

MASTER BIOTECHNOLOGIES

PARCOURS MASTER INTERNATIONAL EN BIOTECHNOLOGIES MARINES

semestre 9

Ingredients and active molecules

Bioactive molecules from marine animal biomasses

Objectifs

The objective is to make the student ready to develop and propose a comprehensive approach for enhancing the value of fisheries and aquaculture products from animal origin (including by-products) for the development of new added-value molecules and ingredients, intended for food, feed, aquaculture, cosmetics, ...

Marine biotechnologies are targeting niche markets by offering products with low volumes and high added-values, and also mass markets like bio-sourced polymers.

2 crédits ECTS

Volume horaire

Travaux Pratiques : 4h

Travaux Dirigés : 12h

Cours Magistral : 20h

Pré-requis nécessaires

Bases of biology, biochemistry, enzyme engineering, microbial engineering.

Possibly, bases of marine biology and ecology.

Compétences visées

Learning outcomes:

- A comprehensive vision of blue biotechnologies on a worldwide scale.
- The capacity to identify the research teams and research activities for establishing collaborations.
- The ability to identify the emerging markets, their size and their potential.
- The ability to transpose data and concepts of the scientific literature into R & D approaches integrating scaling-up.
- The capacity to explain the biological activities and functionality of molecules to non-specialists while having a dialogue with experts.
- The ability to inject new ideas, and to create innovative products.
- The ability to understand what is hindering and driving in marine process, and to choose the most appropriate strategy for achieving the final objective.

Descriptif

Introduction: Global overview of how enhancing the value of fisheries and aquaculture products from animal origin: definitions, resources, markets, notion of value chain, current trends, and examples of innovation in Norway.

Chapter 1: Concentrates and isolates of proteins: conventional methods, Ph-shift, pulps.

Chapter 2: Gelatines et collagens: general properties, specificities of marine collagens, impact of process on techno functional properties. Niche and mass applications of gelatines. Innovative uses in nutraceuticals, nutri-cosmetics et biomaterials (tissue engineering, ...)

Chapter 3: Enzymes in industrial processes: 3.1. Fish protein hydrolysates (FPH) with functional properties: pH-stat method, characterisation of peptidic populations, choice of enzymes for FPH. 3.2 Use of enzymes for the controlled destructuration of complex matrices: application to microalgae.

Chapter 4: Peptides exhibiting biological activities: definitions, examples in food, feed, nutraceutical, cosmetics,

Chapter 5: Biopolymers (chitin and chitosan, chondroitin sulphate, hyaluronic acid: general characteristics, extraction process, properties et exemple of uses.

Chapter 6: Marine lipids: structures and functions: PUFA and phospholipids

Bibliographie

Handbook of Marine Biotechnology 2015 SPRINGER

Marine Biotechnology : Enabling Solutions for Ocean Productivity and Sustainability (2013) OECD

An Introduction to Biomaterials, Second Edition (2011) Jeffrey O. Hollinger, CRC Press

Added Value to Fisheries Waste (2008) J.-P. Bergé Ed., © Transworld Research Network, Kerala, India.

Maximising the Value of Marine By-Products (2007) F. Shahidi Ed In: F. Shahidi (Ed.). Woodhead (GB),

Improving seafood products for the consumer (2008). T. Børresen (Ed.) Woodhead (GB)

Seafood research from fish to dish. Quality, safety and processing of wild and farmed fish (2006) Luten J., Jacobsen C., Bekaert K., Saebo A., Oehlenschläger J. (Eds.). Editions Wageningen Academic Publishers (Netherlands),

Marine Biotechnology I & II (2005), Le Gal & Ulber (Eds.) SPRINGER

Chitine et chitosane: du biopolymère à l'application (2009), Crini, Badot & Guibal, Presses Univ. Franche-Comté,

[Biofutur N° 301 : Biotechnologies marines \(Juillet-Août 2009\)](#), Tec & Doc

Substances naturelles d'origine marine : Chimiodiversité, pharmacodiversité, biotechnologies (2005) Kornprobst JM Tec & Doc

Modalités de contrôle des connaissances

Session 1 ou session unique - Contrôle de connaissances

Nature de l'enseignement	Modalité	Nature	Durée (min.)	Coefficient	Remarques
UE	CT	Ecrit - devoir surveillé	120	50%	
UE	CT	Ecrit - mémoire		30%	
UE	CT	Oral - exposé	35	20%	

Bioactive molecules from marine plants biomasses

Objectifs

The objective is to make the student ready to develop and propose a comprehensive and integrated approach for enhancing the value of marine plants (macroalgae and halophytes) and their by-products for the development of novel added-value molecules and ingredients, intended for food, agrifood, aquaculture, cosmetics, pharmaceutical and medical sectors, together with the sector of fouling.

