Module no.: MBT-21
Food and Environmental Biotechnology

Location: UWM
Workload: 30 C (ECTS)
Semester: MBT2

Module coordinator:

Dr. Hab. Eng. Agnieszka Cydzik-Kwiatkowska (Mrs.), UWM

Course(s):

1) Biorefineries

2) Bioproducts from waste materials

3) Molecular biology techniques in biotechnology

4) Environmental biotechnology

5) Biological methods of food and feed preservation

6) Introduction to food biotechnology

7) Enzyme technology and bioinformatics

8) Electives environmental biotechnology

- 8a) Biotechnology of solid waste
- 8b) Reuse and recycling of solid waste
- 8c) Biomarkers of environmental contamination
- 8d) Toxic chemical risk

9) Electives food biotechnology

- 9a) Fermented products in food and feed chain
- 9b) Innovation in food biotechnology
- 9c) Food and bioprocess engineering
- 9d) Membrane processes in food industry

10) Writing scientific papers

11) Design thinking

Objectives and competences (Learning outcomes):

Upon completion of the module the students will be able to:
create and develop strategies that reflect the interdisciplinary nature of science, regulation and enterprise in the environmental and food biotechnology and deliver working knowledge of the various steps in the development of an environmental and food biotechnology-derived product from inception to the final product.

workload:

Module 900 h / 30 C (ECTS), including:

1) Biorefineries, total 30 h / 1 C:
   - presence during lectures: 5 weeks · 1 h/w = 5 h
   - presence during classes: 15 weeks · 1 h/w = 15 h
   - preparation to classes and exam: 10 h

2) Bioproducts from waste materials, total 90 h / 3 C:
   - presence during lectures: 15 weeks · 1 h/w = 15 h
   - presence during classes: 15 weeks · 2 h/w = 30 h
   - preparation to classes and exam: 45 h

3) Molecular biology techniques in biotechnology, total 60 h / 2 C:
   - presence during lectures: 5 weeks · 2 h/w = 10 h
   - presence during classes: 5 weeks · 4 h/w = 20 h
   - preparation to classes and final test: 30 h

4) Environmental biotechnology, total 120 h / 4 C:
   - presence during lectures: 15 weeks · 1 h/w = 15 h
   - presence during classes: 15 weeks · 3 h/w = 45 h
   - preparation to classes and final test: 60 h

5) Biological methods of food and feed preservation, total 90 h / 3 C
- presence during lectures: 7.5 weeks · 2 h/w = 15 h
- presence during classes: 10 weeks · 3 h/w = 30 h
- preparation to classes and exam: 45 h

6) Introduction to food biotechnology, total 90 h / 3 C
- presence during lectures: 5 weeks · 3 h/w = 15 h
- presence during classes: 6 weeks · 5 h/w = 30 h
- preparation to classes and exam: 45 h

7) Enzyme technology and bioinformatics, total 120 h / 4 C
- presence during lectures: 7.5 weeks · 2 h/w = 15 h
- presence during classes: 15 weeks · 3 h/w = 45 h
- preparation to classes and exam: 60 h

8) Electives environmental biotechnology, total 90 h / 3C

8a) Biotechnology of solid waste, total 45 h/1.5 C
- presence during lectures: 5 weeks · 1 h/w = 5 h
- presence during classes: 5 weeks · 3 h/w = 15 h
- preparation to classes and final test: 25 h

8b) Reuse and recycling of solid waste, total 45 h/1.5 C
- presence during lectures: 5 weeks · 1 h/w = 5 h
- presence during classes: 5 weeks · 3 h/w = 15 h
- preparation to classes and final test: 25 h

8c) Biomarkers of environmental contamination, total 45 h/1.5 C
- presence during lectures: 5 weeks · 1 h/w = 5 h
- presence during classes: 5 weeks · 3 h/w = 15 h
- preparation to classes and final test: 25 h

8d) Toxic chemical risk, total 45 h/1.5 C

- presence during lectures: 5 weeks · 1 h/w = 5 h
- presence during classes: 5 weeks · 3 h/w = 15 h
- preparation to classes and final test: 25 h

9) Electives food biotechnology, total 90 h / 3 C

9a) Fermented products in food and feed chain, total 45 h/1.5 C
- presence during lectures: 3 weeks · 2 h/w = 6 h
- presence during classes: 3 weeks · 4.6 h/w = 14 h
- preparation to classes and final test: 25 h

9b) Innovation in food biotechnology, total 45 h/1.5 C
- presence during lectures: 5 weeks · 1 h/w = 5 h
- presence during classes: 3 weeks · 5 h/w = 15 h
- preparation to classes and final test: 25 h

9c) Food and bioprocess engineering, total 45 h/1.5 C
- presence during lectures: 5 weeks · 1 h/w = 5 h
- presence during classes: 3 weeks · 5 h/w = 15 h
- preparation to classes and final test: 25 h

9d) Membrane processes in food industry, total 45 h/1.5 C
- presence during lectures: 5 weeks · 1 h/w = 5 h
- presence during classes: 5 weeks · 3 h/w = 15 h
- preparation to classes and final test: 25 h

10) Writing scientific papers, total 60 h/2 C
- presence during classes: 10 weeks · 3 h/w = 30 h
- preparation to classes: 30 h

11) Design thinking, total 60 h / 2 C
- presence during classes: 10 weeks · 3 h/w = 30 h
- preparation to classes: 30 h

Frequency:

Winter semester

Module duration

1 semester

Allocation::

Biotechnology (Master's) / mandatory

Assessment:

Written examination (90 min.), written examination (60 min.), written test (60 min), written test (90), scientific homework, oral presentation, laboratory report(s),

The module grade is the product of the individual course grades multiplied with the respective C, divided by the total C of 10 for the module.

