Supervisor Project Idea

Supervisor

Insert a brief CV and/or external link, the total number of publications, the ORCID link, 5 of the most significant/recent publications, and a list of funded projects and awards. max 300 words

Simona Sabbatini is an Associate Professor of Chemistry at the Università Politecnica delle Marche (UnivPM), Ancona, Italy. https://orcid.org/0000-0002-2383-787x . Her research work, documented in Scopus, includes 63 publications and 2 chapters of a book, with a total of 1450 citations and an H index of 23.

Research area: vibrational analysis and characterization of various materials, including biological material, biomaterials, synthetic nano-structures, microplastics, bitumens and inert materials. Synthesis and spectroscopic characterization (FTIR, both in the medium and in the near infrared, NMR and EPR) of biodegradable polymers, with a particular emphasis on understanding their degree of crosslinking.

Teaching activity: course of "Chemistry" (CHIM/07) and course of "Diagnostics for restoration" at Polytechnic University of Marche, Ancona, Italy;

Projects: PNRR **VITALITY**-Innovation, digitalisation and sustainability for the diffused economy in Central Italy - (D.D. n. 3277/2021, CUP I33C22001330007) (2022-2025), PNRR **MOST**-Sustainable Mobility Center (D.D. n. 3138/2021, CUPCN00000023) (2022-2025), **Place - ARS01_00891** (Conversione di Piattaforme Off-Shore per usi multipli eco-sostenibili) (2018-2020), **AMOCEAB** -Adrion Master On Circular Economy And Bioeconomy (CUP I53C23000110005) (January -September 2023).

Academic duties: Member of Quality Committee of the Degree Course in Mechanical Engineering, Member of the Commission for tutoring and guidance and member of the Review Commission for the Faculty of Engineering of the Marche Polytechnic University, Member of the Commission of PhD teachers in "Civil, Environmental, Building and Architecture Engineering"

Most recent publications: https://doi.org/10.1002/smsc.202300286.

Research Group Description

Provide the name the reference department and a brief description of the research group, including external links, and available instrumentations and infrastructures. max 300 words

The Research group is composed by S. Sabbatini (*https://www.univpm.it/simona.sabbatini*), P. Stipa (*https://www.univpm.it/pierluigi.stipa*), E. Laudadio (*https://www.univpm.it/emiliano.laudadio*), F. Luzi (*https://www.univpm.it/francesca.luzi*) from Department of Science and Engineering of Matter, Environment and Urban Planning (SIMAU) and S. Rinaldi (*https://www.univpm.it/samuele .rinaldi*) from Department Life and Environmental Sciences (DISVA). The Director of the SIMAU Department is Prof. P. Stipa. The research group makes use of chemistry laboratory for the synthesis and development of possible new materials. **Lab facilities**: a Perkin Elmer Spectrum GX1 Fourier Transform Infra-Red (IR) spectrometer, equipped with DTGS detectors and Attenuated Total Reflectance (ATR) attachment with a zinc selenide (ZnSe) crystal; Bruker EMX/Xenon Electron Paramagnetic Resonance (EPR) spectrometer system equipped with a microwave frequency counter and an NMR Gauss meter for field calibration in X band, variable temperature with the possibility of "in cavity" direct light irradiation; Bruker Fourier 80 Nuclear Magnetic Resonance spectrometer; Shimadzu LCMS-2050 liquid chromatograph single quadrupole mass spectrometer. Materials design and analysis can be carried out by means of atomistic simulation techniques based on ab-initio, Density Functional Theory (DFT), and Molecular Dynamics (MD) Simulations using 16-core central processing unit (CPU) of type Intel I9 10900K workstations, but for extremely onerous and time-consuming simulations, the Research group use the high-performance computing system located at CINECA Supercomputing Center (https://www.cineca.it/).

Mechanic Materials properties can be studied by means Antor Paar Rheometer.

Title and goals

Provide the title of the topic and a short summary of the project idea. max 200 words

The title of this topic is: **Development and characterization of Sustainable Biopolymer-Based Food Biosensors using Polylactic Acid (PLA)**. Integrating biosensors into food packaging materials can enable us to assess the quality of food products. Intelligent packaging monitors food products using active compounds that change based on the physicochemical and microbiological properties of foods. The materials selected for creating biosensor packaging must fulfill the requirements for the biomolecule deposition but also meet the standard packing properties such as gas barrier properties and vapor or moisture permeability. Typical substrates utilized for intelligent biosensor packaging include natural polymers, primarily derived from agricultural crop-based feedstocks. Among them, PLA exhibits good functional properties and satisfies various packaging requirements to improve shelf life and food protection. PLA could be further enhanced with antimicrobial activity through the incorporation of natural essential oils, displaying a promising active packaging to maintain high standards in terms of environmental sustainability.
The target of the project is to produce eco-friendly and biodegradable polymers using PLA as a base for the development of food biosensors. The project aims to investigate their biocompatibility and environmental sustainability, improve their barrier properties, and optimize their specificity through controlled modifications of the chemical structure of PLA.

Contact details (*including email address of the supervisor*)

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