

P029 SYNCHROTRON BASED STRUCTURAL CHARACTERIZATION OF BIONSPIRED SUPERHYDROPHOBIC COATINGS FOR SUSTAINABLE AGRICULTURAL APPLICATIONS

Fabiana Crucitti,^a Alessia Calora,^a Niv Ben-Arie,^b Giuseppe Falini,^a Claudio Ratti,^c Iryna Polishchuk,^b Boaz Pokroy,^{b,d} Simona Fermani,^a and Silvia Milita^e

^aDepartment of Chemistry "Giacomo Ciamician", University of Bologna, via Gobetti, 85 – 40126, Bologna, Italy; ^bDepartment of Materials Science and Engineering, Technion – Israel Institute of Technology, 320001, Haifa, Israel; ^cDepartment of Agricultural and Food Sciences, University of Bologna, viale Fanin, 44, 40127, Bologna, Italy; ^dThe Russell Berrie Nanotechnology Institute, Technion – Israel Institute of Technology, 320001, Haifa, Israel; ^eCNR-ISMN – Institute of Nanostructured Materials ISMN, 40129, Bologna, Italy.
fabiana.crucitti2@unibo.it

ABSTRACT

Physiological alterations in agricultural crops represent an extremely negative consequence of the rise in temperature and humidity levels associated with climate change. These environmental conditions create a favorable environment for the proliferation of various pathogens, such as fungi, responsible for diseases like powdery and downy mildew, currently affecting crops such as grapevine and tomatoes.

In this regard, SafeWax coating has been identified as a promising and sustainable alternative to traditional synthetic or heavy-metal fungicides. It was developed to satisfy the requirements established by the European Green Deal concerning different crop protection strategies, whose aim is a 50% reduction of the use of harmful pesticides by 2030. A key advantage of this technology lies in its composition, being made of fatty acids (FA) derived from fruit and vegetables waste, such as stearic or palmitic acid, promoting circularity of resources and allowing to obtain a bio-based and bio-degradable formulation [1]. The aim of SafeWax is to modify the leaf surfaces, mimicking the natural cuticles present in some plants like lotus leaf or cauliflower, which are responsible for the superhydrophobic and self-cleaning properties, as well as protection from dehydration and UV radiation.

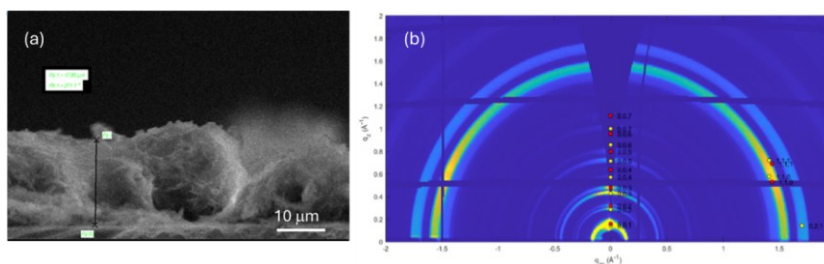


Figure 1. (a) SEM image and (b) GIWAXS pattern of SafeWax coating.

SafeWax coating replicates a similar passive protective function by a solvent-based deposition method using a spraying technique. The roughness onto the surface, which is observed by scanning electron microscopy (SEM; Fig. 1a), prevents pathogens from adhering to the leaf and facilitates water droplets to roll off minimizing the level of moisture and carrying away pathogens such as fungal spores or debris. Preliminary structural characterization of SafeWax coatings by grazing incidence wide angle x-ray scattering (GIWAXS) (see a typical 2D GIWAXS image in Fig. 1b) using the synchrotron light reveals that SafeWax coating shows a hierarchical crystalline structure with pronounced texturing and extremely low mosaicity. The composition of the crystalline phase was also determined.

REFERENCES

[1] Polishchuk, E. Prudnikov, H. Abu-Hamad, et al. "SafeWax: A Bio-Inspired Multifunctional Coating for Sustainable Crop Protection." *Small* (2025): e05360. <https://doi.org/10.1002/smll.202505360>