FOOD 520 Advances in Food Analysis

Instructor: **Dr. Jerzy Zawistowski**

Credits: 3, Term 2
Lecture: Tuesday 9:00- 11:00 am, Room 300, FNH Building
Laboratory: Thursday 9:00-12:00

Course Description and Learning Objectives

Theory, potentials and applications of advanced analytical techniques employed in food analysis. The course will focus on providing students with a detailed knowledge of modern techniques used in research and development as well as inspection of food products in industry, analytical laboratories and government. The course is composed of lectures and hands-on laboratories.

Outline

Spectroscopy: fundamental principles, spectral behavior, difference derivative and fluorescence spectroscopy, mass spectroscopy, infrared spectroscopy, instrumental parameters.

Enzymatic Analysis: properties of enzymes, enzyme kinetics, systems for assay of enzyme activity (direct and coupled assays), instrumental methods, and systems for stabilization of enzymes (immobilized enzymes).

Liquid chromatography: basis of chromatography (mobile and stationary phases, the separation process, resolution, characteristics of the chromatographic peak), size exclusion, ion exchange, basic affinity, and metal chelate affinity chromatography.

High Performance Liquid Chromatography or Gas Chromatography: concepts and principles, methodology, instrumentation and applications.

Electrophoresis: basic principles, PAGE, SDS-PAGE, isolectric focusing, gel blotting methods and applications for detecting proteins and nucleic acid fragments (Western, Southern and Northern), capillary electrophoresis.

Immunochemical Techniques: definitions and basic immunological principles, polyclonal and monoclonal antibodies, precipitation techniques, radioimmunoassays and enzyme immunoassays, antigen-antibody interactions, enzymatic labels, amplification systems, applications.

Nucleic Acid Hybridization Assays: introduction to recombinant DNA technology, basic concept of nucleic acid hybridization methods, characteristics of nucleic acid probes, assay formats and amplification systems: PCR, LCR

Laboratory

Topics may include:

- Fluorescence Spectroscopy: Quantitative analysis of riboflavin
- Enzymatic Analysis: Determination of phosphatase in milk
- Enzymatic Analysis: Determination of glucose and fructose in food products using and enzymatic test kit
- HPLC: Analysis of sugar components in milk chocolate
- GC-MS: Determination of pantothenic acid in infant milk formula (Demonstration)
- Enzyme immunoassays: Detection of beta-lactam antibiotics in milk by ELISA
- Enzyme Immunoassays: Detection of allergen content in foods. Using a direct sandwich ELISA for detection of gluten (Tepnel Biokits)
- PCR: Qualitative analysis of GMO content in food using detection kits (Gen-Probe)

Students will work in groups but will submit individual reports. For the sake of consistency, students will be expected to follow the format and style of the *Journal of Food Science* in the preparation of lab reports.

Evaluation

Theory 60%

- Midterm 20%
- Final Exam 40%

Laboratory 40%

Suggested References

Daussant, J. and Bureau, D. 1989. Immunochemical methods in food analysis. In: King R.D., editor. Developments in Food Analysis Techniques. London & New York: Elsevier Applied Sci. p. 175.

Frazier, R. A., Ames, J.M. and Nursten, H.E. (Eds.). 2000. Capillary electrophoresis for food analysis. Cambridge: The Royal Society of Chemistry. 127 p.

Guilbault, G.G. (Eds.). 1976. Handbook of Enzymatic Methods of Analysis. New York: Marcel Dekker, Inc.

Hames, B.D. and Rickwood, D. (Eds.). 1983. Gel Electrophoresis of Proteins. Washington: IRL Press.

Horwitz, W. and Latimer, G.W. (Eds.). 2005. Official methods of analysis of AOAC International. 18th ed. Gaithersburg: AOAC International.

Joslyn, M.A. (Eds.). 1970. Methods in Food Analysis. New York: Academic Press.

Laemmli, U.K. 1970. Cleavage of structural proteins during the assembly of the head of bacteriophage T4. Nature, 227:680685.

MacRae, R. (Ed.). 1982. HPLC in food analysis. London: Academic Press.

Nielsen, S.S. (Ed.). 2003. Food analysis. 3rd ed. Gaithersburg: Aspen Publishers Inc.

Norris, B.A. and Clifford, M.N. (Eds.). 1985. Immunoassays in food analysis. London & New York: Elsevier Applied Sci.

Ozaki, Y., McClure, W.F. and Christy, A.A. (Eds.). 2007. Near-infrared spectroscopy in food science and technology. New Jersey: Wiley-Interscience. 408 p.

Reischl, U., Wittwer, C. and Cockerill, F. (Eds.). 2002. Rapid cycle real-time PCR. Methods and applications. Microbiology and food analysis. Berlin: Springer. 258 p.

Whitaker, J. (Ed.). 1972. Principles of enzymology for the food sciences. New York: Marcel Dekker, Inc.

Wilson, R.H. (Ed). 1994. Spectroscopic techniques for food analysis. New York: VCH Publishers, Inc. 246 p.

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