KOVAL Research Group

DIPARTIMENTO DI BIOTECNOLOGIE, CHIMICA E FARMACIA

RESEARCHERS
PI
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non-structured personnel
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DBCF Collaborations
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DEPARTMENT OF BIOTECHNOLOGY, CHEMISTRY AND PHARMACY

LAB NMR KOVAL

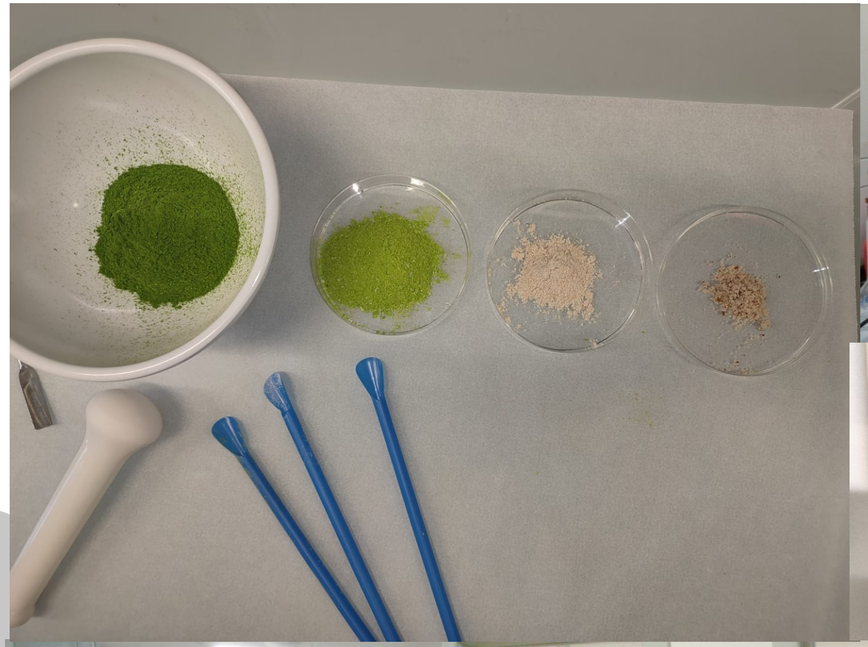
Research activity

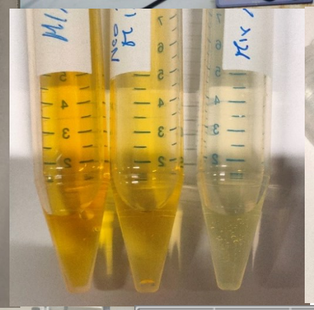
The research group focuses on the study of molecular interactions in complex systems and matrices through the combined use of various analysis techniques, including nuclear magnetic resonance (NMR) spectroscopy, capable of monitoring all components present in a sample in a single experiment. The NMR technique is non-destructive and is used to gather information about the structure, dynamics, and molecular environment of a wide range of materials, as well as to identify any impurities or contaminants in the samples. Its high spectral resolution allows for the precise differentiation of signals from different molecular species in samples of complex mixtures, such as food matrices, biological samples, and intermediate products in industrial production. The NMR technique is employed in various industrial sectors, including pharmaceuticals, food and agriculture, polymers and materials, advanced materials, environmental and health, textile and dye industry, cosmetics, detergents, paper, and cellulose industry.

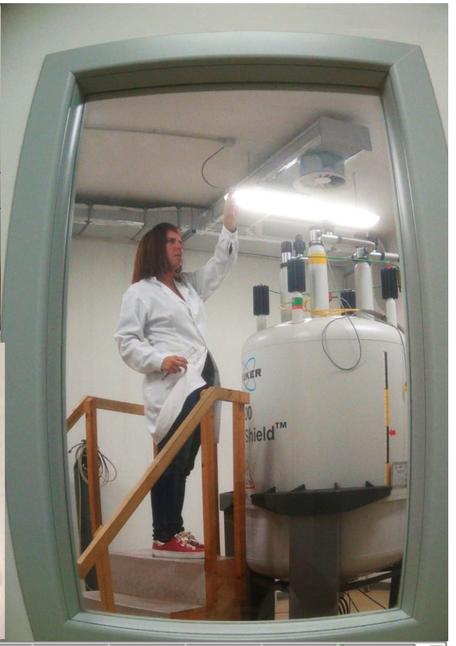
The research activities of our group are carried out in multiple research lines, including:

