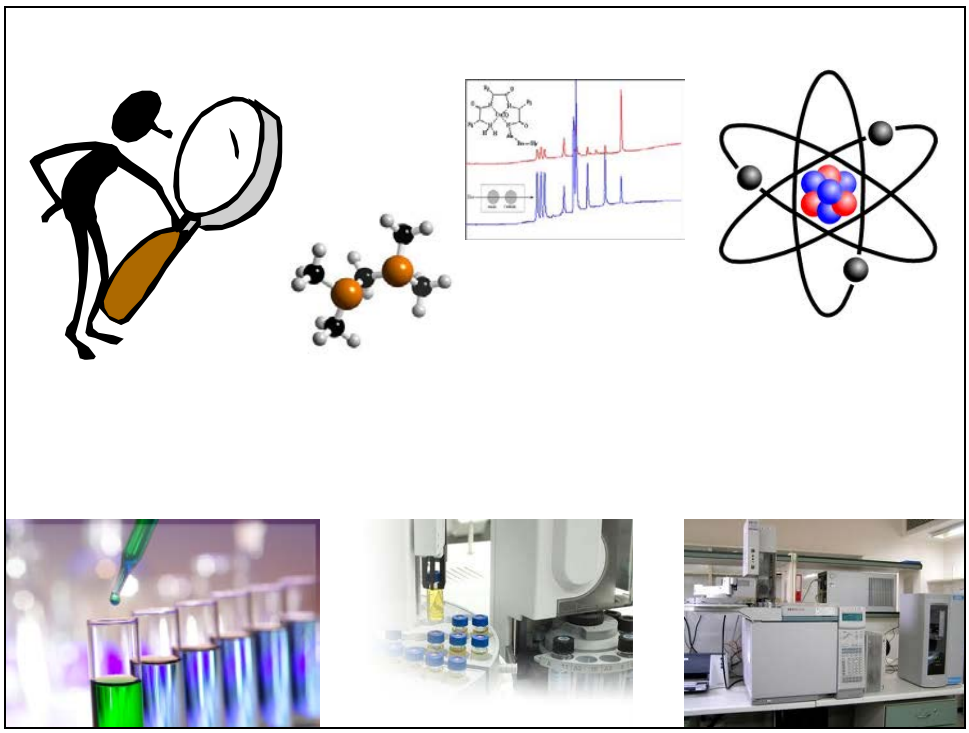
COURSE GUIDE

Environmental Analytical Techniques

SOQ – 33806



Department of Soil Quality
www.wageningenur.nl/soq

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Environmental Analytical Techniques (SOQ-33806)

Acronym:	EAT
Contributing chair groups:	**Soil chemistry and chemical soil quality (SOQ)** **Organic chemistry (ORC)**
Language of instruction:	English
Study load / Credit points:	6 ects
Components:	Lectures 35% (16 lectures) Tutorials 10% (8 tutorials) Lab-practical 35% (12 half days) Case-Study 20% (problem based education)
Period/time:	period 3 (January), full days (8:30 – 17:15 h)
Contact person & examiner:	J.E. Groenenberg
Lecturers:	J.E. Groenenberg (Course setup, Speciation, Free ion analysis, Spectrometry), T.A. van Beek (Chromatography), H. Zuilhof (Structure elucidation), L. Weng (DMT), R. Comans (OC-fractionation), H.L.M. van Rozendaal (Basic organic chemistry)
Examination:	Exam (75%) Lab-practical: analysis + report (testimonium) Case-study: report + presentation (25%)
Assumed knowledge:	Basic organic and inorganic chemistry
Continuation courses:	MSc thesis research involving chemical analysis of natural materials and (eco)systems. MSc Thesis Soil Chemistry and Chemical Soil Quality (SOQ-813xx)
Study material:	Part-1 Reader and Part-2 Supplement EAT (WURshop).
For whom?	For those interested in the chemical analysis of natural materials (e.g. soil, water, food) and (eco)systems. Study programmes: MEE, MES, ….
Information:	J.E. Groenenberg, bertjan.groenenberg@wur.nl

Profile of the course:

Biology, chemistry, biotechnology, earth system science, environmental science, forest and nature conservation, food technology, hydrology, water quality, molecular sciences, plant sciences, soil sciences, pharmacy have at least one thing in common: all of these disciplines use chemical analysis. People working in these areas need answers to questions about the content of materials: how to find their elemental and molecular composition. Determination of the composition of solids, liquids and gases enables us to understand their characteristics.

