High-water Vapor-permeable / Antibacterial Casein-Based MOFs Leather Finishing

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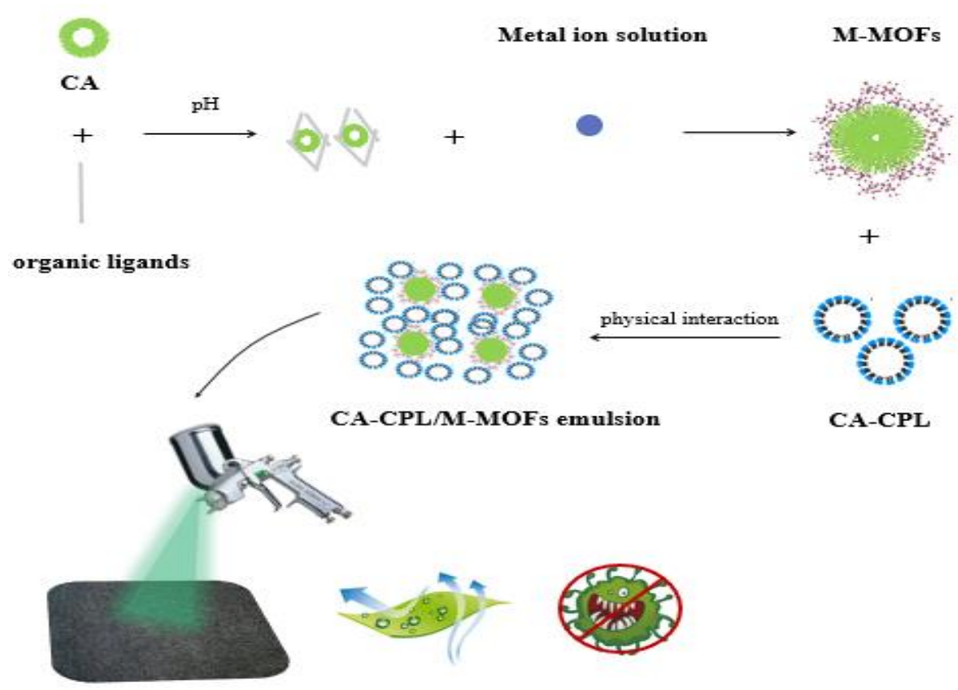
Abstract

In this study, casein-based MOFs leather finishing possessing better water vapor permeability and antibacterial property were obtained by introducing M-ZIF-8 with larger size prepared via in situ method using casein as the template into casein matrix. The structure and morphology of the composite material were characterized by Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD), specific surface area analyzer (BET), scanning electron microscope (SEM), transmission electron microscope (TEM), etc., the hygienic and antibacterial properties of the finishing materials were investigated.

Introduction

Modern leather industry is trending towards green, functional and intelligent development, thus finishing materials must adapt to this development trend of leather industry. Casein shows good market competitiveness and broad application prospects in leather finishing because of its advantages including strong adhesive force, high loss and superior hygienic property, etc. However, the pristine casein film is hard, brittle, and intolerant to water and microorganisms, so it must be modified.

Material and Methods



- M-ZIF-8 was grown via in situ method before introducing into casein emulsion by physical blending to prepare CA/M-MOFS composite emulsion, which was applied to leather finishing, endows leather with high moisture permeability and excellent antibacterial properties.