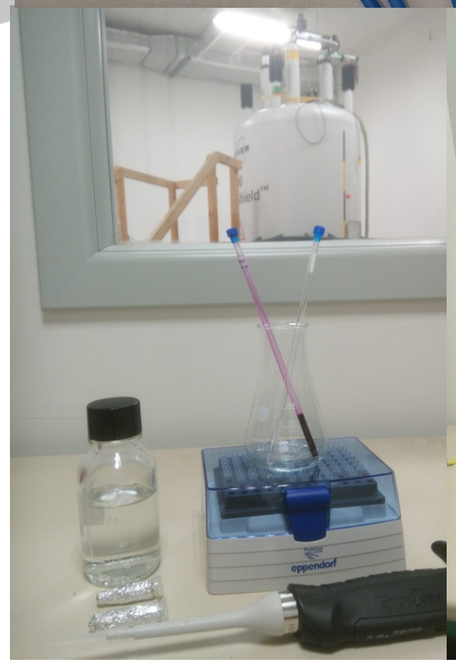
1. Study of the antioxidant and anti-aggregating activity of compounds or natural composites with neuroprotective activity through cellular assays, ligand-protein structural studies, proteomic and metabolomic investigations.
2. Qualitative and quantitative characterization of complex matrices derived from various industrial processes for quality control of the final product and/or the valorization of industrial waste (circular bioeconomy).
3. Qualitative and quantitative analysis of micronutrients present in food composites.
4. Development of customized nuclear magnetic resonance spectroscopy analysis protocols for the identification of unknown components.
5. Metabolomic analysis of biological fluids for the identification of biomarkers.
6. Study of the interactions of transition metals with peptide sequences exhibiting biological activity.

