project	**1**
3.4. Total of hours in the curriculum	36	of which: 3.5. course	24	3.6. seminar/ laboratory	12
Time allocation for individual study (IS) and self-taught activities (ST)					**hours**
Learning from textbooks, course materials, bibliography, and notes (IS)					35
Additional research in the library, on subject-specific electronic platforms, and on-site					93
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					80
Tutoring (professional guidance)					3
Examinations					3
Other activities					
3.7. Total hours of individual study (IS) and self-taught activities (ST)				**214**	
3.8. Total hours per semester				**250**	
3.9. Number of credits				**10**	

4. Prerequisites (where applicable)

4.1. curriculum-related	-
4.2 skills-related	-

5. Specific conditions (where applicable)

5.1. course-related	Students must attend class with their mobile phones turned off. Late arrivals will not be accepted.
5.2. seminar/laboratory-related	Students must attend class with their mobile phones turned off.

6.1. Competencies resulting from the completion of the degree programme[1]

Professional competencies	
Competency code	**Competency**
PC1	Advanced expertise in chemistry and doctoral-level research topics
PC4	Planning, designing, and implementing an original scientific research project, in compliance with academic ethics and integrity
PC5	Applying and developing advanced research and analytical methods; critically interpreting data and formulating innovative solutions
Transversal competencies	
Competency code	**Competency**
TC2	Advanced scientific communication in Romanian and English; collaboration in interdisciplinary and multicultural settings
TC3	Advanced digital skills for research, data analysis, and dissemination; responsible use of digital tools.

6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)[2]

Learning outcomes targeted by the subject		
Competency code	**Knowledge and comprehension**	**Specific academic skills**
PC1	Advanced and up-to-date knowledge in chemistry and the research field; critical understanding of the scientific literature.	Applies and synthesizes advanced concepts/theories to formulate research hypotheses; justifies the choice of scientific approaches.
PC4	Advanced research methodologies: experimental design, modern synthesis and characterization techniques, analysis and validation; principles of research project management.	Designs, plans and implements a research project; applies quality and safety procedures and documents stages and data with full traceability.
PC5	Advanced strategies for data analysis, interpretation, and integration; evaluation of methodological limitations, reproducibility, and scientific impact.	Critically analyses complex data, estimates uncertainty and formulates conclusions; proposes methodological improvements and directions for research/innovation.
TC2	Scientific terminology and communication in Romanian and English; the structure of scientific articles and presentations; good citation practices.	Writes and presents scientific results in Romanian/English coherently; provides well-argued responses to comments and peer reviews.
TC3	Digital tools for research, citation, and data processing (databases, specialized software, reference managers); responsible use of digital resources.	Uses discipline-specific digital tools effectively; manages citations; uses digital resources responsibly in research activities.

7. Subject-specific learning outcomes

Knowledge and comprehension
1. A critical understanding of the structure-functional properties-industrial applications relationships based on relevant scientific literature.
2. Assessment of the using natural compounds in industrial production.

[1] The professional and/or transversal skills targeted by the subject for which the course description is prepared will be copied from the curriculum of the degree programme. For each competency, the complete entry, including the competency code, will be copied with the exact wording that appears in the curriculum, without any changes. If no competency is copied from either of the two categories, the row corresponding to that category is deleted from the table.

[2] The learning outcomes relevant for the degree programme and targeted by the subject for which the course description is prepared will be listed. The entries, copied without any changes from the Curriculum by subject type (Core Subject/Specialisation Subject/Complementary Subject), are listed under the corresponding competency.

3. Knowledge of the adequate language and scientific terminology in the field of natural compound chemistry (in Romanian and English).
4. Advanced knowledge of digital tools for scientific documentation and of applications dedicated to the analysis and processing of scientific data.
Specific academic skills
1. Apply appropriate methods for obtaining and using natural compounds at an industrial level.
2. Propose and justify methodological improvements, identify new research and innovation directions regarding the industrial applications of natural compounds.
3. Elaborate and present the results of scientific research in a clear, structured, and coherent manner, for dissemination within the scientific community (in Romanian and English).
4. Use information technology resources responsibly to conduct advanced research and data analysis on natural compounds.

8. Contents

8.1. Course	**Teaching and learning methods**	**Remarks[3]**
8.1.1-2. Natural compounds with industrial applications: sources, isolation, purification and analysis methods	Lecture; Explanation; Conversation; Description; Problematization; Debate	4h
8.1.3. Carotenoids: classification, properties, industrial applications	Lecture; Explanation; Conversation; Description; Problematization; Debate	2h
8.1.4. Polisaccharides: classification, properties, industrial applications	Lecture; Explanation; Conversation; Description; Problematization; Debate	2h
8.1.5-6. Flavonoids: classification, properties, industrial applications	Lecture; Explanation; Conversation; Description; Problematization; Debate	4h
8.1.7-8. Enzymes: classification, properties, industrial applications	Lecture; Explanation; Conversation; Description; Problematization; Debate	4h
8.1.9. Tannins: classification, properties, industrial applications	Lecture; Explanation; Conversation; Description; Problematization; Debate	2h
8.1.10. Essential oils: composition, properties, industrial applications	Lecture; Explanation; Conversation; Description; Problematization; Debate	2h
8.1.11-12. Other natural compounds with industrial applications (terpenes and terpenoids, lactoferrin, chlorophyll, betalain)	Lecture; Explanation; Conversation; Description; Problematization; Debate	4h