Results & Discussion

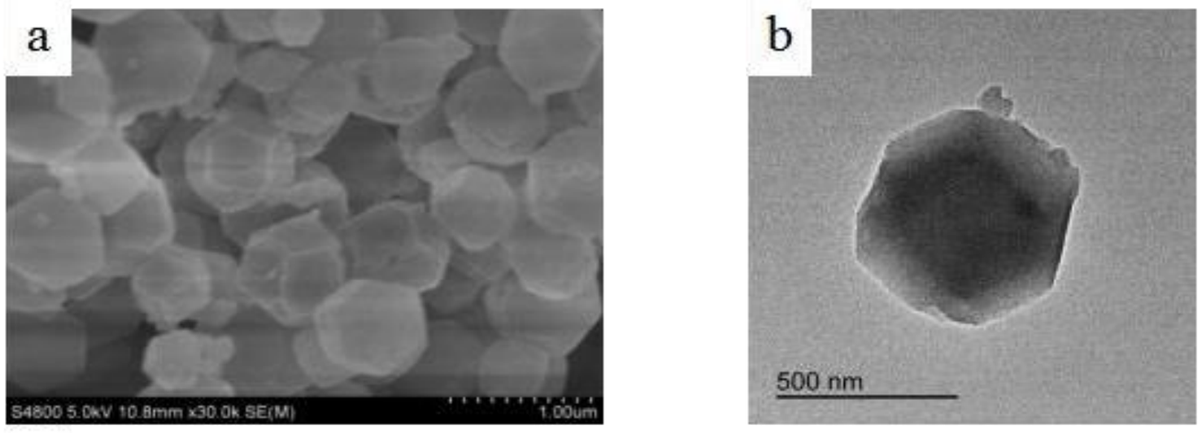


Fig. 1. (a) SEM, (b)TEM, images of M-ZIF-8

- The average particle size of M-MOFs is about 800 nm, and the morphology is dodecahedral diamond structure.

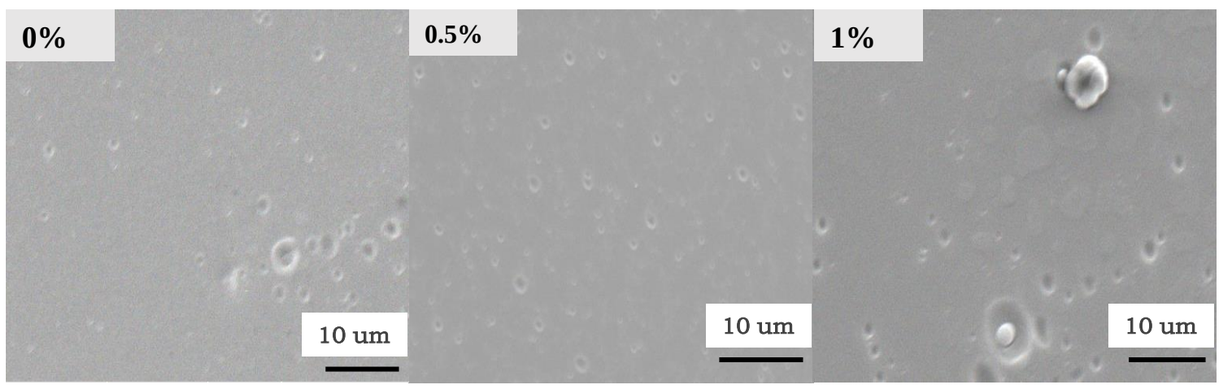


Fig. 2 SEM images of CA-CPL/M-MOFs composite films with different ZIF-8 dosages

- The surface of the composite film is not smooth, and there are micropores and particle-like substances, which are attributed to the introduction of ZIF-8.

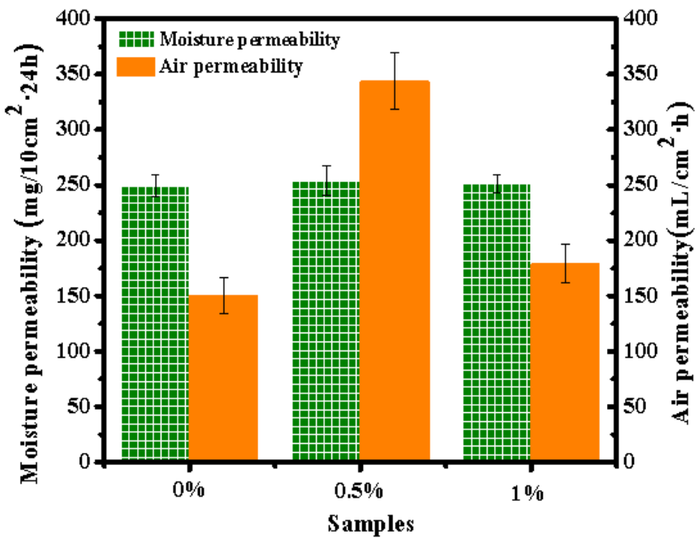


Fig. 3. Sanitary properties of leather samples

- With the introduction of M-ZIF-8, the air permeability of the leather sample was enhanced.

