Short Description of Scientific Activities

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March 2018

THE BIOLOGICAL SYSTEM OF THE ELEMENTS

scientifically developed

through

INNOVATIVE ENVIRONMENTAL ANALYTICAL CHEMISTRY OF CHEMICAL ELEMENTS

has

CONSEQUENCES

for

ESSENTIAL, BENEFICIAL AND TOXICOLOGICAL EFFECTS OF CHEMICAL ELEMENTS IN BETWEEN HUMANS, ANIMALS, PLANTS AND MICROORGANISMS

INCLUDING APPLICATIONS OF MODERN AND SUSTAINABLE TECHNIQUES OF ENVIRONMENTAL ENGINEERING

Abstract of lectures

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Instrumental (multi-) element analysis can be divided into the following steps: planning the analysis, representative sampling, sample preparation, the instrumental measurement of the analytical signal, and evaluation of the data. In general each step of the analysis has a degree of error associated with. The degree of difficulty of each analytical study and the degree to which it is subject to error depends less on the chemical or physical properties of the sample or substance to be analyzed than it does on the concentration range in which the substance occurs in the sample. Even if percent, ppm and ppb range, especially the ppt range is problematical and often impossible. As the concentration of the analyte decreases, the analytical error increases exponentially. One reason for this is the fact, that with small concentrations of the analyte, the basic matrix can interfere significantly with the instrumental determination of an element. For this reason , the companion matrix is usually separated before the actual instrumental measurement takes place. Another reason is the risk of contamination of the sample. For example, the mercury concentration in the laboratory air can reach concentrations that are so high that mercury levels in body fluids can only be detected without contamination by using clean-room conditions.When working with sensitive trace element analysis, care must be taken to use inert labware (e.g. quartz glass and highly purified reagents).

An overview of the occurrence, distribution and contamination of inorganic substances in various environmental compartments and the rates of flow between these will be given. In an ecosystem the pathways and location of elements can be influenced in a specific manner by the organisms, e.g. by selective uptake and enrichment of the inorganic substances. Special emphasis is placed on the distribution and activity of chemical elements in plants in relation to their occurrence in the earth crust, their beneficial effects to living organisms and their acute or toxicity to living systems. From here a so called “reference plant” could be developed, which allows for a direct comparison of individual plant species by standardizing them

against the “reference plant”. A Biological System of the Elements (BSE) has been established, which takes interelemental correlation, the biological function and the uptake form of individual elements into consideration. If the relationship in between these functions of elements is out of balance the inorganic contamination might have a toxicological effect.

An interdisciplinary approach towards the technical diagnosis, relief, avoidance of anthropogenic burdens on the environment by both inorganic and organic compounds as well as factors like waste heat, the technical diagnosis and so on being based on pieces of knowledge and methods from the natural sciences. This approach is going to be taught herein, for example in use of Bioindication and Biomonitoring (B&B) technologies or different phytoremediation methods. Obviously, some of these topics are quite complex to grasp. Hence we opt rather to “narrate” things, developments and options touching issues of environmental diagnosis, therapy and prophylaxis in their respective historical context, to make students understand, why people selected one technology (e.g. vehicle propulsion) rather than another, thereby accepting environmental risks. Notwithstanding this, interested students are fully supplied with definitions of terms and causes, formulas and tasks of comprehensive environmental technologies as they are in the third millennium so much shaped by information and communication technologies. But this is not a technocratic perspective: I also will address ethical issues and juridical, political implications on national and global scales when musing what could be done to achieve a more suitable, “greener”, yet responsible and libertarian way of life. Educating people with either faced this issue (which we express as a “Dialogic Education Process” (DEP) makes them familiar with things mentioned above.

Markert B (1996) Instrumental Element and Multi-Element Analysis of Plant Samples. Methods and Applications. Wiley & Sons Chichester, New York, Brisbane, Toronto, Singapore.