Module no.: MBT-21
Course 1: Biorefineries

Lectures, classes | 1.33 SWS, 1 C (ECTS)
Semester: MBT2
Exam: K90 (written exam 90 min), scientific homework

Lecturer(s):

Prof. Dr. Hab. Eng. Irena Wojnowska-Baryła (Mrs.), UWM
Dr. Hab. Eng. Tomasz Pokój (Mr.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction::

English

Prerequisites:

Objectives of the course:

Upon completion of the course the students shall be able to achieve fundamental knowledge of the basics and raw materials of biorefinery, the conceptual design and engineering of processes in biorefineries, and ecological assessment of the entire value chain.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: The fundamental basis of bioproducts bioengineering based on the biorefinery concept, green chemical strategies for the processing of biomass and waste into valuable biomaterials, biochemicals and biofuels. Four areas: energy from biomass and waste, bioengineering of biomaterials, bioproducts from biomass and waste as examples of biorefinery concepts.

Classes: The biorefinery concept as a way to approach the problem for integrated municipal solid waste management. An oleochemical biorefinery, lignocellulotic feedstock biorefinery, acidogenesis driven by hydrogen partial pressure towards bioethanol production through fatty acids reduction; evaluating the sustainability of biorefineries at the conceptual design stage.

Literature:

1) Articles from Journal of Biomass Conversion and Biorefinery

Downloads:

Module no.: MBT-21
Course 2: Bioproducts from waste materials

Lectures, classes | 3 SWS, 3 C (ECTS)
Semester: MBT2
Exam: K90 (written exam 90 min), laboratory reports, scientific homework

Lecturer(s):

Dr. Hab. Eng. Dorota Kulikowska (Mrs.), UWM
Dr. Eng. Katarzyna Bułkowska (Mrs.), UWM
Dr. Hab. Eng. Tomasz Pokój (Mr.), UWM
Dr. Eng. Zygmunt Mariusz Gusiatin (Mr.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

Upon completion of the course the students shall be able to get acquainted with the possibilities and technologies of recovery of different bioproducts from waste materials.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Composting – theoretical background. Role of additives (amendments and bulking agent). Moisture, C/N ratio, porosity and free air space. Oxygen demand and aeration strategies. Maturation and humification; factors affecting humic substances content in mature compost. Compost/humic substances as useful bioproducts. Basic and principles of anaerobic digestion. Hydrogen production from waste materials. Enhancement of methane production during anaerobic digestion. Two-stage technologies of anaerobic digestion to increase biogas production. Hydrogen production technologies. Production of methane from agricultural wastes. Technological strategies for biodegradable polymers – production of polyhydroxyalkanoates (PHAs) using pure and mixed microbial cultures. Biochar production technology – factors and types of reactors. Characteristics and classification of biochar. Biochar application.

Classes: Sewage sludge composting – technological concept. Characterization of basic parameters in feedstock and mature compost. Technological concept of two stage biogas plant (1^o dark fermentation, 2^o methane production) for optimum biogas production. Hydrogen and methane as bioproducts of anaerobic digestion. The effect of carbon to nitrogen ratio (C/N) in the culture medium on the efficiency of PHAs accumulation in activated sludge. Calculations on biochar classification and its application as soil amendment.

Literature:

1) Materials supported by the teacher. 2) Martin A.M. (Eds.). 1998. *Bioconversion of waste materials to industrial products. Part IV. Composting process*. Blackie Academic&Professional. 3) Lehmann J., & Joseph S. (Eds.). 2015. *Biochar for environmental management: science, technology and implementation*. Routledge.

Downloads:

Module no.: MBT-21
Course 3: Molecular biology techniques in biotechnology

Lectures, classes | 2 SWS, 2 C (ECTS)
Semester: MBT2
Written test (90 min), laboratory reports

Lecturer(s):

Dr. Hab. Eng. Sławomir Ciesielski (Mr.), UWM
Dr. Eng. Dariusz Kaczmarczyk (Mr.), UWM
Dr. Eng. Maciej Woźny (Mr.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Fundamentals of biology

Objectives of the course:

The aim of the course is to provide an overview of molecular biology techniques and possibility of their use in biotechnology.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Organization of cells and cellular compartments. Structure of DNA and RNA. Molecular mechanisms of DNA replication, transcription and translation. Methods of RNA and DNA purification. Agarose and polyacryloamide electrophoresis. Basics of polymerase chain reaction PCR. Real-time PCR. Restriction enzymes. Fingerprinting techniques (T-RFLP, SSCP, DGGE). DNA cloning. Vectors. Heterologous protein production. Basics of computer based DNA sequence analysis. Omics- and metaomics approaches: genomics, metagenomics, transcriptomics, metatranscriptomics, proteomics, metaproteomics. Application of molecular techniques in environmental protection, agriculture and aquaculture.

