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| Course Unit | Bioassays and isolation of natural products | | Field of study | Life Sciences | |
| Master in | Natural Products and Bioprospecting | | School | School of Agriculture | |
| Academic Year | 2023/2024 | Year of study | 1 | Level | 2-1 |
| Type | Semestral | Semester | 2 | ECTS credits | 6.0 |
| Code | 5012-740-1202-00-23 | | | | |
| Workload (hours) | 162 | Contact hours | T - | TP 60 | PL - |
| | | | TC - | S - | E - |
| | | | OT 4 | O - | |

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Lillian Boucada de Barros, Josiana Adelaide Vaz, Olívia Rodrigues Pereira

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Recognize the preparatory processes for the isolation of natural products from biological sources
2. Know and apply the techniques for extraction of natural products
3. Acquire and apply the principles for purification and isolation of compounds from natural extracts
4. Know and apply the different chemical methods and spectroscopic techniques, important to the correct identification of natural compounds
5. Recognize the importance of natural products bioactivity
6. Know basic mechanisms of antioxidant, antitumor, anti-inflammatory, antimicrobial
7. Correlate the biological activity with bioactive compounds
8. Distinguish in vitro procedures to evaluate bioactivity; Analyze and discuss the experimental results

Prerequisites

Before the course unit the learner is expected to be able to:
Understand what secondary metabolites and biological functionalities are

Course contents

Preparations procedures for extraction. Solvent extractions. Purification of natural products. Application of chemical methods and elemental analysis. Application of identification techniques of natural compounds mixtures. Projection of biological activity of natural products to the drug. Antioxidant, anticancer, anti-inflammatory and antimicrobial activity of natural products. Correlate compounds identified in natural products and bioactivities.

Course contents (extended version)

1. Preparations procedures for extraction
 - Selection and collection
 - Identification
 - Drying and grinding
2. Extraction of natural products
 - Infusion, maceration and percolation
 - Vacuum and steam distillation, Soxhlet, microwave and ultrasonication
3. Fractionation and purification of natural products
 - By liquid-liquid extraction and crystallization
 - Low pressure liquid chromatography, ion exchange and preparative HPLC
4. From natural products biological activity screening to drugs
5. Molecular modelling and predictability of bioactivity
6. Bioactivity of natural matrixes and products
 - Antioxidant, antitumor, anti-inflammatory activity
 - Antimicrobial, antimalarial, analgesic and anti-hypertensive activity
 - Basic mechanisms and bioactive compounds

Recommended reading

1. J. H. Liu. Traditional Herbal Medicine Research Methods: Identification, Analysis, Bioassay, and Pharmaceutical and Clinical Studies. 2011
2. Noor F, Tahir UI Qamar M, Ashfaq UA, Albutti A, Alwashmi ASS, Aljasir MA. Network Pharmacology Approach for Medicinal Plants: Review and Assessment. Pharmaceuticals (Basel). 2022 May 4; 15(5): 572.
3. Shahzad F, Anderson D, Najafzadeh M. The Antiviral, Anti-Inflammatory Effects of Natural Medicinal Herbs and Mushrooms and SARS-CoV-2 Infection. Nutrients. 2020 Aug 25; 12(9): 2573.
4. Calhelha, et al. , (2023). New Trends from Fungi Secondary Metabolism in the Pharmaceutical Industry. Natural Secondary Metabolites. Springer
5. Márcio Caroch, Sandrina A. Heleno, Lillian Barros. Natural Secondary Metabolites: From Nature, Through Science, to Industry. Springer 2023 (<https://doi.org/10.1007/978-3-031-18587-8>)

Teaching and learning methods

Theoretical Classes. Practical Classes: Realization of protocols that involve the pre-treatment of biological samples, the extraction and purification of natural compounds, and identification and characterization. To carry out the identification studies, several theoretical and practical examples of spectrum analysis and combination. Realization of experimental protocols including in vitro tests.

Assessment methods

- 1 - (Regular, Student Worker) (Final, Supplementary, Special)
- Final Written Exam - 70% (Theoretical component)
- Practical Work - 30% (Practical component: Diagnostic evaluation of protocols and/or reports and/or examination.)

Language of instruction

1. Portuguese
2. English

Electronic validation

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|---------------------------|--------------------------------|---------------------------------|----------------------------------|
| Lillian Boucada de Barros | Paula Cristina Santos Baptista | Maria João Almeida Coelho Sousa | Paula Cristina Azevedo Rodrigues |
| 14-02-2024 | 15-02-2024 | 15-02-2024 | 15-02-2024 |

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