

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Module name: Practical Aspects of Trace Elemental Analysis

Academic year: 2019/2020 Code: ZSDA-3-0234-s ECTS credits: 3

Faculty of: Szkoła Doktorska AGH

Field of study: Szkoła Doktorska AGH Specialty: —

Study level: Third-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 0

Course homepage: —

Responsible teacher: dr Reczyński Witold (wreczyn@agh.edu.pl)

Module summary

Lectures

General aspects of trace elemental analysis (TEA) Requirements regarding the procedures and methods; functional analysis.. Chemical “asepsis” problems. Sample preparation procedures. Characterization of methods used in TEA. Validation of procedures.

Laboratory

Sampling and digestion and dissolution of various samples. Determination of trace elements. Interferences in metals’ determination.

Seminar

Analytical problems solving referring to sample type, matrix, analytes, method.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	Student will improve self-discipline and organization of work.	SDA3A_K02	Participation in a discussion, Completion of laboratory classes, Activity during classes
Skills: he can			
M_U001	Student will be able to develop and execute analytical process to solve a given problem.	SDA3A_U06	Report, Execution of laboratory classes, Completion of laboratory classes
M_U002	Development of practical analytical skills - laboratory work.	SDA3A_U06	Involvement in teamwork
Knowledge: he knows and understands			

M_W001	Student will gain extended knowledge in the field of trace elemental analysis - analytical problems, methods used, difficulties, restrictions	SDA3A_W03, SDA3A_W02	Presentation, Participation in a discussion, Execution of laboratory classes, Case study, Activity during classes
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Number of hours for each form of classes

Suma	Form of classes										
	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
30	10	0	15	0	0	5	0	0	0	0	0

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	Student will improve self-discipline and organization of work.	+	-	-	-	-	+	-	-	-	-	-
Skills: he can												
M_U001	Student will be able to develop and execute analytical process to solve a given problem.	-	-	+	-	-	-	-	-	-	-	-
M_U002	Development of practical analytical skills - laboratory work.	-	-	-	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Student will gain extended knowledge in the field of trace elemental analysis - analytical problems, methods used, difficulties, restrictions	-	-	-	-	-	+	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	30 h
Preparation for classes	15 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	20 h
Realization of independently performed tasks	15 h
Examination or Final test	2 h
Contact hours	5 h
Summary student workload	87 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

Introduction, basics of trace elemental analysis

Analytical problems, analytical procedures

Sample preparation procedures, matrix decomposition, separation and pre-concentration techniques

Methods of traces quantitative analysis

atomic absorption spectrometry - techniques, application, interferences

Problems solving - examples

Laboratory classes

1. Sampling of various types of materials - alloys, biological tissues, liquid and solid samples

Students will receive few various samples, solid and liquid, and will have to collect representative analytical samples (considering specificity of the task).

Digestion and dissolution of the chosen samples (dry and wet methods)

The analytical samples will be digested (microwave wet digestion and dry digestion in a muffle furnace) appropriately to the task.

Quantitative determination of elements at ppm level (AAS flame technique)

In the prepared samples students will determine quantitatively few (3-6) analytes, depending on the sample type.

Determination of elements at ppb level (ET AAS) - optimization of the graphite furnace program

Students will perform complete optimization of the graphite furnace operation program using the prepared samples, and determine one or two analytes.

Interferences in quantitative determination of metals by means of AAS - spectral and chemical

Students will prepare standards of the chosen metals and spike them with interfering agents. Then they will determine the analytes using instrumental methods of background correction and various calibration methods.

Seminar classes

Review of instrumental methods used in trace elemental analysis

Students will present chosen methods (basics, instrumentation, applications, limitations, interferences) in a form of multimedia presentation

Solving of analytical problems

Basing on available literature students will present a detailed solutions of a given analytical problems – discussion of advantages and disadvantages of the proposed procedure .

Teaching methods and techniques:

Lectures: The topics are presented in the form of multimedia presentations with the elements of discussion with the students.

Laboratory classes: Performing complete analytical procedures in respect to various samples and analytes, including: sampling, sample digestion, quantitative metals' determination by means of AAS and AES methods.

Seminar classes: Preparation of multimedia presentation on a given analytical problem basing on available literature data. Discussion of the considered problem.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

Seminar – quality of the presentation and discussion will be evaluated by the chairmen.

Laboratories – the quality of the students worku will be estimated basing on: agreement of the obtained results of metals' determination with the true values; observation of the student's work and skills.

Final – oral exam, after completion of seminar and laboratory tasks.

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:

- Attendance is mandatory: Yes
- Participation rules in classes: Active participation is obligatory.

Laboratory classes:

- Attendance is mandatory: Yes
- Participation rules in classes: Students active participation is obligatory.

Seminar classes:

- Attendance is mandatory: Yes
- Participation rules in classes: Students participation is obligatory. One presentation in a semester.

Method of calculating the final grade

Final grade = 0.4 grade from laboratory classe + 0,2 grade from presentation + 0.4 grade from exam

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

One additional laboratory will be organized.

Prerequisites and additional requirements

Finished basic chemistry courses.