Classes: DNA purification and quantification. Agarose gel electrophoresis. Polymerase chain reaction (PCR). Amplified DNA fragment analysis using automatic DNA sequencer. Genotyping and genetic variation assessment. Protein analysis using SDS-Page electrophoresis.

Literature:

1) Brown T.A., 2001, Gene Cloning and DNA Analysis: An Introduction. Blackwell Science. 2) Nicholl D.S.T., 2002, An Introduction to Genetic Engineering. Cambridge University Press.

Downloads:

Module no.: MBT-21
Course 4: Environmental biotechnology

Lectures, classes | 4 SWS, 4 C (ECTS)
Semester: MBT2
Written test (90 min), laboratory reports, scientific homework

Lecturer(s):

Dr. Hab. Eng. Agnieszka Cydzik-Kwiatkowska (Mrs.), UWM
Dr. Hab. Eng. Magdalena Zielińska (Mrs.), UWM
Dr. Eng. Zygmunt Mariusz Gusiatin (Mr.), UWM
Dr. Eng. Sławomir Kasiński (Mr.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

Upon completion of the course the students shall be able to achieve knowledge of biotechnological methods used for environmental engineering

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Biotechnology in environmental engineering – definitions and objectives. Aerobic and anaerobic biological wastewater treatment (typical plant configuration), continuous-flow and batch systems, the role of extracellular polymeric substances in biomass formation. Biological deodorization. Generation and management of waste in wastewater treatment systems. Bioremediation of polluted soils, biosurfactants in bioremediation - types, characteristics, application.

Classes: Field classes at facilities that implement different biotechnological processes for environmental purposes. Efficiency of pollutant removal and operational parameters in wastewater treatment systems, designing of reactors for wastewater treatment (activated sludge, aerobic granular sludge technology, membrane bioreactors), polymers in biomass from wastewater treatment systems. Amount of sewage sludge generated during urban wastewater treatment (ATV, EPA), design tasks for thickening, aerobic stabilization, methane fermentation with energy balance of the process, conditioning, dewatering and final disposal of sludge. Soil bioremediation in biopile – concept and design, indexes to evaluate terrestrial plant performance in phytoremediation, the use of biosurfactants in soil bioremediation.

Literature:

1) Kuhad, R. C., & Ward, O. P. (2009). Advances in applied bioremediation. A. Singh (Ed.). Berlin: Springer-Verlag. 2) Sáenz-Marta, C. I., de Lourdes Ballinas-Casarrubias, M., Rivera-Chavira, B. E., & Nevárez-Moorillón, G. V. (2015). Biosurfactants as useful tools in bioremediation. In Advances in Bioremediation of Wastewater and Polluted Soil. InTech. 3) Jördening H. J., Winter J. (Eds.) 2005. Environmental Biotechnology: Concepts and Applications. Wiley-Blackwell. 4) Evans G. G., Furlong J. 2010. Environmental Biotechnology: Theory and Application. Wiley. Rittmann B. E., McCarty P. L. 2001. Environmental Biotechnology: Principles and Applications. McGraw-Hill. 5) Wastewater Engineering (Treatment, Disposal, Reuse) McGraw-Hill International Editions 1991. 6) Wastewater treatment plant design, Ed. P.A. Vesilind, IWA Publishing, 2003. 7) Publications on sewage sludge disposal available on the Elsevier service. 8) Sewage Sludge Assessment, Treatment & Environmental Impact. Nova Science Publishers Inc. 2017.

Downloads:

Module no.: MBT-21
Course 5: Biological methods of food and feed preservation

Lectures, classes | 3 SWS, 3 C (ECTS)
Semester: MBT2
Exam: K60 (written exam 60 min), laboratory reports

Lecturer(s):

Dr. Magdalena Olszewska (Mrs.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

The course aims at providing knowledge of the method used for food and feed preservation by using natural antimicrobials and microbiota thereby increasing the storage life of food and feed.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: The fundamental aspects of the biologically viable methods for food and feed preservation. Principles of biopreservation. The beneficial fermentation processes used in order to reduce the rate of food/feed spoilage and to render the food/feed free from pathogenic microorganisms and metabolites. Bacteriocins and bacteriocin-producing bacteria: basic aspects and applications. Hurdle technology.

Classes: Phenotypic identification and technological properties of microorganisms in fermented and biopreserved foods and feeds. Food fermentations employed to produce safe and shelf stable food products. Starter culture design. Protective cultures in food and feed and their impact in food safety. Antimicrobial activity of lactic acid bacteria and propionic acid bacteria.