Marine biotechnologies are targeting niche markets by offering products with low volumes and high added-values, and also mass markets like bio-sourced polymers.

3 crédits ECTS

Volume horaire

Cours Magistral : 20h

Travaux Pratiques : 6h

Travaux Dirigés : 6h

Pré-requis nécessaires

Basic marine biology, marine biochemistry, botany.

Compétences visées

Learning outcomes for students are to obtain a comprehensive vision, in a context of sustainable and innovative researches:

- of the macroalgal and halophytes industries at different scales (France, Europe and worldwide)

- on the possibilities to valorize marine plants

- on the application of biotechnological processes in the domain of marine sciences

- on biological assays which could be carried out along the research of innovative marine ingredients

- on the formulation of ingredients.

Students will also acquire:

- the ability to transpose data/concepts of the scientific literature into R & D approaches integrating scaling-up.

- the capacity to bind extractive and purification processes and their uses, depending on the needs of industrials

Descriptif

Introduction: utilization of marine plants worldwide, chemodiversity and sectors which use marine plants

Chapter 1: Global overview of the marine plants industry in France, Europe and in the world: definitions, types of resources (harvested, cultivated resources together with beaching), markets, value chains, culture versus harvesting following countries with case studies in occidental and oriental countries (for seaweeds).

Chapter 2: The different industrial sectors which use marine plants: general properties, specificities of marine ingredients, classical and innovative uses

Chapter 3: focus on phenolic compounds: extraction, purification, quantification and biological activities, innovative and green processes for their extraction/purification, applications in cosmetic, agrifood and medical industries

Chapter 4: focus on carbohydrates (mono-, di- and polysaccharides): extraction, purification, quantification and biological activities, innovative and green processes for their extraction/purification, applications in cosmetic and medical industries

Chapter 5: focus on marine lipids (terpens, fatty acids,...): extraction, purification, quantification and biological activities, applications in fouling industries and use as natural conservatives.

Chapter 6: innovations in relation with researches on marine plants. Cosmetic Ingredients and formulation: theory and practical way to obtain a cosmetic product.

Bibliographie

Stengel et al. (2011) Algal chemodiversity and bioactivity: sources of natural variability and implications for commercial application. *Biotechnology Advances* 29: 483–501

Kornprobst (2005) *Substances naturelles d'origine marine : Chimiodiversité, pharmacodiversité, biotechnologies*, Tec & Doc

Fleurence & Levine (2016) *Seaweed in Health and Disease Prevention*, 1st Edition. ISBN: 9780128027721

Se-Kwon (2012) *Handbook of Marine Macroalgae: Biotechnology and Applied Phycology*, Wiley-Blackwell. ISBN: 9780470979181

Anonyme (2011) *Récolte des algues de rive. Guide de bonnes pratiques*. Inter Bio Bretagne (IBB). Accessible en ligne : <http://www.bio-bretagne-ibb.fr/wp-content/uploads/IBB-Guide-recolte-algues-29122013.pdf>

Modalités de contrôle des connaissances

Session 1 ou session unique - Contrôle de connaissances

Nature de l'enseignement	Modalité	Nature	Durée (min.)	Coefficient	Remarques
	CT	Ecrit - rapport		50%	
	CT	Oral - exposé	20	50%	par groupe de 2 ou 3

Green biotechnology and intelligent mariculture

Objectifs

Teaching objectives

The impact that biotechnology can have on our society and economy will be reviewed in this unit. An overview of industrial biotechnology and its applications in a number of product categories ranging from food ingredients, vitamins, bio-colorants, solvents, plastics and biofuels will be exposed. This module will also focus on the understanding of the environmental and safety risks associated with biotechnology together with methods for limiting damage and risk. New biotechnologies will affect the natural environment primarily in two ways: by bringing relatively "wild" areas, such as estuaries, under domestication, and by forcing areas now domesticated, such as farms, out of production, because of surpluses. The problem of the safety of biotechnology—the risk of some inadvertent side-effect—seems almost trivial in relation to the social and economic implications of these intentional uses. Aquaculture productivity is predicted to increase but will need to be re-designed to avoid pollution. The module will focus on the practice of integrating aquaculture and agriculture, also referred to as Integrated Agri-Aquaculture Systems (IAAS), which is based on the need to achieve more economically viable and environmentally sustainable primary industries, and specifically to enhance farm productivity and water use efficiency through multiple water use for integrated production of both terrestrial and aquatic crops. The importance of life cycle analysis (LCA) in biotechnology will be highlighted.

