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ABSTRACT BOOK

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SPECTROSCOPIC ANALYSIS OF AUREOBASIDIUM PULLULANS BIOFILM FOR THE DEVELOPMENT OF LIVING COATING FOR ARCHITECTURE

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Fungal biofilms play crucial roles in ecology, medicine, and industry but remain relatively under-researched. Studying the biofilm of the yeast-like fungus Aureobasidium pullulans provides valuable insights into fungal biofilms with biotechnological potential. Additionally, spectroscopic analysis helps evaluate biofilm composition and structural properties, further enhancing our understanding. In this study, we analysed biofilms of three morphologically different strains of A. pullulans on four different solid media – Yeast Nitrogen Base (YNB), Potato Dextrose Agar (PDA), Sabouraud Agar (SA) and Synthetic Nutrient Deficient Agar (SNA). Depending on their morphology, the strains were inoculated onto solid media as a cell suspension or with a cork border and incubated at 25 °C for two weeks. Afterwards, the biofilms grown on solid media were analyzed using a Fourier transform near-infrared spectrometer (FT-NIR) MPA II and a Fourier transform infrared spectrometer (FTIR) Alpha (both from Bruker Optics GmBH). Three biological replicates of each biofilm sample were prepared and each sample was subjected to five measurements. Spectral pre-processing and data mining were performed using Opus 6.5 (Bruker, Ettlingen, Germany) and PLS_Toolbox (Eigenvector Inc, Manson, IA, USA), an extension of the Matlab package (Mathworks Inc, Natick, MA, USA).

Principal Component Analysis (PCA) of all spectra shows no major differences between the biofilms of the different strains. However, there are clear spectral differences in the nutrient-poor SNA medium compared to other media. This pattern is consistently observed in both spectroscopic methods and confirms that chemical variations in the fingerprint region of the IR spectra are also reflected in the NIR spectra, which capture overtones and combination bands. The analysis of loadings emphasises the importance of the bands associated with -OH groups (around 5000 cm-1 and 7000 cm-1) in the NIR range and -CH groups (around 1000 cm-1) in the IR range. Previous results suggest that all strains adopt a yeast form on SNA medium, which may influence the structure of the biofilm, but further investigation is required.

These findings suggest that biofilm composition and structure are influenced by nutrient availability, with potential implications for adhesion and functional properties in coating applications. The integration of FT-NIR and FTIR spectroscopy proves valuable in characterizing biofilms and can be further used to adjust the formulation of living coating. Future studies will explore the interplay between morphology, biochemical composition, and performance in real-world applications. These results provide new insight into A. pullulans biofilm structure and serve as a foundation for developing an optimal living coating for various materials, which is the main goal of the ARCHI-SKIN project.

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