Literature:

1) Articles from Trends in Food Science and Technology and Journals related to Food Microbiology

2) MDPI journals, such as Microorganisms, Fermentation

Downloads:

Module no.: MBT-21
Course 6: Introduction to food biotechnology

Lectures, classes | 3 SWS, 3 C (ECT)
Semester: MBT2
Exam: K90 or K60 (written exam 90 min or test 60 min), laboratory reports, scientific homework

Lecturer(s):

Dr. Hab. Eng. Marek Adamczak (Mr.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

Upon completion of the course the students shall be able to achieve knowledge of the classical applications of microorganisms and enzymes in food processing and food product synthesis, including the analysis of the modification of food compounds by microorganisms and enzymes. The synthesis of enzymes and bioproducts by microorganisms will be presented. Both individual activity and cooperation with group members will be assessed.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Bioprocess technology for the production of cell biomass and primary/secondary metabolites, such as baker's yeast, ethanol, citric acid, amino acids, exo-polysacharides, antibiotics, biosurfactants, lipids, proteins, enzymes and pigments, etc. Microbial production, purification and bioprocess application of industrial enzymes. Kinetics of microbial growth, substrate utilization and product formation. Sterilization of air and media. Batch, fed-batch and continuous processes. Aeration and agitation. Mass transfer in bioreactors. Rheology of fermentation fluids. Scale-up concepts. Design of fermentation media. Various types of microbial and enzyme reactors. Instrumentation in bioreactors. Chromatographic and membrane based bioseparation methods. Immobilization of enzymes and cells and their application for bioconversion processes. Large-scale production and purification of bioproducts.

Classes: Evaluation of the parameters influencing the synthesis of yeast biomass. Analysis of parameters influencing the synthesis of bioproducts, e.g. lipids and/or proteins by microorganisms and algae. Separation and purification of intra- and extracellular metabolites. The application of lipases in ester synthesis. Production of low-lactose milk. Transgalactosylation activity of β-D-galactosidase. Properties of milk clotting enzymes.

Literature:

1) Perry Johnson-Green, 2002, Introduction to Food Biotechnology. CRC Series, Series: Contemporary Food Science 2) Byong H. Lee, 2015, Fundamentals of Food Biotechnology. John Wiley & Sons, Ltd 3) Articles from journal Food Biotechnology: http://www.tandfonline.com/toc/lfbt20/current 4) Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin , 2005, Food Biotechnology, Second Edition, CRC Pres 5) Stahl, Ulf, Donalies, Ute E.B., Nevoigt, Elke (Eds.), 2008, Food Biotechnology, Springer 6) Gustavo F. Gutierrez-Lopez, 2003, Food Science and Food Biotechnology. CRC Press 7) Casimir C. Akoh, 2017, Food Lipids: Chemistry, Nutrition, and Biotechnology, Fourth Edition. CRC Press

Downloads:

Module no.: MBT-21
Course 7: Enzyme technology and bioinformatics

Lectures, classes | 4 SWS, 4 C (ECTS)
Semester: MBT2
Exam: K90 (written exam 90 min, laboratory reports, scientific homework

Lecturer(s):

Prof. Dr. Hab. Eng. Małgorzata Darewicz (Mrs.), UWM
Prof. Dr. Hab. Piotr Minkiewicz (Mr.), UWM
Dr. Hab. Eng. Anna Iwaniak (Mrs.), UWM
Dr. Eng. Justyna Bucholska (Mrs.), UWM
Dr. Eng. Justyna Borawska-Dziadkiewicz (Mrs.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:
computer skills (familiarity with MS Word and MS Excel) and intermediate English level.

Objectives of the course:

Upon completion of the course the students shall be able to achieve knowledge of enzymes and coenzymes, proteins purification and isolation, proteins, lipids, carbohydrates metabolism, enzymes modifications and applications, the databases of low molecular weight compounds and their enzymatic reactions. The students will be able to define the similarities of biomolecules and practical application of bioinformatics in food science.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Lectures concern the characteristics of in silico, in vitro, in vivo methods applied in a contemporary life sciences, proteins, enzymes, coenzymes.

Classes: The exercises concern: enzymes mode of action, specificity, kinetics, prediction of physicochemical properties of high- and low molecular weight molecules; analysis of proteins as the source of peptides with biological and functional properties and searching for compound data in databases using structure search options including molecule editors and chemical codes.

Literature:

1) Selzer P. M., Marhöfer R. J., Rohwer A., 2008: "Applied Bioinformatics", Springer,
2) Dziuba J., Iwaniak A.,2006: "Database of bioactive peptide sequences. In: Nutraceutical Proteins and Peptides in Health and Disease.", CRC Press, p.543-564,
3. Stryer L., Biochemistry, 7th edition, pdf free,
4. Whitaker J.R., Voragen A.G.J., Wong D.W.S., 2003, Handbook of food enzymology. Marcel Dekker, Inc.

Downloads:

Module no.: MBT-21
Course 8a: Biotechnology of solid waste

Lectures, classes | 1.33 SWS, 1.5 C (ECTS)
Semester: MBT2
Written test (60 min), scientific homework

Lecturer(s):

Dr. Hab. Eng. Katarzyna Bernat (Mrs.), UWM
Dr. Eng. Sławomir Kasiński (Mr.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

Upon completion of the course the students shall be able to get acquainted with the basic definitions, technologies and biotechnologies of disposal of municipal solid waste.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Definitions of recovery and disposal of solid waste. Properties of solid waste. The development of mechanical-biological systems (MBP) for the bio-stabilization of solid waste. Technical and technological solutions applied in MBP. Composting of solid waste. Anaerobic stabilization of the organic fraction of solid waste.

