Materials chemistry and applications

Biopolymer films doped with silver(I) coordination polymers against bacterial biofilms

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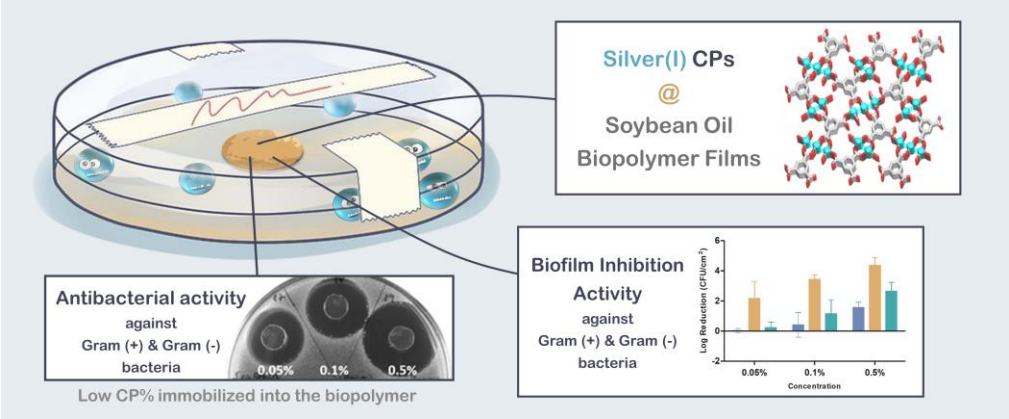
This report describes a template-mediated self-assembly synthesis, full characterization, and structural features of two new silver-based bioactive coordination polymers (CPs) as well their immobilization into acrylated epoxidized soybean oil (ESOA) biopolymer films for antimicrobial applications. The 3D silver(I) CPs $[Ag_4(\mu_8\text{-}H_2pma)_2]_n \cdot 4nH_2O$ (**1**) and $[Ag_5(\mu_6\text{-}H_{0.5}tma)_2(H_2O)_4]_n \cdot 2nH_2O$ (**2**) were generated from $AgNO_3$ and pyromellitic (H_4pma) or trimesic (H_3tma) acid, also using *N*,*N*′-dimethylethanolamine (Hdmea) as a template. Both **1** and **2** feature the intricate 3D layer-pillared structures driven by distinct polycarboxylate blocks. Topological analysis revealed binodal nets with the **flu** and **tcj**/hc topology in **1** and **2**, respectively. These CPs were used to create new hybrid materials, namely by doping the $[ESOA]_n$ biopolymer films with very low amounts of **1** and **2** (0.05, 0.1, and 0.5%). Their antimicrobial activity and ability to inhibit bacterial biofilm formation was investigated in detail against both Gram-positive (*Staphylococcus epidermidis* and *Staphylococcus aureus*) and Gram-negative (*Pseudomonas aeruginosa* and *Escherichia coli*) bacteria. Both silver(I) coordination polymers and derived biopolymer films showed activity against all the tested bacteria in a concentration dependent manner. Compound **1** was far more active, especially in preventing biofilm formation, with mean bacterial load reductions ranging from 3.7 to 4.3 log against the four bacteria (99.99% bacterial eradication). Thus, the present study expands the antibiofilm applications of CP-doped biopolymers, offering new perspectives and promising results for the design of functional biomaterials (**Scheme 1**).[1]



Scheme 1

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References:

1. Fernandes, T.A.; Costa, I.F.M.; Jorge, P.; Sousa, A.C.; André, V.; Cerca, N.; Kirillov, A.M.; *ACS Appl. Mater. Interfaces*, **2021**, *13*, 12836–12844.