

BIOANALYSIS

From physical chemical analysis and activity testing of the bioactive supramolecular nanocompounds to the xenobiotics and toxins control and monitoring from medicines, food and environment

ABSTRACT

The research experience has a special importance, basic training as a senior researcher after fulltime and mostly exclusive research activity lasting over 10 years, makes that the subjects variety, in majority under BIOANALYSIS subdomain, to be further developed, in supporting the scientific coordination of the research themes proposed by the PhD candidates.

The scientific research themes, that are developed together with scientific groups and throughout cooperation with partners from foreign universities, will include active scientific involving either the students, master students or PhD students from our University.

1. synthesis/characterization of supramolecular nanocomplexes with biological activity

- the self-building process that takes place to the POM formation by metal elements oxoions polycondensation, produces a large number of chemical similar species, the process being influenced by the environment and its pH, by the reagents concentrations with different molar ratios and not last by the temperature and reaction kinetics. Basically for the entire polyoxometallates class of compounds the stability study is essential either in solid form or in solution. As long as the characterization and stability in solid form may be determined easily by IR spectra recording and X-Ray diffraction, in solution the problems appear due to multiple equilibrium established between POM species present to a certain pH value. Thus, a deep scientific study may start to characterize these compounds only after a thorough and advanced species separation;
- the crystallographic structures determination for the polyoxometallic class complex combinations represents the main and decisive stage for solving the supramolecular nanocompounds spatial symmetries. In order to solve the huge supramolecular structures, firstly the powder X-Ray diffraction for the studied compounds has to be performed, so the raw recorded data concerning the polyoxometallates nanomolecules crystallographic arrangements will offer some details about these compounds association to the specific class;
- the polyoxometallates are widely different compounds, formed within polycondensation processes and they present very different stabilities, but most of their practical applications are based on ionic exchange reversibility and their catalytic properties;
- the electrochemical sensors as for example graphite membrane, vitreous carbon, carbon paste, all of them chemically modified by inserting polyoxometallic type of compounds, electrodes obtained technical and functional with optimal performance, due allow compounds quantification to a very low level and making possible by this way the determination of toxic inorganic cations from waste water samples;

2. properties testing of the bioactive supramolecular nanocomplexes

- the advantage of POM compounds is their properties switch including those properties that involve molecular recognition and reactivity to a macromolecular biological target, that include polarity, redox potential, electrostatic charge distribution on surface, form and acidity. For very long time the polyoxometallates were used as protein specific reagents the same for the alkaloids, and for the colorimetric uric acid determination. The basic reaction that takes place is the interaction between polyoxometallates and the cationic part of biomolecules;
- the specific properties that are studied and researched is aimed on POM are: antiviral activity, antibacterial, antidiabetics, antitumoral and antifungal – all of them performed in order to increase the human health and people wellness;

3. active pharmaceutical substances monitoring and control, including bioequivalence studies of some medicines

- being involved into a several bioequivalence studies for some medicines, allows me to have a wider vision of the active pharmaceuticals administration effects, that is very helpful for a more focused scientific coordination on these subjects;
- the obtained results prove the major impact but in the same time the necessity of the medicine bioequivalence studies, including biological samples from human volunteers;
- the pharmaceutical substances traces and wastes over a very wide spectrum of media, mostly in fresh and salty water (due to their high solubility) requires developing of advanced bioanalytical methods development for their control and monitoring;

4. xenobiotics and toxins monitoring and control for the food and environmental samples

- the major influence of the food and environment over the human health justify further scientific studies for monitoring and control of the xenobiotics but mostly on toxins with powerful impact in human and animal organism;
- the diverse food sources that are or aren't contaminated with aggressive chemicals, also the environment associated with each areal individually polluted, have to be protected by removing the cause that produces the contamination in order to reduce heavily the impact and their effect on human and animal health;
- the increase of the involvement in the xenobiotics and toxins studies has to produce series of changes on the actual regulations and standards, in order to reduce the maximum admissible limits of these substances by deeper correlations between them.

The scientific results obtained together with the outcomes from the European programs cooperation will build the basic justification for new project proposals on scientific national or international projects calls. In the same time the increase of the contributions to the existing studies or running projects that have definite aims on the BIOANALYSIS subdomain should become the main objective.

Definitely, the studies results dissemination and undergraduates, master students and PhD students' outcomes will be included in their graduation papers, dissertation and doctoral thesis, forwarding by this important way on the path of cotutela scientific coordination.