Food Quality and Chemistry of Natural Products

Organized by

Mediterranean Agronomic Institute of Chania

Food Quality and Chemistry of Natural Products

MAI coordinator: Dr. Panagiotis KEFALAS

Aims: Increasing concern over issues on food and uses of natural products in the Mediterranean area have formed the basis for a Master's of Science (M.Sc.) degree on "Food Quality and Chemistry of Natural Products". The programme is chemistry oriented and aims at the specialisation of students in Food Quality concepts, Food Authenticity, various aspects of Natural Product Chemistry and at the valorisation of Agrifood Renewable Sources for added value products. The postgraduate programme promotes expertise on quality control and various natural product applications as well as on high technology up-to-date laboratory instrumentation of analytical and preparative scope. The attainment of the M.Sc. degree qualifies them to successfully continue their doctorate studies and/or pursue an expert's career in both the public and private sector.

Objectives:

- to impart advanced knowledge in the area of food chemical composition and food technology aspects;
- to introduce indispensable notions of quality, authenticity and safety in all levels of production of food or other products;
- to present current advances for the isolation, characterisation and application of natural products;
- to provide laboratory experience in food and natural product analysis.

Part 1
Post graduate specialization programme

The programme is organized in 4 Units (60 ECTS)

Unit I
05 Oct.-13 November'09

FUNDAMENTAL OVERVIEWS (12 ECTS)

Content:
Statistics.
Organic Chemistry.
Analytical Chemistry I.
Biochemistry of Secondary Metabolism.

Learning outcomes:
Students learn how to use the basic theories and concepts of statistics; they strengthen their background in organic chemistry and receive advanced knowledge in analytical chemistry and fundamental biochemistry of secondary metabolism.

Unit II
16 Nov. to 05 February'10

ADVANCED FOOD CHEMISTRY (18 ECTS)

Content:
Foods/ Lipids/ Antioxidants.
Water Relations in Food – Food Carbohydrates.
Food Microbiology.
Food Proteins and Enzymes.
Analytical Chemistry II.
Functional Foods and Bioactive Ingredients.

Learning outcomes:
The candidates are provided with advanced knowledge in the field of lipids and their function, in the field of antioxidants and neutraceuticals. They learn about the interactive mechanisms between water and carbohydrates, an important topic of food technology. They are guided through the understanding of the role of food proteins and enzyme functions. Students are also expected to apply their knowledge in problem solving cases in the laboratory and develop scientific reasoning. Basic concepts of microbiology are taught.

Unit III
08 Feb.'10 to 19 March'10

CHEMISTRY OF NATURAL PRODUCTS (12 ECTS)

Content:
Chemistry of Terpenoids and Essential Oils.
Chemistry of Alkaloids, Flavonoids and other Phenolics.
Laboratory Techniques I.
Laboratory Techniques II.

Learning outcomes:
The students are expected to get knowledge and know-how over techniques and methodologies for the isolation, characterisation and quantitation of natural products and food ingredients. They learn notions and applications of NMR, Mass Spectroscopy, Liquid and Gas Chromatography, etc. They are also guided through the basic secondary metabolic pathways that yield the terpenoid, alkaloid and phenolic families of compounds and are introduced into their respective chemistry, properties and applications.

Unit IV **TOPICS IN FOOD SCIENCE (18 ECTS)**

22 March to 11 June'10

Content:

New Concepts in Food Packaging.
Trends in Food Processing – Preservation Technologies.
Food Product Development & Predictive Modelling of Food Quality.
Food Legislation.
Products of Appellation of Origin.
Quality Assurance.

Learning outcomes:

The unit is devoted to special topics of interest in food science, covering
- packaging and preservation,
- product development, authenticity and legislation and
- quality assurance

The important topics of food stability and shelf life are approached in detail, in relation to processing-formulation and preservation strategies adopted in food product development. The students are introduced into legislation and authenticity case studies. Last but not least, they learn how to tackle issues of quality assurance and accreditation, perceived through the technical and practical prism of a quality system officer.

