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From coffee to lignin: some words about my previous research projects

Abstract

To introduce myself, during the seminar I will give you an overview of what I did as a researcher. Particularly, I will focus on:

- Ph.D. project: "Biomolecules as recognition elements for bioactive polyphenols in coffee" Università di Trieste, supervisor Dott. Federico Berti

Chlorogenic acids and their derivatives are abundant in coffee and their composition changes among coffee species, but also in the same coffee bean before and after the roasting process. These compounds contribute to the bitterness of the beverage: their identification and their quantification are a central focus for the coffee industry to optimize the roasting process. The aim of the project, arisen from this industrial interest, was to develop a selective biosensor for chlorogenic acids and their derivatives. Some chosen target compounds were synthesized and fully characterized. To develop a proper bio-receptor for the biosensor, as a first attempt the interaction between Human Serum Albumin (HSA) and some chlorogenic compounds was studied by fluorescence technique: the results revealed that HSA is a promising starting point. The following step, thus, was the analysis of the interaction between a smaller peptide, which reproduces the involved binding site of HSA, and two of the selected compounds: as expected, the collected data confirmed that the developing of a HSA-based biosensor could be the right strategy to obtain a suitable and selective tool.
Considering the potential biological activities of polyphenols, the antiviral properties of the synthesized compounds against many viruses have been also evaluated, revealing some interesting activities (test in vitro).

- Post-doc project: "Metal functionalization of lignin for agrochemical applications" Università di Parma, supervisor Dott. Dominga Rogolino

After cellulose, lignin is the most abundant plant-derived polymer in nature. Lignin is produced in huge quantity as a byproduct of several industrial process, particularly in paper and bioethanol production. Although in the last decades many efforts have been directed to transform lignin in high-value products, it is still largely underutilized. In the perspective to exploit this bio-based polymer in the agrochemical field, instead of the widely diffused synthetic pesticides, the possibility of combining lignin with copper was explored. A novel Cu-containing lignin derivative (called lignin@Cu) was developed. This hybrid organic-inorganic material was characterized by different techniques, revealing nanocrystals of brochantite (formula Cu4SO4(OH)6) grown in the lignin matrix. Furthermore, Lignin@Cu demonstrated very promising activities against various microorganisms of agronomical interest (test in vitro) and an interesting protective action on tomato plants (test in greenhouse), indicating a great potential of this novel material for agrochemical use.