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作品名稱 **Antimicrobial and Heavy Metal Sequestration Capacities of Graphene Polymer Nanofilms**

得獎獎項 **一等獎**

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Abstract

Membrane bioreactors (MBR) are important components in the production of effluent in wastewater treatment systems. However, MBR are susceptible to biofouling, a process by which bacteria colonize the surface of the membrane in contact with water. Graphene could be a solution to biofilm formation. In this study, the graphene polymer nanocomposite's antimicrobial and heavy metal removal properties and the mechanisms behind the properties were investigated. Five different films of nanocomposites with a form of graphene and a polymer were synthesized: Graphene, Graphene Oxide, PVK-GO, PVK-G, PVK. A Büchner funnel and a vacuum pump were used to coat membrane filters with solutions of each nanomaterial. Using the Büchner funnel, *E. coli* and *B. subtilis* bacteria were filtered through the filter and both the filtrate and the filter were examined for bacterial content. Similarly, a Pb^{2+} solution was filtered through the coated filters and percentage removal of the ion was calculated using Atomic Absorbtion Spectrometry. Further analysis from SEM data, ATR-IR, and an Oxidative Stress test revealed that the PVK-GO nanocomposite inactivates bacteria by causing oxidative stress and the carboxyl group binds to lead ions. PVK-GO was most effective at removing the highest percentage of heavy metal and inactivated the most bacteria and displayed the most antimicrobial properties. PVK-GO coatings provide an efficient and economical alternative to the current wastewater industry standard and can save millions of dollars and reduce environmental waste. Also, the coatings have applications in indwelling medical devices and can reduce the risks associated with biofilm formational and bacterial infections.

評語

Membrane bioreactor (MBR) was fabricated using Graphene for antimicrobial and heavy metal removal applications. E. coli and B. subtilis bacteria were filtered for antimicrobial test. Similarly, Pb^{2+} was selected for heavy metal removal test. This is a complete and interesting study. Also, the further applications in indwelling medical devices for reduction of the risk associated with biofilm formational and bacterial infections.