14 to 18 June/10 **RETAKE EXAMS**

21 to 25 June'10 **ORAL EXAMS**

EXAMINATIONS

Participants are obliged to take an examination in order to obtain **an individual grade for each component** in the following arrangement: For every one or two week(s) of course delivery the given examination period is one week. For every three weeks of course delivery the given examination period is two weeks.

All units are subject to examination.

Examinations may take the form of written exams (problems, set of questions, exercises, multiple choice questions), individual or team work project, computer assisted exams or any combination of the above forms.

Retake examination is allowed for a maximum of three weeks course delivery **(9 ECTS)** of any unit **except the last four weeks** of course delivery **(12 ECTS)** of the final unit.

At the end of the 60 ECTS first year programme participants are obliged to take an oral comprehensive examination **weighting 15%** of the overall graduation grade.

Language of instruction: ENGLISH

ACADEMIC STAFF

The academic visiting faculty of the Food Quality and Chemistry of Natural Products programme is compounded by highly qualified professors from internationally renowned universities who are considered leaders in their fields. The scientific faculty of MAICh selects and invites them on the basis of specialisation to the subject matter, their international reputation and experience in teaching and research, as recognised by the academic community. MAICh is committed to the constant reviewing of the visiting faculty by the students on a yearly basis, in order to ensure the high quality of the teaching program and a dynamic adaptation to new scientific developments.
Additionally, the academic visiting faculty collaborates in the formulation of research and development projects, exchange of ideas and expertise for recent advances in science and encouragement for active participation in student's MSc thesis research projects through consultation and/ or assignment of official supervising duties. Outstanding MSc MAICh graduates are subsequently recruited into their reputable PhD programs on a full scholarship basis. A considerable number of former MAICh graduates are now active and successful members of the international academic community.
The following academic quality indicators have been achieved, during the period 1985-2005.

Research Indicators

- **39%** of the total number of research Master theses have been published in peer review journals (256 publications);

- **43%** have been presented and published in international conferences and proceedings.

Academic Mobility Indicators

- **28%** of graduates have been accepted with full scholarships in PhD programmes by highly ranked universities;

- **30** graduates and PhD holders serve as University Professors in their home country or abroad.

Weeks	TITLE	CREDITS	DATES
	Unit I Fundamental overviews	**12**	**05/10-13/11/2009**
1	Component 1- STATISTICS		05-09/10/2009
2	Component 2- ORGANIC CHEMISTRY		12-16/10/2009
3	**EXAMS**		19-23/10/2009
4	Component 3- ANALYTICAL CHEMISTRY I		26-30/10/2009
5	Component 4- BIOCHEMISTRY OF SECONDARY METABOLISM		02-06/11/2009
6	**EXAMS**		09-13/11/2009
	Unit II Advanced Food Chemistry		**16/11-05/02/2010**
7	Component 1- FOODS/LIPIDS/ANTIOXIDANTS	**18**	16-20/11/2009
8	Component 2- WATER RELATIONS IN FOOD-FOOD CARBOHYDRATES		23-27/11/2009
9	**EXAMS**		30/11-04/12/2009
10	Component 3- FOOD MICROBIOLOGY		07-11/12/2009
11	Component 4- FOOD PROTEIN AND ENZYMES		14-18/12/2009
12	***EXAM PREPARATION***		*21-25/12/2009*
13	***EXAM PREPARATION***		*28/12/2008-01/01/2010*
14	**EXAMS**		04-08/01/2010
15	Component 5- ANALYTICAL CHEMISTRY II		11-15/01/2010
16	**EXAMS**		18-22/01/2010
17	Component 6- FUNCTIONAL FOODS AND BIOACTIVE INGREDIENTS		25-29/01/2010
18	**EXAMS**		01-05/02/2010
	Unit III Chemistry of Natural Products	**12**	**08/02-19/03/2010**
19	Component 1- CHEMISTRY OF TERPENOIDS AND ESSENTIAL OILS		08-12/02/2010
20	Component 2- CHEMISTRY OF ALKALOIDS, FLAVONOIDS AND OTHER PHENOLICS		15-19/02/2010
21	**EXAMS**		22-26/02/2010
22	Component 3- LABORATORY TECHNIQUES I		01-05/03/2010
23	Component 4- LABORATORY TECHNIQUES II		08-12/03/2010
24	**EXAMS**		15-19/03/2010
	Unit IV Topics in Food Science	**18**	**22/03-11/06/2010**
25	Component 1- NEW CONCEPTS IN FOOD PACKAGING		22-26/03/2010
26	**EXAM PREPARATION**		*29/03-02/04/2010*
27	**EXAM PREPARATION**		*05-09/04/2010*
28	**EXAMS**		12/04-16/04/2010
29	Component 2- TRENDS IN FOOD PROCESSING-PRESERVATION TECHNOLOGIES		19-23/04/2010
30	Component 3- FOOD PRODUCT DEVELOPMENT & PREDICTIVE MODELING OF FOOD QUALITY		26-30/04/2010
31	Component 4- FOOD LEGISLATION		03-07/05/2010
32	**EXAMS**		10-14/05/2010
33	**EXAMS**		17-21/05/2010
34	Component 5- PRODUCTS OF APPELLATION OF ORIGIN		24-28/05/2010
35	Component 6- QUALITY ASSURANCE		31/05-04/06/2010
36	**EXAMS**		07-11/06/2010
37	**RETAKE EXAMS**		14-18/06/2010
38	**ORAL EXAMS**		**21-25/06/2010**

