

WATER FILTRATION PLATFORM TECHNOLOGIES USING CRUMPLED GRAPHENE OXIDE NANOCOMPOSITES

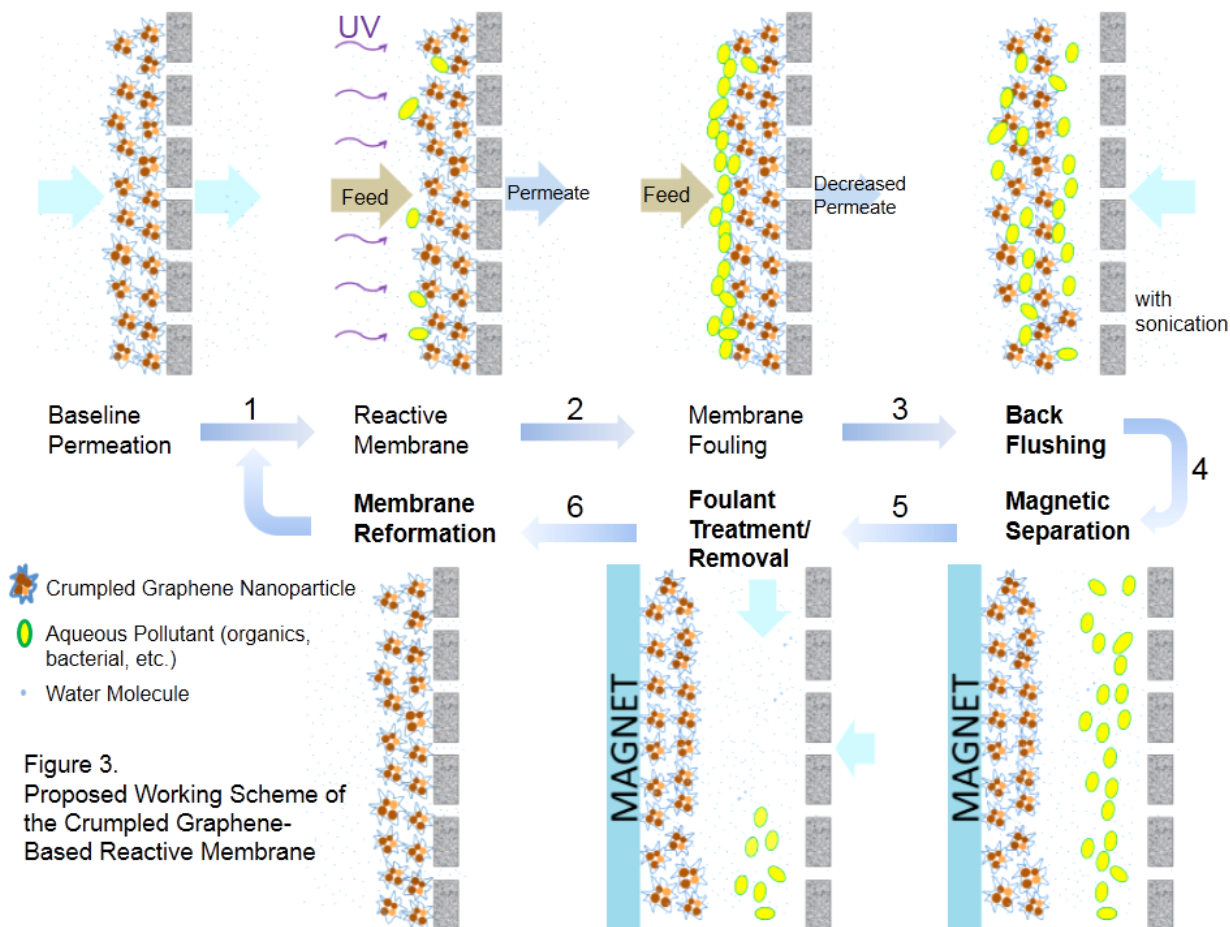
Biswas, Pratim, Fortner, John, Jiang, Yi, Wang, WeiNing

Markiewicz, Gregory

T-014428

Technology Description

A team of researchers at Washington University, led by Pratim Biswas and John Fortner, has constructed crumpled graphene oxide nanoparticles encapsulating TiO₂ and Ag to create reactive, easily cleaned water filtration membranes. The TiO₂ and Ag, which can be periodically regenerated using photocatalytic synthesis, act as anti-microbials at the membrane. The crumpled graphene oxide shells provide a backbone for easy magnetic separation and membrane cleaning without disassembling the entire filter.



Most water filtration membranes suffer from fouling, or buildup of unwanted material, which necessitates disassembly and cleaning of the membrane. The cleaning process for crumpled graphene oxide nanocomposites would not require full disassembly to remove buildup, and periodic phototreatment regenerates the anti-microbial activity of the Ag

nanoparticles.

Stage of Research

The inventors have performed proof-of-concept experiments on crumpled graphene oxide nanocomposites encapsulating TiO₂ and Ag, showing that they can exclude >30% of a model organic and >80% of a model protein (compared to <10% rejection for the commercial support membrane). These results were achieved while still maintaining a water flux of almost 250 L/(m²·h·bar), which outperforms most commercial ultrafiltration membranes.

Publications

- Jiang, Y., Wang, W.-N., Liu, D., Nie, Y., ... Fortner, J.D. (2015). [Engineering crumpled graphene oxide nanocomposite membrane assemblies for advanced water treatment processes](#). *Environ. Sci. Technol.*, 49(11): 6846-6854.
- Jiang, Y., Liu, D., Cho, M., Lee, S.S., Zhang, F., Biswas, P., Fortner, J.D. (2016). [In situ photocatalytic synthesis of Ag nanoparticles \(nAg\) by crumpled graphene oxide composite membranes for filtration and disinfection applications](#). *Environ. Sci. Technol.* 50(5): 2514-2521.
- Jiang, Y., Zeng, Q., Biswas, P., Fortner, J.D. (2019). [Graphene oxides as nanofillers in polysulfone ultrafiltration membranes: Shape matters](#). *Journal of Membrane Science*, 581(1): 453-461.

Applications

- Water filtration membranes and treatment systems

Key Advantages

- Can encapsulate nanoparticles with array of functions (anti-microbial, UV-reactive)
 - Photocatalytic synthesis can regenerate this function
- Adjustable pore size down to 10nm
- Easily cleaned with UV light and magnetic “scatter/gather” treatment

Patents: [US 10,099,184](#)

Related Web Links: Biswas [Profile](#) & [Lab](#)