The lectures give an introduction into instrumental analytical chemistry with emphasis on spectrometry, structure elucidation (spectroscopy), extraction, chromatography, electro-chemistry, OC-fractionation and quantitative analysis. Selection of a particular method is exemplified by real-world problems in air, soil and water chemistry, environmental chemistry, environmental technology, etc. Tutorials related to the lecture topics help improving insight by answering questions and solving problems.
In the practical students determine different chemical forms of compounds (e.g. heavy metals, organic chemicals) in groundwater, surface water, soil, and plant material with a variety of analytical techniques, such as: inductively coupled plasma optical emission (ICP-OES), high resolution ICP mass spectrometry (HR-ICP-MS), gas chromatography and high pressure liquid chromatography (HPLC). The structure of unknown organic constituents is elucidated by means of mass spectroscopy (MS) and different types of radiation (UV, VIS, IR) and nuclear magnetic resonance (NMR). Organic material is fractionated to determine humic and fulvic acid (HA, FA) concentrations using TOC analysis (Total Organic Carbon). Heavy metal interaction with organic matter compounds (HA, FA) is demonstrated by measurement of free metal concentrations with Donnan membrane technique (DMT) and ion selective metallic electrodes. The various methods available are compared with respect to their field of application, limits of detection, selectivity, accuracy, precision, throughput and robustness.
Groups of students (3-4) will work on a case-study reflecting real-life problems where chemical analysis of natural materials or (eco)systems can help to understand the situation, to improve insight in the complex processes involved and to contribute to solving the problem(s). The group has to analyse the problem situation regarding chemical analytical aspects, formulate a proposal for further research and specify the chemical analytical techniques to be used.

Learning outcomes

After completion of the course students are able to:

- demonstrate insight into how to tackle practical analytical chemical problems.
- demonstrate understanding of the basic theory and relevant parameters in analytical chemistry.
- apply methods of instrumental chemical analysis to natural materials and (eco)systems.
- demonstrate awareness of the limitations of the various methods.
- report about experimental chemical analytical results and draw correct conclusions.

- discuss chemical analytical aspects relevant for the selection of proper analytical techniques for real-life problem situations.

Activities

- attend the introductory and topic specific lectures.
- read and study various chapters in the obligatory book on analytical chemistry, the lecture presentations and the articles in the reader.
- carry out different practical experiments and report results.
- analyse a real-life problem in analytical chemistry to indicate possible chemical analytical solutions for the analysis of the system composition (case-study) in a group with 3-4 other students; write a brief report and give a short oral presentation.
- exam preparation and 'open book' exam.

Assessment strategy:

assessors: J.E. Groenenberg, T. van Beek, H. Zuilhof, L. Weng, R. Comans

Assessment of learning outcomes

	Exam*	Practical's	Case-study*
Demonstrate insight into how to tackle practical analytical chemical problems.	x	x	x
Demonstrate understanding of the basic theory and relevant parameters in analytical chemistry.	x	x	x
Apply methods of instrumental chemical analysis to natural materials and (eco)systems.		x	
Demonstrate awareness of the limitations of the various methods.	x	x	x
Report about experimental chemical analytical results and draw correct conclusions.		x	
Discuss chemical analytical aspects relevant for the selection of proper analytical techniques for real-life problem situations.			x
Contribution to final mark (%)	75	- testimonium	25

* Mark for exam and case-study should be ≥ 5.5
Results of partial interim examinations stay valid for a time period of 5 years.

Course schedule: A detailed schedule will be handed out.

First 2 days: Introduction instrumental analysis; speciation and basic organic chemistry; lectures and tutorials.
Next 11 days: Specialisation blocks (Spectrometry, Free ion analysis + OC-fractionation, Chromatography, Structure elucidation); lectures, tutorials, practical's.
Then 3 days case-study (project based education) followed by 4 days exam preparation + exam.