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Reduced Biofouling in Water Treatment Membrane Systems (2015-021)

Uses Ultraviolet Radiation to Reduce Growth of Unwanted Bacteria and Biofilms

Market Overview

This approach reduces biofouling by using X-ray irradiation and ultraviolet-emitting materials to reduce bacterial growth and biofilms. Biofouling is a critical issue in membrane water and waste water treatment as it greatly compromises the efficiency of the treatment processes. It is difficult to control and results in increased operational costs and poor performance. Current anti-biofouling techniques involve chemical cleaning steps or antimicrobial surfaces which have proven inadequate over long-term operation for many feed waters. In contrast, Clemson University researchers have developed an anti-biofouling approach that can inactivate bacteria without introducing chemicals into the feed water and without pausing operation of the membrane treatment process. This is accomplished by incorporating radioluminescent materials onto the module feed spacers and applying an external X-ray source to produce germicidal UVC within the membrane element.

Application

Reverse osmosis; water purification

Stage of Development

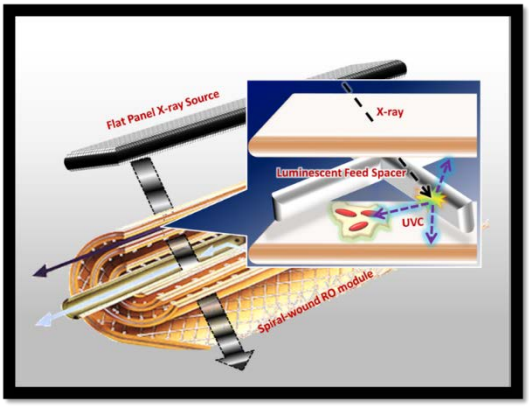
Preliminary Prototype

Advantages

- Reduces biofouling in water treatment/membrane water systems, increasing efficiency and decreasing operation costs caused by degradation
- Uses ultraviolet radiation inside membrane modules, presenting a unique and effective approach to eliminating bacteria
- Allows membrane to operate at maximum water fluxes with less pressure demand, extending membrane lifetime

Technical Summary

Germicidal ultraviolet radiation is an effective, broad spectrum biocide. By controlling the x-ray dose rate, the biocidal action of the system may be tuned to meet changing conditions. The phosphors in this technology are designed to emit ultraviolet radiation when stimulated by hard x-rays within a certain range. When an external x-ray source is applied, they penetrate the module and are absorbed by the phosphors, producing ultraviolet radiation and eliminating bacteria within the system. This is the first method to achieve production of germicidal radiation within the interior of a spiral-wound membrane module.



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App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Utility	United States	14/882,773	NA	2015-021	Ezra Cates

About the Inventor

Dr. Ezra Cates is an Assistant Professor in the Department of Environmental Engineering and Earth Sciences at Clemson University. He earned his Ph.D. in Environmental Engineering from Georgia Institute of Technology and his B.S. in Environmental Studies from the University of North Carolina, Asheville. His research interests include fundamental phosphor development for improving the efficiency of visible-to-UV upconversion; (2) applications of UV-radioluminescent materials to environmental technologies; (3) microbial inhibition and singlet oxygen photosensitization by silicon nanocrystals; and (4) material technologies for enhancing solar water disinfection for the developing world.

For More Information

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