

Module Title: WATER- METAL ANALYSIS
Module Code: AM0104
Maximum Number of Students: 20
Total ECTS Credits 2
Notional Learning Hours (a) Contact Time - 10 h (b) Private Study - 10 h Format of Teaching: Lectures 10 h Laboratories or Practicals 0 h Other 0 h Teaching Strategy: Formal lectures in 60/90 min timetable.
Convener: M.D. Galindo Riaño
University: University of Cádiz
Language of Tuition: English
Module Description - The Purpose or Aims: <ol style="list-style-type: none"> 1. To introduce on the topic of water in the environment and metal analysis. 2. To introduce general strategies for metal analysis 3. To introduce fundamentals of the most important techniques for metal analysis in water. 4. To define the concept of metal speciation 5. To understand the importance of important principles of environmental analysis: planning, sampling, representativeness, precision and accuracy, validation, measurement and quality assurance.
Learning Outcomes: At the end of the module the learner is expected to be able to: <ol style="list-style-type: none"> 1. Know the importance of metals in water and define appropriately the origin, distribution, different chemical forms and types of chemical interaction among metals species in water 2. Detail the most important techniques of sampling, handling, preservation, pretreatment and preconcentration of water for metal analysis. 3. Correctly report the different commonly techniques for metal analysis and their applicability depending on water matrices, chemical forms of the elements and the metal concentration in water. 4. Know the importance of speciation analysis. 5. Manage the quality assurance in water analysis.

Summary of Course Content:

Water has an important significance as an integral part of the environment and it is essential to man and to all living beings. However, the impacts of human activities on environmental systems and in particular chemical pollution are becoming increasingly important issues. Ensuring availability of adequate amounts of water of appropriate quality is crucial task in protecting the environment.

Water contains naturally occurring components and contaminants. Metals belong one of types of substances that are presented in water and can be classified into non-toxic and toxic.

This course deals with various aspects of the significance and determination of metals in different types of water at macro, micro and trace concentrations. Their origin, distribution, different chemical forms and types of chemical interaction among metals species in water will be considered.

Analysis of water may seem simpler. However, natural water matrices vary wide in composition and laboratories deal with samples ranging from rain, hard river, lake, sea or estuarine waters. Therefore, the contents of most metals are below the limits of detection of the majority of direct methods and pre-treatment and preconcentration of samples are usually required. The choice of methods for determination of metals will depend on factors as sensitivity, accuracy, available equipment, costs, etc., in addition to the chemical form of the element to be determined and to matrix effects.

Metal determinations are preferentially carried out by flame or flameless atomic absorption spectroscopy, voltammetric stripping and spectrophotometry. They are commonly used in routine analyses. Kinetic methodology and neutron activation technique are more advantageously.

Speciation analysis is concerned with the determination of the forms in which a given element occurs in water. They are usually conducted for to study the transport and biogeochemical cycling processes and to predict their biological impact. They rely on both chemical and physical criteria, being chemical speciation very important in controlling metal toxicity and bioavailability to biota. Hyphenated techniques for speciation analysis focus on the determination of redox species of metals and the discrimination between inorganic and organometallic species in water samples. Gas chromatography and HPLC are widely used for that.

Transferable Skills Taught:*Communication:*

To be able to select and report the selection of a method of analysis depending on the type of water, the metal, and its concentration in water.

Interpersonal skills:

Elaborate and show a group written assignment

Assessment Methods:

1. LO1 – Written Examination (20%)
2. LO2 – Written Examination (20%)
3. LO3 – Written Examination (20%)
4. LO4 – Work assignment (20%)
5. LO5 – Group Work Discussion (20%)

Assessment Criteria:Threshold

To correctly describe the concepts related to LO1, LO2, LO3, LO4 and LO5.

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Good

To correctly describe and apply the concepts, and establish correlations between aspects included in LO1, LO2, LO3, LO4 and LO5.

Excellent

To correctly describe and apply the concepts and establish correlations between aspects included in LO1, LO2, LO3, LO4 and LO5, and to be able to choose the best analytical method for metal analysis in water, determining the best analytical methodology and knowing the reason for its election.

Resource Implications of Proposal and Proposed Solutions:

Lecture notes will be available for students.

Recommended reading:

- E. Popek. "Sampling and analysis of Environmental Chemical Pollutants. A complete guide". Elsevier. California (USA), 2003.
- J.R. Dean. "Methods for Environmental Trace Analysis". Elsevier. Texas (USA), 2003.
- D. Barceló. "Environmental Analysis. Techniques, applications and quality assurance". 2^a ed. Elsevier, Amsterdam, 1996.
- D. Pérez Bendito and S. Rubio. "Environmental Analytical Chemistry". Comprehensive Analytical Chemistry, Vol. XXXII. Elsevier, Amsterdam 1998.
- B.B. Kebbekus, S. Mitra. "Environmental Chemical Analysis". Stanley Thornes, 2000.
- APHA-AWWA-WPCF. "Standard Methods for the Examination of Water and Wastewater", 21 ed., 2005.