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LICENSING & PARTNERING OPPORTUNITY

جامعة حمد بن خليفة
HAMAD BIN KHALIFA UNIVERSITY
عضو في مؤسسة قطر
Member of Qatar Foundation

MXene Provides Superior Antimicrobial Performance

Effectively achieves dramatic reductions of E. coli and other bacteria

REDUCTIONS OF E. COLI AND OTHER BACTERIA

HBKU Researchers at QEERI and Drexel University have identified antibacterial properties in two-dimensional titanium carbide (Ti3C2), a nanomaterial from the MXene family. Combining metallic conductivity with a hydrophilic surface, MXenes act as "conductive clays." Tests revealed that few- to single-layer Ti3C2 flakes effectively inhibited E. coli and B. subtilis, outperforming graphene materials. This breakthrough has significant implications for waterborne bacteria removal and can be applied as antimicrobial coatings on water filtration membranes to prevent biofouling while maintaining high efficiency.

One of the biggest challenges in membrane based water purification is biofouling.

When bacteria and other microorganisms adhere to the membrane surface, they form a viscous, gel-like biofilm that causes a severe decline in flux.

This reduces the efficiency of the purification system and requires cleaning.

QEERI researchers have discovered an innovative approach for addressing this problem, using MXene.

HOW IT WORKS

Antimicrobial MXene-coated membranes are fabricated via vacuum-assisted filtration onto a commercial PVDF support, offering controllable thickness and mass-loading. Using a dilute colloidal Ti3C2Tx solution, the resulting membranes are 1 nm thick, with high aspect ratiosensuring uniform nanochannels and minimal pores. These membranes outperform graphene oxide filters in inhibiting E. coli and B. subtilis growth.

MXenes can also function in suspension. At concentrations as low as 10 µg/ml, they damage bacterial surfaces, and higher concentrations cause severe deformation, collapse, or bursting of cells, significantly reducing survival rates. The sharp edges of MXene nanosheets can disrupt cellular membranes, causing instant bacterial death upon contact.

MXene outperforms graphene in antibacterial activity, achieving 98% cell death for E. coli and B. subtilis at 100 µg/ml, compared to graphene oxide's 90%.

Its effectiveness makes it ideal for antifouling membranes in water treatment and biomedical applications.

APPLICATIONS

- Water/Wastewater purification and desalination
- Biomedical applications
- Antibacterial coatings (e.g., for surgical instruments)

VALUE PROPOSITIONS

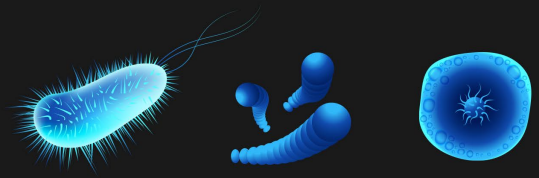
Effective:: Kills both Gramnegative and Gram-positive bacteria

Efficient: Exhibits higher antibacterial activity than graphene materials

Robust: Reduces the possibility of leaching

Selective: Can be doped or chemically altered to attack specific bacteria

Versatile: Works in suspension and as a membrane, and is extendable to other forms of MXene



PATENT STATUS

Patent US10493408B2 Granted

LICENSING OPPORTUNITIES

Hamad Bin Khalifa University is offering this technology for license.

For more information, please contact: innovation@hbku.edu.qa