World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:18, No:09, 2024

Polymer Composites Of MOF-5 For Efficient and Sustained Delivery of Cephalexin and Metronidazole

Authors : Anoff Anim, Lila Mahmoud, Maria Katsikogianni, Sanjit Nayak

Abstract : Sustained and controlled delivery of antimicrobial drugs have been largely studied recently using metal organic frameworks (MOFs)and different polymers. However, much attention has not been given to combining both MOFs and biodegradable polymers, which would be a good strategy in providing a sustained gradual release of the drugs. Herein, we report a comparative study of the sustained and controlled release of widely used antibacterial drugs, cephalexin and metronidazole, from zinc-based MOF-5 incorporated in biodegradable polycaprolactone (PCL) and poly-lactic glycolic acid (PLGA) membranes. Cephalexin and metronidazole were separately incorporated in MOF-5 post-synthetically, followed by their integration into biodegradable PLGA and PCL membranes. The pristine MOF-5 and the loaded MOFs were thoroughly characterized by FT-IR, SEM, TGA and PXRD. Drug release studies were carried out to assess the release rate of the drugs in PBS and distilled water for up to 48 hours using UV-Vis Spectroscopy. Four bacterial strains from both the Gram-positive and Gram-negative types, Staphylococus aureus, Staphylococuss epidermidis, Escherichia coli, Acinetobacter baumanii, were tested against the pristine MOF, pure drugs, loaded MOFs and the drug-loaded MOF-polymer composites. Metronidazole-loaded MOF-5 composite of PLGA (PLGA-Met@MOF-5) was found to show highest efficiency to inhibit the growth of S. epidermidis compared to the other bacteria strains while maintaining a sustained minimum inhibitory concentration (MIC). This study demonstrates that the combination of biodegradable MOF-polymer composites can provide an efficient platform for sustained and controlled release of antimicrobial drugs and can be a potential strategy to integrate them in biomedical devices.

Keywords : antimicrobial resistance, biodegradable polymers, cephalexin, drug release metronidazole, MOF-5, PCL, PLGA
Conference Title : ICPC 2024 : International Conference on Polymers and Composites
Conference Location : New York, United States
Conference Dates : September 12-13, 2024