Classes: Sources of waste. Quantity and morphological composition of municipal waste. Mechanical-biological processing with aerobic bio-stabilization. Composting of selectively collected organic waste in two-stage system: biological reactor and turned windrows. Mechanical-biological processing of waste with anaerobic bio-stabilization. Stabilization of organic fraction of waste using the fermentation process in energetic piles. Calculation of the amount of biogas produced using models and on the basis of the operational data.

Literature:

Resource, recovery and reuse in organic solid waste management, 2004, edited by Lens P., Hamelers B., Hoitink H., Bidlingmaier W., TJ International Padstwo, Cornwall, UK.

Downloads:

Module no.: MBT-21
Course 8b: Reuse and recycling of solid waste

Lectures, classes | 1.33 SWS, 1.5 C (ECTS)
Semester: MBT2
Written test (60 min), scientific homework

Lecturer(s):

Dr. Hab. Eng. Katarzyna Bernat (Mrs.), UWM
Dr. Eng. Sławomir Kasiński (Mr.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

Upon completion of the course the students shall be able to get acquainted with the basic definitions, technologies and biotechnologies of recycling and disposal of municipal solid waste.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Definitions of the recycling, recovery and disposal of solid waste. The levels of recovery of selectively collected solid waste. Technologies of recycling. Recycling of organic fraction of solid waste. Technological solutions applied in mechanical-biological treatment (MBP). Aerobic and anaerobic stabilization of the organic fraction of solid waste.

Classes: Quantity and morphological composition of municipal waste; selectively collected fraction of waste. Mechanical-biological processing with aerobic bio-stabilization. Composting of selectively collected organic waste in two-stage system: biological reactor and turned windrows. Mechanical-biological processing of waste with anaerobic bio-stabilization. Stabilization of organic fraction of waste using the fermentation process in energetic piles. Calculation of the amount of biogas produced using models and on the basis of the operational data.

Literature:

Resource, recovery and reuse in organic solid waste management, 2004, edited by Lens P., Hamelers B., Hoitink H., Bidlingmaier W., TJ International Padstwo, Cornwall, UK.

Downloads:

Module no.: MBT-21
Course 8c: Biomarkers of environmental contamination

Lectures, classes | 1.33 SWS, 1.5 C (ECTS)
Semester: MBT2
Written test (60 min), laboratory reports

Lecturer(s):

Prof. Dr. Hab. Eng. Paweł Brzuzan (Mr.), UWM
Dr. Eng. Maciej Woźny (Mr.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

Upon completion of the course the students shall be able to display a comprehensive understanding about biomarkers of exposure to environmental stressors and possibility of using them in environmental monitoring. The course should bring them to better understanding effects and negative impact of toxic chemicals that are widely considered environmental pollutants.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Definition and classification of biomarkers. Specificity of biomarkers. Plant's response to environmental stress. Behavioral changes of animals. Anatomical, physiological and molecular endpoints of environmental pollutants. Biomarkers of mutagenic, genotoxic, carcinogenic, or endocrine disrupting environmental contaminants. Pharmaceuticals and their residues in aquatic environment. Nanoparticles – threat or chance? The role of biomarkers in environmental risk assessment and environmental monitoring.

Classes: Health and Safety regulations, organizational issues, introduction to the subject. User manual of the laboratory equipment. Pipetting micro volumes of liquids with different physical properties (density, viscosity). Analysis of gene expression after exposure to model toxic substance (a case study): Isolation of total RNA using modified Chomczynski method. Spectrophotometric measurement of quantity and purity of the isolated RNA samples. Elimination of genomic DNA from the samples. Assessment of RNA integrity. Reverse transcription. Analysis of gene expression using real-time quantitative PCR (qPCR). Calculations of raw values obtained from qPCR and their statistical analysis. Seminar on the molecular mechanisms of action of selected groups of environmental contaminant. Presentation of the laboratory results (writing lab report).

Literature:

1) Huggett R.J., 1992, Biomarkers: biochemical, physiological, and histological markers of anthropogenic stress. Lewis Publishing. 2) McCarthy J.F., Shugart L.R., 1990, Biomarkers of environmental contamination. Lewis Publishers. 3) Penningroth, S., 2010, Essentials of Toxic Chemical Risk Science and Society. CRC Press, London. 4) Walker C. H., Hopkin S. P., Sibly R. M., Peakall B., 2005, Principles of Ecotoxicology, Third Edition. CRC Press. 5) Logan, J., Edwards, K., Saunders, N., 2009, Real Time PCR: Current technology and applications. Caister Academic Press. 6) Brown T.A., 2007, Genomes 3. Garland Science Publishing. 7) Fisher J., Arnold, J.R.P., 2000, Chemistry for Biologists. Instant Notes Series. Bios Scientific Publishers, Oxford. 8) Current original and review articles from international scientific journals, e.g. Nature, Science, Toxicology, Environmental Toxicology and Pharmacology, Environmental Health Perspectives, Environmental Science and Technology, Ecotoxicology and Environmental Safety, Environmental Toxicology and Chemistry, Environmental Biotechnology, Biomarkers, Aquatic Toxicology, Chemico-Biological Interactions, Chemosphere.