3 crédits ECTS

Volume horaire

Cours Magistral : 20h

Travaux Dirigés : 12h

Compétences visées

Course objectives

- In lectures, to provide a framework for understanding contemporary constraints and opportunities for modern use of marine biomass for food and non-food products within a framework of integrated culture
- In paper analysis and small group work, develop skills in critical analysis and provide confidence in working with complex concepts in biology and society;
- In oral presentations, promote skills in succinct oral communication of science;
- In essays, promote scientific writing skills and to encourage the use of library, archival, electronic and other reference sources.

Descriptif

The unit will focus on the expected changes in society and technology, ranging from the shift in the supply of resources, the growing need for efficiency and sustainability of the production systems, changing consumer perception and behaviour and changing mariculture systems and practices. Many of these changes are expected to speed up the transition from a fossil-based to a bio-based economy and society. The module provides an understanding of the use of raw materials such as water, energy and land/coastal waters in industry and transport. It lays the foundation for further in-depth studies of ways in which biotechnology can support recycling, reuse of existing materials and in the generation of new supplies of raw materials.

During lectures and workshops, the following topics will be covered :

Chapter 1: industrial sustainability

Chapter 2: risk (perception and assessment)and safety in biotechnology

Chapter 3: environmental impact of biotechnology

Chapter 4 : integrated agri-aquaculture systems (IAAS).

Bibliographie

G. Acquaa. Understanding Biotechnology: An Integrated and Cyber-Based Approach 1st Edition. Publisher: Pearson Prentice Hall. ISBN-13: 978-0130945006 .

A. Scragg. Environmental biotechnology. 2nd edition. Publisher: Oxford University Press. ISBN-13: 9780199268672

Modalités de contrôle des connaissances

Session 1 ou session unique - Contrôle de connaissances

Nature de l'enseignement	Modalité	Nature	Durée (min.)	Coefficient	Remarques
	CT	Ecrit - devoir surveillé	120	100%	

Marine biotechnology applied to cosmetics and healthcare products development

Présentation

The purpose of this course is to enable students to consolidate knowledge about the corporate world of cosmetics. Cosmetic products represent more than 80 billion of turnover in Europe. This is an area in perpetual change and renewal. In fact, the cosmetic products marketing is regulated by a European directive which was introduced in July 2013. Companies have the obligation to declare the composition of all their products, and, the trend is that Increasingly substances are banned because of their toxic power. Many companies are looking for alternative solution and thus are turning to marine products in order to replace toxic synthetic molecules and because it attracts some customers as well.

This is why companies recruit more scientists with knowledge of the marine biotechnology, and raw materials needed to make these cosmetic products.

2 crédits ECTS

Volume horaire

Travaux Pratiques : 4h

Cours Magistral : 26h

Descriptif

Introduction: Definition of cosmetic products, European settlement (4 hours by Sandrine Morvan)

Chapter 1: Biology of skin and appendages (4 hours by Laurence Meslet-Cladiere).

Chapter 2: The physicochemical properties of cosmetic products (2 hours by Sandrine Morvan)

Chapter 3: All raw materials for cosmetics products (4 hours by Laurence Meslet-Cladiere)

Chapter 4: Formulation of cosmetics products (4 hours by Laurence Meslet-Cladiere)

Chapter 5: Toxicology and security of cosmetic products (2 hours by Nolwenn Hymery)

Chapter 6: Research of new conservatives products (2 hours by Julien Claus)

Chapter 7 : Algae in cosmetics products (2 hours by Bernard Kloareg)

Chapter 8 : Voluntary testing on cosmetics (3 hours by Alexandre Batardière)

Bibliographie

Manuel d'anatomie et de physiologie humaine

[Bryan Derrickson](#) (Auteur), [Gérard G. Tortora](#) (Auteur) - Manuel (broché). Paru en 03/2009

Biologie, cosmétologie BTS esthétique cosmétologie

[G. Peyrefitte](#) (Auteur), [M.C. Martini](#) (Auteur) - Scolaire / Universitaire (broché). Paru en 05/2013

Modalités de contrôle des connaissances

Session 1 ou session unique - Contrôle de connaissances

Nature de l'enseignement	Modalité	Nature	Durée (min.)	Coefficient	Remarques
	CT	Ecrit - devoir surveillé	120	100%	

Session 2 : Contrôle de connaissances

Nature de l'enseignement	Modalité	Nature	Durée (min.)	Coefficient	Remarques
	CT	Ecrit - devoir surveillé	120	100%	