Recommended literature and teaching resources

J.A.C. Broekaert, "Analytical Atomic Spectrometry with Flames and Plasmas", Wiley-VCH, Weinheim,

2005

R. Kellner, J.M. Mermet, M. Otto, M. Valcarel, H.M. Widmer, "Analytical Chemistry: A Modern Approach to Analytical Science", Wiley-VCH, Weinheim 2004

R.M.Harrison, S.J.de Mora, S.Rapsomanikis, W.R.Johnston, "Introductory chemistry for the environmental sciences", Cambridge University Press, 1991

A.Hulanicki, "Współczesna chemia analityczna", PWN Warszawa, 2001

W.Żyrnicki, J.Borkowska-Burnecka, E.Bulska, E.Szmyd (red.) "Metody analitycznej spektrometrii atomowej", Malamut, Warszawa, 2010

Scientific publications of module course instructors related to the topic of the module

1. Analysis of elements and bacosides in in vitro shoot culture of *Bacopa monnieri* / M. Łojewski, A. KRAKOWSKA, W. RECZYŃSKI, A. Szewczyk, B. Muszyńska // Acta Physiologiae Plantarum ; ISSN 0137-5881. — 2016 vol. 38 iss. 7 art. no. 162, s. 1-10. — Bibliogr. s. 9-10, Abstr.. — Publikacja dostępna online od: 2016-06-03. — tekst: <http://goo.gl/br11CN>

2. A readout circuit dedicated for the detection of chemiluminescence using a silicon photomultiplier / M. BASZCZYK, P. DOROSZ, Ł. MIK, W. KUCEWICZ, W. RECZYŃSKI, M. SAPOR // Journal of Instrumentation [Dokument elektroniczny]. — Czasopismo elektroniczne ; ISSN 1748-0221. — 2018 vol. 13 art. no. P05010, s. [1], 1-12. — Wymagania systemowe: Adobe Reader. — Bibliogr. s. 10-12, Abstr.. — Publikacja dostępna online od: 2018-05-08. — Ł. Mik, W. Kucewicz - dod. afiliacja: State Higher Vocational School, Tarnow. — tekst: <https://goo.gl/S1SsSk>

3. Chemistry of sediments from the Dobczyce Reservoir, Poland, and the environmental implications / Witold RECZYŃSKI, Małgorzata JAKUBOWSKA, Janusz GOŁAŚ, Andrew Parker, Barbara Kubica // International Journal of Sediment Research ; ISSN 1013-7866. — błędny ISSN 1001-6279. — 2010 vol. 25 no. 1, s. 28-38. — Bibliogr. s. 38, Abstr.. — tekst: <http://www.sciencedirect.com/science/article/pii/S100162791060025X/pdf?md5=1d8f97d173691a88c726b3837b4f8809&pid=1-s2.0-S100162791060025X-main.pdf>

4. Chronic but not acute antidepressant treatment alters serum zinc/copper ratio under pathological/zinc-deficient conditions in mice / K. Młyniec, B. OSTACHOWICZ, A. KRAKOWSKA, W. RECZYŃSKI, W. Opoka, G. Nowak // Journal of Physiology and Pharmacology ; ISSN 0867-5910. — 2014 vol. 65 no. 5, s. 673-678. — Bibliogr. s. 677-678

5. Comprehensive study of the mountainous lake sediments in relation to natural and anthropogenic processes and time (Mały Staw Lake, Poland) / Katarzyna SZARŁOWICZ, Witold RECZYŃSKI, Agnieszka Czajka, Barbra Spyt, Grzegorz SZACIŁOWSKI // Environmental Science and Pollution Research ; ISSN 0944-1344. — 2018 vol. 25 iss. 4, s. 3335-3347. — Bibliogr. s. 3346-3347, Abstr.. — Publikacja dostępna online od: 2017-11-17. — tekst: <https://goo.gl/1jEjiZ>

6. Investigation of the GPR39 zinc receptor following inhibition of monoaminergic neurotransmission and potentialization of glutamatergic neurotransmission / Katarzyna Młyniec, Magdalena Gaweł, Tadeusz Librowski, Witold RECZYŃSKI, Beata Bystrowska, Brigitte Holst // Brain Research Bulletin ; ISSN 0361-9230. — 2015 vol. 115, s. 23-29. — Bibliogr. s. 28-29, Abstr.. — Publikacja dostępna online od: 2015-04-24. — tekst: <http://www.sciencedirect.com.atoz.wbg2.bg.agh.edu.pl/science/article/pii/S0361923015000660/pdf?md5=ae56f17b98bb2ef003c819a07a48b284&pid=1-s2.0-S0361923015000660-main.pdf>

7. Lake biota response to human impact and local climate during the last 200 years: a multi-proxy study of a subalpine lake (Tatra Mountains, W Carpathians) / Ladislav Hamerlík, Daniela Dobříková, Katarzyna SZARŁOWICZ, Witold RECZYŃSKI, Barbara KUBICA, Ferdinand Šporka, Peter Bitušík // Science of the Total Environment ; ISSN 0048-9697. — 2016 vols. 545-546, s. 320-328. — Bibliogr. s. 327-328, Abstr.. — Publikacja dostępna online od: 2015-12-31. — tekst: <http://wbg2.bg.agh.edu.pl/han/atoz/www.sciencedirect.com/science/article/pii/S0048969715312055/pdf?md5=f462cfc62b06b2734e23b636ef2ec912&pid=1-s2.0-S0048969715312055-main.pdf>

Additional information

None