Downloads:

Module no.: MBT-21
Course 8d: Toxic chemical risk

Lectures, classes | 1.33 SWS, 1.5 C (ECTS)
Semester: MBT2
Written test (60 min), laboratory reports

Lecturer(s):

Prof. Dr. Hab. Eng. Paweł Brzuzan (Mr.), UWM
Dr. Eng. Maciej Woźny (Mr.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

Upon completion of the course the students shall be able to display a comprehensive understanding of the basis of toxicology from a risk assessment perspective

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Toxic chemical risk as science. Environmental pathways of toxic chemicals. Dose effect. Toxicity testing in animals. Studies of human populations at risk. The body's defenses against chemical toxicity. Mechanisms of chemical disease. Human health risk assessment. Ecological risk assessment. Managing chemical risk.

Classes: Health and Safety regulations, organizational issues, introduction to the subject. User manual of the laboratory equipment. Lethal toxicity tests on fish. Calculation of median lethal concentration (LC50), median lethal time (LT50) values, and toxic units number. Phytotoxicity assessment using PHYTOTOX kit for tests on monocotyledonous (sorghum) and cotyledonous plants (cress, mustard). Physiological endpoints of toxicity: examination of blood smears and liver sections of fish exposed to polycyclic aromatic hydrocarbons (PAHs) using light microscopy (laboratory classess). Molecular toxicology: analysis of gene expression after exposure to model toxic substance. Genotoxicology: assessment of genotoxic effect of PAHs on fish's erythrocytes and hepatocytes using the comet assay. Risk assessment: hazard identification, analysis of exposure, analysis of effects, rick characterization. Ecological risk assessment.

Literature:

1) Penningroth, S. 2010. Essentials of toxic chemical risk-science and society. CRC Press pp. 1-194. 2) Brzuzan P., Woźny M., 2012, Toxicology. Student's coursebook. Department of Environmental Biotechnology, University of Warmia and Mazury in Olsztyn, Poland. 3) Walker C. H., Hopkin S. P., Sibly R. M., Peakall B., 2005, Principles of Ecotoxicology, Third Edition. CRC Press. 4) McCarthy J.F., Shugart L.R., 1990, Biomarkers of environmental contamination. Lewis Publishers. 5) Brown T.A., 2007, Genomes 3. Garland Science Publishing. 6) Manly, B.F. J. Statsitics for environmental science and management. 2nd ed. Chapman and Hall/CRC , pp. 1-295.

Downloads:

Module no.: MBT-21
Course 9a: Fermented products in food and feed chain

Lectures, laboratories | 1.33 SWS, 1.5 C (ECTS)
Semester: MBT2
Written test (60 min), laboratory reports, scientific homework

Lecturer(s):

Prof. Dr. Hab. Eng. Katarzyna Majewska (Mrs.), UWM
Dr. Hab. Eng. Justyna Żulewska (Mrs.), UWM
Dr. Hab. Eng. Monika Modzelewska-Kapituła (Mrs.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

This course is intended to familiarize students with the role of microbials in chosen food products of animal (milk, meat) and plant origin. The issues related to the production and evaluation of fermented products, sausages and hams, will be raised. The role of yeast and sourdough microbials in the production of wheat and rye bread will be presented. The influence of dough proofing, the role of different stages of bulk fermentation on the final quality of obtained bread will be underlined. The technological role of different microorganisms, especially lactic acid bacteria (LAB) will be discussed in products like yoghurt and cheese. The focus will be also on the application of beneficial bacteria on physicochemical, rheological and sensory properties of dairy products.

Type of course, didactics:

Lectures, laboratory

Contents:

Lectures:

1. The fundamental basis of the production process of fermented meat products, including sausages and dry-fermented hams.
2. The fundamental basis of the breadmaking process. The role of dough fermentation process in wheat and rye bread production and its final quality. The use of microbial cultures for preparing dough during breadmaking process.
3. The role of microorganisms in production and safety of dairy products. Basic biochemistry on selected microorganism metabolism/fermentation to control processing conditions for the desired finished product quality.

Laboratory classes:

1. Evaluating the quality of different types of fermented meat products.
2. The laboratory baking trials and quality evaluation of obtained wheat and rye bread.
3. Yoghurt and cheese making practical sessions. Evaluation of technological parameters necessary for obtaining key product characteristics.

Literature:

Articles from

1) Meat Science Journal,
2) Food Microbiology,
3) Journal of Cereal Science,
4) Cereal Chemistry,
5) Plant Foods For Human Nutrition,
6) Trends in Food Science & Technology,
7) Journal of Dairy Science
8) Fox P.F., P.L.H. McSweeney, T.M. Cogan, and T.P. Guinee. 2004. Cheese. Chemistry, Physics, and Microbiology. Elsevier Academic Press. London. UK.
9) Tamime A.Y., and R.K. Robinson. 2007. Yoghurt. Science and technology. Woodhead Publishing Limited, Cambridge, UK

Downloads:

Module no.: MBT-21
Course 9b: Innovation in food biotechnology

Lectures, classes | 1.33 SWS, 1.5 C (ECT)
Semester: MBT2
Written test (60 min), laboratory reports, scientific homework

Lecturer(s):