Bibliography

1. S.V.Bhat, B.A.Nagasampagi, M.Sivakumar, "Chemistry of natural products", 2005, Ed. Springer, Berlin
2. "Herbs, spices and medicinal plants: processing, health benefits and safety", N.P.Brunton, M.B.Hossain, D.K.Rai (Eds.), 2020, Ed. Wiley-Blackwell
3. B. Moldovan, **L. David**, "Influence of different sweeteners on the stability of anthocyanins from Cornelian cherry juice", *Foods*, **2020**, *9(9)*, 1266

[3] For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

4. I. P. Laszlo, M. R. Laszlo, V. Toma, I. Bâldea, D. Olteanu, **L. David**, B. Moldovan, R.M. Ion, R. Moldovan, G. A. Filip, G. Kacso, C. Cainap, S. Clichici, A. Mureşan, "The *in vivo* modulatory effects of *Cornus mas* extract on photodynamic therapy in experimental tumors", *Photodiagnosis and Photodynamic Therapy*, **2020**, 30, 10165
5. C. Bidian, D.-R. Mitrea, C. Tatomir, M. Perde-Schrepler, C. Lazăr, I. Cheţan, P. Bolfa, **L. David**, S. Clichici, G. A. Filip, M. Mureşan, O. Micle, "*Vitis vinifera* L. and *Sambucus nigra* L. extracts attenuate oxidative stress and inflammation in femoral ischemia", *Farmacia*, **2021**, *69*, 59-67
6. M. Filip, I. Baldea, **L. David**, B. Moldovan, G. C. Flontas, S. Macavei, D. M. Muntean, N. Decea, A. B. Tigu, S. V. Clichici, "Hybrid material based on *Vaccinium myrtillum* L. extract and gold nanoparticles reduces oxidative stress and inflammation in hepatic stellate cells exposed to TGF-β", *Biomolecules*, **2023**, *13*, 1271
7. V.S. Neculicioiu, I. Colosi, A. Sevastre-Berghian, D.A. Toc, H.A. Colosi, **L. David**, M. Muntean, R. Moldovan, A.M. Vlase, V.A. Toma, C. Costache, S.M. Suciu, S. Clichici, "Molecular effects of Cornelian cherry fruit (*Cornus mas* L.) extract on sleep deprivation-induced oxidative stress, cytokine dysregulation, and behavioural changes in Wistar rats", *Current Issues in Molecular Biology*, **2025**, *47*, 399
8. Scientific articles from specific journals

8.2. Seminar/ laboratory	**Teaching and learning methods**	**Remarks**
8.2.1. Carotenoids: properties, industrial applications	Explanation; Conversation; Problematization; Debate	Seminars will be organized as 6 meetings of 2 hours each
8.2.2. Polisaccharides: properties, industrial applications	Explanation; Conversation; Problematization; Debate	
8.2.3. Flavonoids: properties, industrial applications	Explanation; Conversation; Problematization; Debate	
8.2.4. Enzymes: properties, industrial applications	Explanation; Conversation; Problematization; Debate	
8.2.5. Tannins: properties, industrial applications	Explanation; Conversation; Problematization; Debate	
8.2.6. Other natural compounds with industrial applications	Explanation; Conversation; Problematization; Debate	

Bibliography

1. S.V.Bhat, B.A.Nagasampagi, M.Sivakumar, "Chemistry of natural products", 2005, Ed. Springer
2. "Herbs, spices and medicinal plants: processing, health benefits and safety", N.P.Brunton, M.B.Hossain, D.K.Rai (Eds.), 2020, Ed. Wiley-Blackwell
3. Scientific articles from specific journals

9. Evaluation

Type of activity	9.1 Evaluation criteria[4]	9.2 Evaluation methods[5]	9.3 Percentage in the final grade
9.4. Course	Theoretical knowledge and conceptual understanding of classes of natural compounds and their properties.	Oral presentation	80%
	Demonstrating the understanding of the correlations between the structure of natural compounds and their function		

[4] The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

[5] Both final evaluation methods and ongoing evaluation strategies should be established.

	Correct identification of the advantages and risks of using natural compounds, proposing responsible solutions		
9.5. Seminar/ laboratory	Assessment of the ability to communicate scientific results clearly, coherently, in a structured and logical manner, using correct scientific terminology	Individual project	20%
9.6 Minimum standard for passing			
Grade 5 (five) in the exam according to the scale. Knowledge of the main classes of natural compounds and their industrial applications.			

10. SDG labels (Sustainable Development Goals)[6]

	○	Sustainable Development Generic Label						
								
○	○	○	x	○	○	○	○	○
								No label applies
○	○	○	○	○	○	○	○	○

Date of entry:
02.02.2026

Signature of course coordinator

Signature of seminar coordinator

Date of approval in CDSC:

Signature of the Director of the DSC

Prof. dr. Niculina Daniela Hădade

[6] Select a single label which, according to the *Implementation of SDG labels in the academic process*, best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: *"No label applies."*