Part 2
The Master of Science Thesis

Project (60 ECTS)

The programme aims to provide students with a comprehensive theoretical background and laboratory skills to successfully address current research and application issues in Natural Products, Renewable Sources Valorisation and Food Quality. Precisely, the candidates receive extensive training in techniques as chromatography analytical and preparative, liquid and gas, spectroscopy (in the premises Mass, UV-Vis, Fluorescence, Luminescence, ICP spectroscopy are available; needs in NMR are covered by external collaboration), natural product isolation and purification, food quality analyses, antioxidant activity, synthetic reactions.

Research activities: topics generally available for Master of Science theses

- Isolation, structural elucidation of various natural products;
- Antioxidants: isolation and screening for antioxidant activity;
- Added value products from cheap, renewable sources;
- Synthesis of natural products and derivatives for agricultural and food uses;
- Methodologies for the estimation of antioxidant activity and/or free radicals, peroxides;
- Model systems to study mechanisms of antioxidant activity;
- Toxicant residues in food;
- Chemical fingerprinting of food and drink products: authenticity, origin;
- Antifraud chemical methodologies;

INDICATIVE MASTER THESES REALIZED WITHIN THE AREA

1. **Title:** Solubility and crystallization behaviour of phytosterols in corn oil (2009)
   Author: Alexandros Avanoglou, Greece
   Place of Realisation: Department of Food Quality and Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece
   Thesis director: Constantinos Biliaderis

2. **Title:** Antioxidant behaviour of polyphenols mixtures in model systems and correlation with redox potential: Distinction of synergistic and / or prooxidant effects (2008)
   Author: Mario Abou Samra, Lebanon
   Place of Realisation: Department of Food Quality and Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece
   Thesis director: Antony C. Calokerinos

3. **Title:** Model oxidation of quercetin: Isolation of two major oxidation products and evaluation of their antioxidant properties (2006)
   Author: Aytac Gulsen, Turkey
   Place of Realisation: Department of Food Quality and Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece
   Thesis director: Dimitrios Makris

4. **Title:** Tea and herbal infusions: their antioxidant activity and phenolic profile (2003)
   Author: Ali Khalil Atoui, Agro-Nutritional Technology, Lebanon
   Place of Realisation: Department of Food Quality Management and Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece
   Thesis director: George Boskou

5. **Title:** Application of peroxyoxalate chemiluminescence for the quantification of hydroxyperoxides and screening of antioxidant activity in non-aqueous media (2003)
   Author: Vahan Stepanyan, Food Technician, Armenia
   Place of Realisation: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece
   Thesis director: Panagiotis Kefalas

Detailed additional information is available at http://www.maich.gr/fqm/