Dr. Hab. Eng. Marek Adamczak, UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

Upon completion of the course the students shall be able to display a comprehensive understanding of modern applications of microorganisms and enzymes in food processing and food product synthesis, including the analysis of the modification of food compounds by microorganisms and enzymes. The students have knowledge of the basic molecular biology and nano(bio)technology approaches, including sustainable technology for waste and by-product utilization and bioprocess engineering as well as high pressure technology in food production. Both individual activity and cooperation with group members will be assessed. Students have familiarity with innovation in industrial application of biotechnology.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Progress in bioprocess technology for the production of cell biomass and primary/secondary metabolites. Molecular engineering techniques. Biodiversity and metagenome and directed evolution. Immobilization of enzymes and cells and their application for bioconversion processes. Large-scale production and purification of bioproducts. Nanobiotechnology. Nanomaterials. Liposomes, phytosomes, encapsulation. High pressure technology, pulsed electric field and cold plasma application. The application of biotechnology for waste and by-products from food industry valorization.

Classes: Preparation of liposomes, nanoliposomes, emulsions. Immobilization of cells and enzymes (carriers and nonocarriers). The influence of high-pressure technology on the properties of food products. Biosynthesis of nanoparticles, their properties and application.

Literature:

1) Perry Johnson-Green, 2002, Introduction to Food Biotechnology. CRC Series, Series: Contemporary Food Science 2) Byong H. Lee, 2015, Fundamentals of Food Biotechnology. John Wiley & Sons, Ltd 3) Articles from journal Food Biotechnology: http://www.tandfonline.com/toc/lfbt20/current 4) Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin , 2005, Food Biotechnology, Second Edition, CRC Pres 5) Stahl, Ulf, Donalies, Ute E.B., Nevoigt, Elke (Eds.), 2008, Food Biotechnology, Springer 6) Gustavo F. Gutierrez-Lopez, 2003, Food Science and Food Biotechnology. CRC Press 7) Casimir C. Akoh, 2017, Food Lipids: Chemistry, Nutrition, and Biotechnology, Fourth Edition. CRC Press 8) Ravishankar Rai V (Editor), 2015, Advances in Food Biotechnology. Wiley 9) Debasis Bagchi, Francis C. Lau, Dilip K. Ghosh, 2010, Biotechnology in Functional Foods and Nutraceuticals. CC Press 10) Didier Montet, Ramesh C. Ray, 2015, Fermented Foods, Part I: Biochemistry and Biotechnology. CRC Press 11) Ching T. Hou, Jei-Fu Shaw, 2005, Biocatalysis and Biotechnology for Functional Foods and Industrial Products. CRC Press.12) Claudio Nicolini, 2008, Nanobiotechnology and Nanobiosciences. Pan Stanfor 13) Ching T. Hou, 2008, Handbook of Industrial Biocatalysis. CRC Press.

Downloads:

Module no.: MBT-21
Course 9c: Food and Bioprocess Engineering

Lectures, classes | 1.33 SWS, 1.5 C (ECT)
Semester: MBT2
Written test (60 min), laboratory reports, scientific homework

Lecturer(s):

Dr. Hab. Agnieszka Jankowska (Mrs), UWM
Dr. Eng. Bartosz Brzozowski (Mr.), UWM
Dr. Hab. Eng. Marek Adamczak, UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

Upon completion of the course the students shall be able to display a comprehensive understanding of the classical and modern applications of microorganisms and enzymes in food processing and food product synthesis, including synthesis and modification of food compounds by microorganisms and enzymes. Both individual activity and cooperation with group members will be assessed.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Bioprocess technology for the production of cell biomass and primary/secondary metabolites, such as baker's yeast, ethanol, citric acid, amino acids, exopolysaccharides, antibiotics, biosurfactants, lipids, proteins, enzymes and pigments, etc. Microbial production, purification and bioprocess application of industrial enzymes. Kinetics of microbial growth, substrate utilization and product formation. Sterilization of air and media. Batch, fed-batch and continuous processes. Aeration and agitation. Mass transfer in bioreactors. Rheology of fermentation fluids. Scale-up concepts. Design of fermentation media. Various types of microbial and enzyme reactors. Instrumentation in bioreactors. Chromatographic and membrane based bioseparation methods. Immobilization of enzymes and cells and their application for bioconversion processes. Large-scale production and purification of bioproducts.

Classes: Evaluation of the parameters influencing the synthesis of yeast biomass. Analysis of parameters influencing the synthesis of lipids and/or proteins by microorganisms and/or algae. Separation and purification of intra- and extracellular metabolites. Immobilization of cells and enzymes. The application of lipases in ester synthesis. Production of low-lactose milk. Transgalactosylation activity of β-D-galactosidase. Properties of milk clotting enzymes.

Literature:

1) Doran P.M., 2013, Bioprocess engineering principles. Academic Press, 2) Dunford N.Y., Kerr R.M., 2012, Food and Industrial Bioproducts and Bioprocessing. Wiley-Blackwell. 3) Whitaker J.R., Voragen A.G.J., Wong D.W.S., 2003, Handbook of food enzymology. Marcel Dekker, Inc. 4) Neeser, J.-R., 2004, Bioprocesses and biotechnology for functional foods and nutraceuticals. Marcel Dekker, Inc. 5) Clarke K.G., 2013, Bioprocess engineering. An introductory engineering and life science approach. Woodhead Publishing Limited. 6) Hou Ch.T., 2005, Handbook of industrial biocatalysis. Taylor&Francis.

