

**Agenda for the Course at UPV (Valencia, Spain) entitled:**

## **"Methods and applications in Radiochemistry"**

**Prof. Dr. Ulrich W. Scherer, Hochschule Mannheim, Germany  
University of Applied Sciences  
Institute of Physical Chemistry and Radiochemistry**

**25 - 29 April 2016 (16 - 20 h)**

### **Foreword.**

*Radioactive materials play an important role in many areas of science and technology. Some of our most pressing problems in nuclear energy production are connected to the chemical properties of radionuclides, e.g. the waste management problems.*

*On the other hand, the multitude of applications of the tracer technique has provided us until now with important insight e.g. in biochemistry and physiology and is being applied every day in medicine to diagnose and treat diseases.*

*This course attempts to provide information on the principles of Radiochemistry and how they are applied in many disciplines to students as well as engineers and scientists interested in the field.*

### **Prerequisites:**

*Participants should have a basic knowledge of chemistry, chemical engineering and nuclear engineering.*

### **Monday –25 April 2016**

*Introduction to the seminar.*

*Definitions, concepts and terminology.*

*Carrier and Tracers.*

- a. Pure Radionuclides have negligible masses.
- b. Implications on chemical properties and handling of radionuclides.
- c. Basic principle of radioindicators as introduced by G. de Hevesy.

*Sources of Radionuclides.*

- a. Natural radionuclides are of limited use.
- b. Production of artificial radionuclides in nuclear reactors and cyclotrons.
- c. The activation equation.

## Tuesday –26 April 2016

### *Decontamination.*

- a. Typical properties of contamination.
- b. Endurable and non-sticking contaminations.
- c. Decontaminations methods in laboratory and industries.

### *Protective Techniques.*

- a. Typical radiation protection techniques when working with open radionuclides.
- b. Technical equipment and industrial norms.

## Wednesday –27 April 2016

### *Radiolabeling.*

- a. Introducing radioactive atoms in molecules to provide well-defined radioactive compounds.
- b. Quality definitions.
- c. Radioiodination as example for radiolabeling of organic compounds.
- d. Chemistry of Technetium as example for radiolabeling with metal ions.
- e. Radiopharmaceuticals.

### *Radiotracer Applications.*

- a. Applications of Radioindicators in various field of science and technology, e.g. Nuclear Medicine, Chemical Process Technology.

## Thursday –28 April 2016

### *Radioanalytical Methods.*

- a. Radioactivity measurement of natural and artificial radionuclides can be employed advantageously in chemical analysis.
- b. Isotope Dilution Analysis.
- c. Activation Analysis.
- d. Analytical methods employing accelerators.

### *Radiochemical Separation Techniques.*

- a. Separation of extremely small amounts of pure radionuclides from bulk material frequently requires special separation techniques.
- b. Typical radiochemical separation methods are demonstrated.

**Friday –29 April 2016**

*The Nuclear Fuel Cycle.*

- a. Production of nuclear fuels based on uranium is shown from mining to the manufacturing of fuel assemblies.
- b. Reprocessing of Nuclear Fuels.
- c. Nuclear Waste Repositories.

*Water Chemistry of Nuclear Power Plants.*

- a. Chemistry of the cooling water cycles to control criticality, to achieve better fuel usage and to prevent corrosion...
  - in pressurized water reactors, and
  - in boiling water reactors.

*Transuranium Elements.*

- a. Discovery of the transuranium elements.
- b. Chemical properties of the actinides and transactinides.
- c. The end of the periodic table.