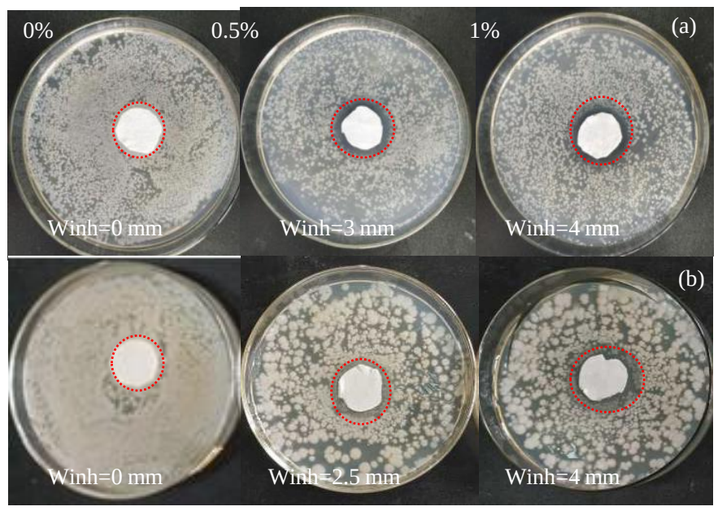


Fig. 4. Antibacterial properties of CA-CPL/M-MOFs emulsion on a) E.coli and b) S.aureus with different ZIF-8 dosages

- When the amount of M-ZIF-8 was 1%, the antibacterial activity of the compound emulsion was the best.

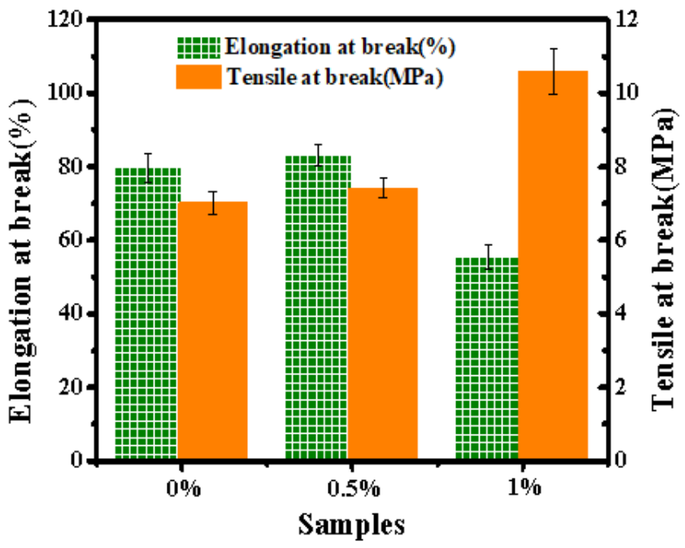


Fig. 5. Mechanical properties of leather samples

- The elongation at break of the casein/M-MOFs composite emulsion coated leather has decreased, and the tensile strength has increased.

Conclusion

The dodecahedron M-ZIF-8 with a size of about 800 nm and a complete crystal structure was successfully prepared. When the dosage of M-ZIF-8 was 1%, the antibacterial effect of the composite emulsion on *E. coli* and *S. aureus* is the best (inhibition zone is 4 mm). When the dosage of M-ZIF-8 was 0.5%, the water vapor permeability of the composite film is the optimal, which is 972 mg/10 cm^2·24 h. This research will provide significant theoretical guidance for the development and utilization of functional leather finishing materials and other functional coating materials.

References

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