Downloads:

Module no.: MBT-21
Course 9d: Membrane processes in food industry

Lectures, classes | 1.33 SWS, 1.5 C (ECT)
Semester: MBT2
Written test (60 min), laboratory reports, scientific homework

Lecturer(s):

Dr. Eng. Bogdan Dec (Mr.), UWM
Dr. Hab. Eng. Justyna Żulewska (Mrs), UWM

Module:

Food and Bioprocess Engineering

Language of instruction:

English

Prerequisites:

Objectives of the course:

Upon completion of the course the students shall be able to have knowledge of the general characteristics of membrane processes and application in the food industry together with the treatment of effluent and reuse of wastewater. Both individual activity and cooperation with group members will be assessed.

Type of course, didactics:

Lectures, classes

Contents:

Lectures: Principles of membrane filtration. Types of membrane processes. Membrane chemistry, structure and properties based on materials. Theory of membrane transport. Factors affecting membrane separations. General characteristics of membrane processes. Membrane configuration (modules). Process design – operation modes. Membrane fouling, cleaning and disinfection. Application of membrane processes in the food industry and for the treatment of effluent and reuse of wastewater.

Classes: Performance characteristics of pilot membrane installations using polymer and ceramic membranes: construction and identification of membrane installation elements, operating parameters analysis. Technical characteristics of membrane separation processes: calculations of typical parameters determining: (1) membrane selectivity (separation efficiency evaluation) and (2) membrane process efficiency based on process data. Technical characteristics of membranes: material, module, parameters determining their selectivity (e.g. pore size) and efficiency (active membrane surface, packing density), operating principles of membranes - work parameters and cleaning procedure. Water treatment (purification) by reverse osmosis.

Literature:

1) Tamime A.Y., 2013, Membrane Processing: Dairy and Beverage Applications. Blackwell Publishing Ltd. 2) Cheryan M., 1998, Ultrafiltration and Microfiltration Handbook, Technomic Publishing Company, Inc. 3) *Grandison A.S., M.J. Lewis,* 1996, Separation processes in the food and biotechnology industries. Principles and applications. Woodhead Publishing Ltd. 4) Baker R.W., 2004, Membrane Technology and Applications, John Wiley & Sons Ltd. 5) Norman N. Li, A. G. Fane, W. S. Winston Ho, T. Matsuura, 2008, Advanced Membrane Technology and Applications", John Wiley & Sons, Inc. 6) Rizvi S., 2010, Separation, Extraction and Concentration Processes in the Food, Beverage and Nutraceutical Industries, Woodhead Publishing.

Downloads:

Module no.: MBT-21
Course 10: Writing scientific papers

Classes | 2 SWS, 2 C (ECTS)
Semester: MBT2
Scientific homework

Lecturer(s):

Dr. Hab. Eng. Agnieszka Cydzik-Kwiatkowska (Mrs.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

The aim of this course is to teach the students how to read, write and publish scientific papers.

Type of course, didactics:

Classes

Contents:

Classes: Variety of publications. Planning. Organizing the paper. Writing the first draft. How to prepare the abstract. How to write the introduction. How to write materials and methods section. How to write the results. How to write the discussion. How to state the acknowledgements. Journal „Impact Factor" (IF). Diagrams, photographic figures. Charts and tables. Slides. Posters.

Literature:

1) Łuczyński M, 2010-2011, English for biotechnologists and hydrobiologists. Bilingual (in English with English-Polish dictionary for each topic, and the dictionary package) materials for internal use at the Department of Environmental Biotechnology. Available in printed and electronic form. 111 pages. 2) Environmental Biotechnology. Periodical of the University of Warmia and Mazury in Olsztyn and the University of Applied Sciences in Offenburg. Available in printed and electronic form [http://www.environmentalbiotechnology.pl].

Downloads:

Module no.: MBT-21
Course 11: Design thinking

Classes | 2 SWS, 2 C (ECTS)
Semester: MBT2
Scientific homework, oral presentation

Llecturer(s):

Dr. Hab. Eng. Anna Sylwia Tarczyńska (Mrs.), UWM
Dr. Eng. Katarzyna Staniewska (Mrs.), UWM

Module:

Food and Environmental Biotechnology

Language of instruction:

English

Prerequisites:

Objectives of the course:

This course aims at introducing students to design thinking. This course has a special focus on skill development through active engagement in real world problems: design thinking and innovation, framing and synthesis, experimentation, creativity, team work.

Type of course, didactics:

Classes

Contents:

Classes: The course is organized around three projects of different type and scope that students work with during several sessions. Each project is supported of seminars in which students will experience various methods and tools. General topics of projects: new trends in creating food concepts, trends in food biotechnology, food security and food waste.

Literature:

Journal articles and book chapters relating to the course, plus additional literature recommended by the discussion leaders or identified by students will be shared as optional reading throughout the course. Also, students are expected to search for and use additional literature in relation to the project tasks.

Downloads: