‘The Future of Water Security – UV LED Microchips’
By Dr. Yitao Liao

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Approximately 50 years ago, the first integrated circuit was produced using a small, thin piece of semiconductor material. Today, we know them simply as ‘microchips’. These tiny components are now found in virtually every piece of electronic equipment and have changed the world we live in. Together with the semiconductor, the microchip has created a revolution of far reaching effects – impacting business, communications, transportation and much more.

Microchips have been integral to the advancement of medical technologies. Only recently though have we seen the introduction of purpose built ‘microchips of health’ that are designed to drive significant advancements in personal wellness. One of the applications for the ‘microchip of health’ that holds enormous potential for improving human health and hygiene is water purification.

Water Security

‘Water security is defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability. (UN-Water, 2013)’

One in seven people lack access to a reliable source of clean drinking water – that’s over one billion people. Furthermore, water-related diseases affect more than 1.5 billion people around the world each year, with improper treatment contributing to the 3.4 million annual deaths. Water treatment systems are more technologically advanced than ever before, yet this crisis prevails.

Part of the reason is the high complexity of conventional municipal water treatment facilities, which usually rely on several separate stages, including filtration, flocculation, sedimentation, filtration and chemical treatment (chlorination and fluoridation).

The final stages of chemical treatment, still widely implemented today, present numerous hazards that inevitably have damaging effects on human health or the environment. These risks are further exacerbated in developing regions, where regulatory guidelines are ambiguous, or entirely absent. In China, the country where I was born and raised, over 980 million people drink partially polluted water every day. The effects are clear: a tainted water supply has been linked to gastric and liver cancers, which causes over 60,000 deaths in China each year.

The Microchip of Health – A Breakthrough Technology

Technological advances in recent years have presented groundbreaking opportunities for ensuring global water security. Ultraviolet-C (UV-C) light has proven to be an effective and reliable method for disinfection, with numerous advantages. This light is traditionally produced using bulky, expensive, fragile and power-intensive mercury-vapor lamps. On top of this, these units require a significant amount of time to warm up, produce excess heat and require mercury, a highly toxic substance that poses substantial risks to human health.

Meet the 'Microchip of Health'. RayVio's powerful microchips produce small yet powerful doses of UV-C light. These diodes are extremely compact and energy efficient, allowing disinfection to begin instantly, with zero warm-up time. Light is emitted precisely in the UV-C wavelength spectrum – deactivating the DNA of bacteria, viruses and other harmful pathogens in seconds – with laboratory-tested 99.9999 percent efficacy. Most importantly, these tiny microchips achieve medical-grade disinfection without the need for toxic substances like mercury and without producing harmful byproducts like ozone.

New Opportunities for Water Purification

This microchip presents a paradigm shift in the way we approach water purification. Potential applications of RayVio's microchips for water might include incorporating one of these tiny, millimeter-scale units into a water bottle, offering clean drinking water on-the-go. Conversely, disinfection can be achieved at a water point-source, ensuring that any throughput is void of harmful pathogens. For example, incorporating a microchip into a tap or faucet can ensure a steady, constant stream of safe, sanitized drinking water.

This is a great convenience for most but potentially life-saving for hundreds of millions of people who suffer in the developing world.