Zero Waste Water Capacitive Deionization

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TECHNIOLOGY

Inventors at UW-Milwaukee (UWM) have developed a technology based on capacitive deionization (CDI) that selectively removes lead (Pb^{2+}) from tap water in a single pass mode with zero wastewater emission and minimal removal of associated healthy ions (Ca^{2+} and Mg^{2+}), leaving water safe and healthy for consumption.

Heavy metal contamination in drinking or potable water is a major concern for human health due to its toxic nature. Many techniques are available in the market that can be effectively used to remove heavy metal ions from the water. These methods not only remove unwanted metal ions like Cu, Pb, Cd etc., but also end up removing healthy metal ions (such as Ca^{2+}, Mg^{2+}) in the process. CDI is a water purifying technique that has been less explored in heavy metal ion removal compared to other traditional methods. Additionally, CDI offers many advantages over other water-purifying techniques (e.g., reverse osmosis, RO) such as low life-cycle cost, high water recovery rate and low energy consumption.

The test results have shown that the natural presence of phosphate ions in the tap water enable lead to form a particulate rather than moving as free ion in the water in the presence of the composite CDI electrode developed by UWM inventors. The precipitate can be collected using filters equipped in the pipeline, thereby leading to zero-wastewater generation during the process.

FEATURES AND BENEFITS

- **Low Cost** – Low energy consumption
- **Improved Performance**- Selective high removal of heavy metal ions (Pb^{2+}) against healthy ions such as Ca^{2+}, Mg^{2+} etc.
- **Healthy Water Standards** - Minimal associated extraction to maintain optimal concentration of healthy ions
- **Zero Waste Discharge Technology** - Retrofit to existing pipelines and easy collection of lead precipitate using filters with zero waste water generation

INTELLECTUAL PROPERTY

Provisional Patent Application (PPA) filed April 2019

This technology is part of an active and ongoing research program and is seeking partners for further development of prototype and testing to demonstrate effective removal of heavy meatal ions from drinking water. It is available for developmental research support and/or licensing under either exclusive or non-exclusive terms.

MARKET POTENTIAL

Drinking water treatments, Analytical Laboratory, Health care (Hospitals and Dental Clinics), Pharmaceutical laboratory

UWM RESEARCH FOUNDATION

Technology Overview

CURRENT MARKETS

There is an increased growth in the market for water treatment options due to radical urbanization and increased public awareness worldwide It is estimated that the global market for water treatment is likely to witness a robust expansion and a steady CAGR of 7.5% throughout the forecast period, 2027 according to Research Report Insights (RRI). According to Hexa Research, water and wastewater treatment market is project to be worth $674.72 Billion by 2025, with Asia Pacific accounting for the largest market revenue share in 2016-2017.

The need for water treatment with zero waste discharge technology is in demand due to the rising global challenge for drinking water and pure water scarcity. While, membrane-based technologies dominate zero waste discharge device market for water treatments, CDI along with the composite electrode developed by UWM inventors can offer a unique solution for challenging times.

INVENTORS

Dr. Junhong Chen is a Distinguished University Professor, a Professor of Mechanical Engineering, a Professor of Materials Science and Engineering, an Excellence in Engineering Faculty Fellow in Nanotechnology at UWM, and a Regent Scholar of UW-System. He is also the Director of the Industry-University Cooperative Research Center (I/UCRC) on Water Equipment and Policy, supported by the U.S. NSF and water-based industrial partners, and the founder of NanoAffix Science, LLC. Dr. Chen received his B.E. degree (in Thermal Engineering) in 1995 from Tongji University, China, and his M.S. and Ph.D. degrees (both in Mechanical Engineering) in 2000 and 2002, respectively, from the University of Minnesota. Professor Chen's research goal is to impact our society through scientific discoveries and sustainable technological innovations. His research interest lies in nanomaterial innovations, particularly hybrid nanomaterials featuring rich interfaces, for sustainable energy and environment.

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