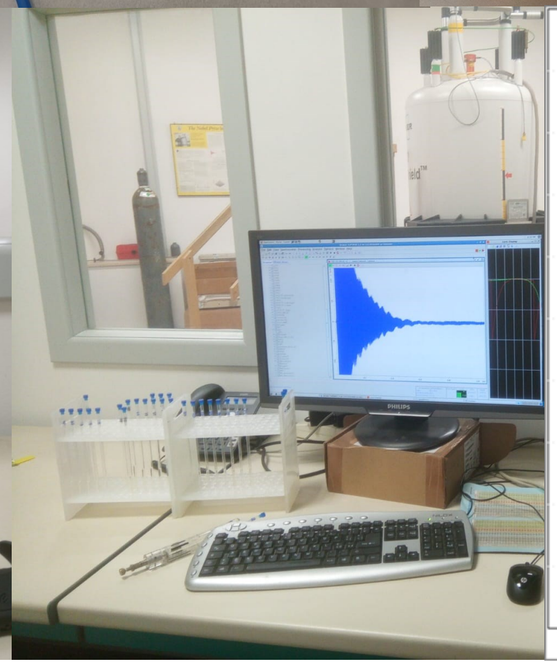
Images

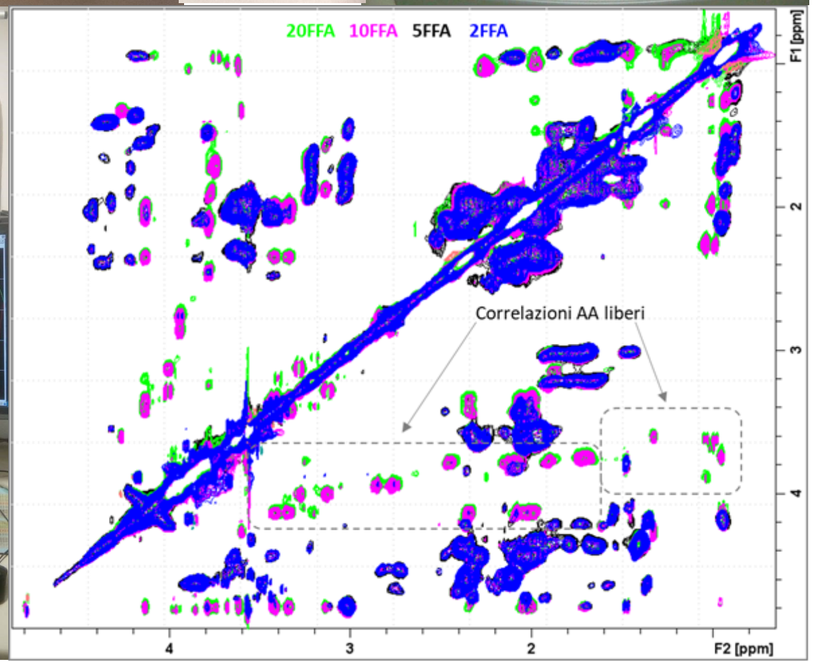











20FFA
10FFA
5FFA
2FFA
Correlazioni AA liberi
F1 [ppm]
F2 [ppm]
2
3
4

Technologies and services

Nuclear Magnetic Resonance (NMR) Spectrometer: Bruker Advance III 600 MHz (14.1 T); Probes: BBI, BBO, SEI, Auto-sampler, Cooling system

UV-Visible Spectroscopy: UV-Vis Spectrophotometer: Cary 60 with Win UV software

Data Acquisition and Spectral Processing Software:Topspin 3.6

Chromatography System: AKTA Purifier 10 FPLC (GE Healthcare)

Chromatographic column: Superdex 30 Increase 10/300 GL

Unicorn 5.11 software

Data Analysis Software: OriginPro® 8.5 (OriginLab)

Laboratory Centrifuge: ThermoFisher SCIENTIFIC Heraeus Multifuge X3

pH Meter: Orion model 420A

Analytical Balance: Explorer™ OHAUS

Vortex Mixer: Grant-Bio PV-1

Mini Centrifuge: Mini Spin plus Eppendorf

Ultrasonic Bath: Skymen Ultrasonic

Power Supply and Electrophoresis Equipment: PowerEase™ Power Supply and XCell SureLock™ Mini-Cell, Thermo Fisher Scientific

Cell Culture: Differentiated neuroblastoma cell line: SHSY-5Y

NMR Analysis and Consulting Services

C.

Applications and collaborations

PRIN 2022RCRWE5 Project

-Bioinspired systems for ROS regulation: Metalloporphyrinoids in neurodegeneration and artificial biocatalysis

PROBIOS Project

- Production of bio-stimulant protein hydrolysates through processes of chemical cleavage and transformation of waste skin and leather into a resource – RS 2020 Call 2, Lead Applicant ItalProgetti s.p.a.

Collaboration Agreement with Biosfera Nature s.r.l. (Poggibonsi, SI, ITALY)

- Study of the physicochemical properties of fresh food matrices and those resulting from selected "ad hoc" processing for the development of nutritional density parameters.

- Identification of food matrices for characterization and the development of nutritional density parameters.

Collaboration Agreement with Consorzio S.G.S. (Santa Croce sull'Arno, PI, ITALY)

- Identification of protein content with a molecular weight lower than 10 kDa and quantification of molecular weights, amino acid sequences, and the percentage of free amino acids in protein hydrolysate samples.

- Research on hydrocarbons and characterization of samples (Sample C and Sample R) using nuclear magnetic resonance spectroscopy (NMR) and mass spectrometry (MS) techniques.

Third-Party Contract with Galenica Senese Pharmaceutical Industry s.r.l. (Monteroni D'Arbia, SI, ITALY)

- Characterization measurements on "raw" material samples before and after sterilization (Sample MP and Sample MS) using nuclear magnetic resonance spectroscopy (NMR) and mass spectrometry.

Third-Party Contract with Ambiente sc. (Nazzano – Carrara, MS, ITALY)

- Qualitative and quantitative characterization of the chemical composition of complex matrices derived from industrial processes through NMR and GC-MS analysis.

International Collaborations with Prof. Magdalena Rowinska-Zyrek (University of Wroclaw – Poland)

- Impact of metal ions on the biological activity of antimicrobial peptides

For more information

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For more information

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Logo

Regione Toscana

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