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Pulsed Electric Field for Drinking Water Disinfection

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Background

Microbiological infestation is known to be a cause of water pollution. Common waterborne pathogens include Pseudomonas, Aeromonas, Mycobacterium and Legionella bacteria. There have been a number of cases of Legionella bacteria being detected in new buildings in Hong Kong. Water disinfection technologies such as chlorination, ozonation, heating and reverse osmosis are now widely used in drinking water disinfection. However, high concentration of chlorine produces a pungent smell and unwanted toxic by-products, while heating and reverse osmosis can be energy consuming and expensive.

The new pulsed electric field disinfection technology can kill bacteria by damaging their cell walls so they are no longer infective. Current technology uses a high-input voltage to generate pulsed electric field, which uses up to a hundred thousand volts and creates a potential electrical hazard for operators. The device invented by the HKUST research team is designed to use low-input voltage. This portable battery-powered device can be installed on any domestic or public tap water systems. It is cost-effective, environmentally friendly and safe for disinfecting tap water at the point of use.

Technology Overview

The invention provides a safe, effective and environmentally benign device for point-of-use disinfection of tap water for drinking by subjecting microorganisms in the water to an intense, pulsating electric field generated between micro-engineered electrodes. The intensity, polarity, strength, duration and interval of the pulse are selected to render the microorganisms nonviable by causing irreversible damage through a combination of cell wall collapse, osmotic stress and enhanced penetration of residual disinfectant. In this way, the water is disinfected without the excessive use of chemical disinfectants and biocides that can alter the taste and quality of the water and potentially lead to resistance and tolerance in the microorganisms. The device is applicable not only in domestic situations, but also in public, commercial and industrial premises where safe drinking water is paramount.

Applications

- Device for drinking water disinfection in households, restaurants, washrooms, etc.

Patents

- US Patent no.: 14/442588
- China Patent no.: 201380060604.9
- Hong Kong Patent no.: 15111936.7
- US CIP Patent no.: 15/241430

Figures

Mini pulsed electric field device invented by HKUST.