APPLICATION OF PULSED ELECTRIC FIELDS AND MAGNETIC PULSE COMPRESSOR TECHNOLOGY FOR WATER DISINFECTION*

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The increasing demand for clean drinking water has significantly intensified the need for long lifetime, inexpensive water disinfection systems. Over the past decade, magnetic pulse compressors have become increasingly popular for a number of pulsed power applications requiring operation at high repetition rates and high average power levels. The application of these systems for the purification of water has yet to be explored for pulsed electric field inactivation of microorganisms. The principal advantage of the magnetic pulse compressor system is their long lifetime and compact size. The magnetic pulse compressor system is comprised of a high voltage power supply and a number of stages that compress the wall plug voltage down to either 1 microsecond, 25,000 Volt pulses or 50-100 nanosecond duration pulses at a kilohertz repetition rate. The magnetic pulse compressor is then used to drive a treatment cell through which water is flowed. The notably high lifetime, reliability and repetition-rates of a magnetic pulse compressor present them as a promising alternative to the existing circuits used for PEF applications. The use of these short duration electrical pulses is being investigated at the University of Missouri-Columbia. The program is investigating the possible use of the system for inactivation of spores, bacteria and viruses in drinking water. Coupled with the demand for clean drinking water, inexpensive water treatment systems based on high rep-rate magnetic pulse compression technology could play a significant role in point of use systems.

The test cell designed herein allows static and flowing tests for pulse widths of 50-100 ns and 1 μs. The applied voltage and the number of pulses depend on the target microorganism to be inactivated. Pulse repetition rates are generally greater than 30 pps and this determines the flow rate and the velocity of liquid flow through the test cell. The viability of the selected pathogens after treatment is assayed after a specific number of pulses are applied. The protocols and test data will also be discussed during the presentation. Experimental measurements up to 100 pps have demonstrated greater than 4 logs of disinfection. The integration and design of a test cell for rapid testing of the microorganisms will also be presented along with the circuit topology of the magnetic pulse compressor.

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