Markert B, Breure A, Zechmeister H, eds, (2003) Bioindicators & Biomonitors. Principles, Concepts and Applications. Elsevier, Amsterdam.

Fränzle S, **Markert B**, Wünschmann S (2012) Introduction to Environmental Engineering. Wiley-VCH, Weinheim.

Markert B, Fränzle S, Wünschmann S (2015) Chemical Evolution & The Biological System of the Elements. Springer, Heidelberg.

Seminars

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Seminar 1: S**tatus** of the chemical environment with special reference to inorganic chemical elements - chemical evolution and state of the art.

Seminar 2: **Changes** of the inorganic chemical environment caused by human activities during past 5000 years till today - Pollution, health effects and therapy, an overview.

Seminar 3: **Diagnoses** of environmental situations - Pollution and risk control by use of Bioindication and Biomonitoring (B & B) technologies

Seminar 4: **Effects** of pollutants on certain defined ecosystems and human beings – Ecotoxicology and human toxicology

Seminar 5: T**herapeutics** – Development of appropriate procedures and techniques – surveillance and control with special reference on phytotechnologies

Seminar 6: **Proactive** environmental measures (1) - estimating the impact of different (competing) technologies on the environment

Seminar 7: **Proactive** environmental measures (2) - define political aims of environmental measures and "translate" them into corresponding technological means, norms ("state of the art") and know how

Seminar 8: **Future** developments (1): Sustainability

Seminar 9: **Future** developments (2): Classical energetic resources

Seminar 10: **Future** developments (3): Alternative energies

Seminar 11: **International** and **interregional** cooperations for solving environmental problems: case studies

Seminar 12: **Interdisciplinarity** - Case studies on research, teaching and management

Seminar 13: **Interculturality** – What does it means? How much is an absolute must and how much is possibly too much? Case studies

Seminar 14: **Information and Communication -** The ratio and relationship between subjective and objective factors in processes of recognition

Seminar 15: **Ethical aspects** of society

Seminar 16: **Learning** and activity by motivation - The influence of psychological and mental conditions to human beings and development

Note:

To fullfill the requirements of a DIALOGIC EDUCATION PROCESS (DEP) some seminars will be supported

- visiting a chemical or pharmaceutical industry in or around Gdansk,
- talks and discussions with experts on topics given above will be stimulated and organized within the seminars,
  - on instrumental inorganic chemical analysis,
  - on health effects and therapy of trace element pollution,
  - and with politicians responsible for the environmental situation in Gdansk and Poland,
- visiting an intercultural event, as theatre, restaurant, a football game, a classical or heavy metal concert, or something else,
- etc., etc.

Termin	Dzień tygodnia	Godzina	Miejsce
05.03.2018	**Poniedziałek**	**09.15 – 12.00**	**Minicentrum Konferencyjne (Luwr)**
06.03.2018	**Wtorek**	**09.15 – 12.00**	**Minicentrum Konferencyjne (Luwr)**
07.03.2018	**Środa**	**09.15 – 12.00**	**Minicentrum Konferencyjne (Luwr)**
08.03.2018	**Czwartek**	**10.15 – 13.00**	**Minicentrum Konferencyjne (Luwr)**
09.03.2018	**Piątek**	**09.15 – 12.00**	**Minicentrum Konferencyjne (Luwr)**
12.03.2018	**Poniedziałek**	**09.15 – 12.00**	**Minicentrum Konferencyjne (Luwr)**
13.03.2018	**Wtorek**	**09.15 – 12.00**	**Minicentrum Konferencyjne (Luwr)**
14.03.2018	**Środa**	**09.15 – 12.00**	**Minicentrum Konferencyjne (Luwr)**
15.03.2018	**Czwartek**	**09.15 – 12.00**	**Minicentrum Konferencyjne (Luwr)**
16.03.2018	**Piątek**	**09.15 – 12.00**	**Minicentrum Konferencyjne (Luwr)**