Electrospun Metal−Organic Framework-Fabric Nanocomposites as Efficient Bactericides

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In this work, we utilized electrospinning to develop advanced composite membranes of polyvinyl chloride (PVC) loaded with postmetalated metal−organic frameworks (MOFs), specifically UiO-66(COOH)2-Ag and ZIF-8-Ag. This innovative technique led to the creation of highly stable PVC/MOFs-Ag membrane composites, which were thoroughly characterized using various analytical techniques, including scanning electron microscopy, powder X-ray diffraction, thermogravimetric analysis, X-ray photoelectron spectroscopy, porosity analysis, and water contact angle measurement. The results verified the successful integration of MOF crystals within the nanofibrous PVC membranes. The obtained composites exhibited larger fiber diameters for 5 and 10% MOF loadings and a smaller diameter for 20% loading. Additionally, they displayed greater average pore sizes than traditional PVC membranes across most MOF loading percentages. Furthermore, we examined the antibacterial properties of the fabricated membranes at different MOFs-Ag loadings. The findings revealed that the membranes demonstrated significant antibacterial activity up to 95% against both Gram-negative (Escherichia coli) and Gram-positive (Staphylococcus aureus) bacteria as the MOFs-Ag loading increased, even when maintaining a constant silver concentration. This indicates a contact-based inhibition mechanism. The outcomes of this study have crucial implications for the development of novel, stable, and highly effective antibacterial materials, which could serve as superior alternatives for face masks and be integrated into materials requiring regular decontamination, as well as potential water filtration systems.