Method for Purifying Water Contaminated with Environmental Chemicals

(2019-038)

Photocatalytic treatment to reduce water contaminants

Market Overview

This novel water treatment uses semiconductor particles in suspended or immobilized form which are excited by light in order to induce reactions that degrade or transform chemical or microbial contaminants in water. Use of poly/perfluoroalkyl substances (PFAS) has caused widespread contamination of surface and ground waters resulting primarily from discharge by chemical plants and firefighting training practices at military installations and airfields. Methods that are effective in removing PFAS from water, and are deployable in the form of compact and intergrated treatment systems, are being heavily sought by industry. PFAS are highly recalcitrant and extremely challenging to remove using exisiting water treatment technologies. Clemson inventors have created a method that is able to degrade perfluorosulfates (PFS), which are the most challenging subcategory of PFAS, more efficiently, and at a faster treatment rate.

Technical Summary

Bismuth phosphate ($BiPO_4$) has been explored previously as a photocatalyst for advanced oxidation of organic contaminants. This method applies $BiPO_4$, in microparticle form, as a suspension in water and reducing conditions are established in order to reduce, rather than oxidize, target contaminants - particularly recalcitrant poly/perfluoroalkyl substances. Reduction conditions are created by purging out dissolved oxygen via nitrogen bubbling, and through addition of an organic electron donor, such as methanol. The anoxic water and catalyst mixture is irradiated with ultraviolet lamps inside a photoreactor to induce treatment. Subsequently, the catalyst particles may be removed and recycled using a membrane separation process. The key aspect of the claims of this invention is the combination of $BiPO_4$ and reducing conditions to induce treatment of PFAS, which has not been similarly demonstrated previously.

Application

Water treatment, PFAS, Photocatalysis

Development Stage

Preliminary Proof of Concept

Advantages

- Can be incorporated into existing commercial photoreactor systems and is thus readily marketable at full scale
- Faster, in terms of treatment rate, then other methods on the market
- More robust in the presense of real water co-constituents, and simple to deploy and operate

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
Provisional	United States	62/879,749	NA	2019-038	Dr. Ezra Cates Dr. Dawei Wang

About the Inventors

Dr. Ezra Cates

Assistant Professor of Environmental and Earth Sciences at Clemson University

Dr. Ezra Cates received his Ph.D. in Environmental Engineering from the Georgia Institute of Technology where he completed his postdoctoral work in the field of visible-to-UVC upconversion phosphors. Cates has made significant contributions to fundamental advances in the design and understanding of light conversion by Pr3+-doped crystals, and has developed a proof-of-concept material system for applying upconversion to sustainable light-activated antimicrobial surfaces.

Dr. Dawei Wang

Postdoctoral Research Fellow at Clemson University

Dr. Dawei Wang received his Ph.D. in Environmental Engineering from Hohai University, China and completed a postdoc fellowship at Virginia Commonwealth University. Dawei is a member of the Cates Lab where he utilizes his extensive experience in nanomaterial synthesis and environmental technology to pursue new directions in photocatalytic technologies.

For more information on this technology contact:

Andy Bluvas
Technology Commercialization Officer
E: bluvasa@clemson.edu
P: (864) 656-0797