DIVERSIFIED TECHNOLOGIES, INC.®

PRODUCT BRIEF

PowerMod Technology Breakthrough Brings High Availability to High Power Electronics

PowerMod™

Pulsed Electric Field Applications

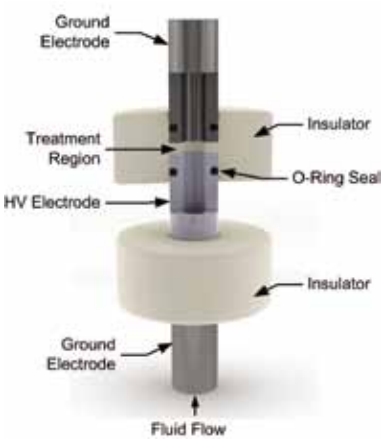
Pulsed Electric Field (PEF) processing uses a high-energy pulsed electric field to breakdown harmful microorganisms and enzymes in liquids and slurries. Liquids are pumped through treatment chambers, where a rapidly pulsed electric field is applied. The field ruptures the cell walls and membranes of the microorganisms in the liquid, killing the cells and rendering them harmless. Similarly, the molecular structure of harmful enzymes is destroyed. PEF treatment can be used in food processing, wastewater treatment, and biofuel production. Precise high voltage output is critical to the performance of PEF systems. Providing very fast pulse rise and fall times and maintaining a pulse with a very "flat" top, insures that the PEF treatment provided to each volume of liquid is highly uniform. No chemical or radiation treatment is involved in PEF applications.

PEF wastewater treatment system comprised of a DC power supply rated at 150 kW, a 40 kV, 500 A pulse modulator, and a treatment chamber with four, 15 mm treatment gaps. It processes 10,000 liters/hour of wastewater sludge prior to anaerobic digestion.

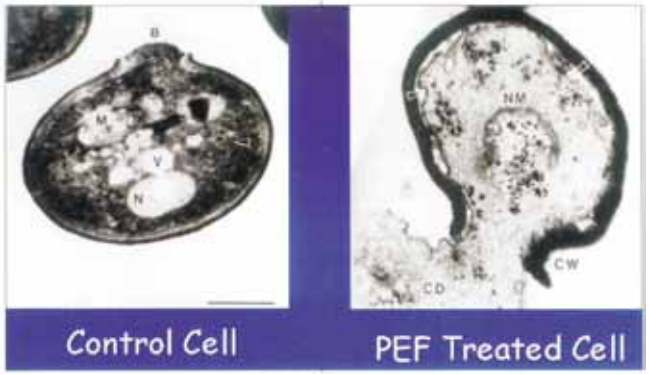
Food Processing

Pasteurization, a form of thermal processing widely used for sterilization in the food processing industry, can have a deleterious effect on a food's taste, color, anti-oxidant content, and consistency. In contrast, PEF treatment preserves the fresh qualities of treated foods because they are not heated. PEF is an in-line process applied prior to packaging or storage.

DTI built the world's first commercial scale PEF food processing system, based upon DTI's PowerMod™ electronics, in association with Ohio State University's department of Food Science and Technology. DTI's 65,000 volt (±65 kV) positive/negative high voltage electronics include two high voltage power supplies, two high voltage pulse modulators, and a system control unit. The system allows researchers to vary the voltage, the duration,



Cutaway view of one-half of a PEF treatment chamber showing a single treatment zone. Pulses of 1-10 µs duration are applied via an electrode to a collar surrounding the tube through which the fluid is flowing. The pulse rate is adjusted proportionally to the rate of flow of the liquid to insure complete processing.



Comparison of control cell (saccharomyces cerevisiae) with PEF treated cell showing damage to cell membrane. Source: Washington State University)

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and frequency of the pulses independently so that optimum PEF parameters can be researched across a range of foods. The OSU/DTI system demonstrated that PEF processing can be scaled to meet processing volumes up to 50,000 liters per hour or more.

DTI has installed PEF processing pilot plants at universities and research centers around the world. A typical pilot plant system includes a 25 kW, power supply, 20 kV modulator, and controls in a single, 24" rack. A separate, vegetable-oil-filled enclosure houses two treatment chambers, each with a single high voltage input and two treatment gaps. The system provides very fast risetimes (~ 200 ns) across a wide conductivity range, and constitutes a highly flexible, moderate flow option for a range of PEF R&D and protocol development, and low volume, commercial PEF operations.

PEF pilot plant with a capacity of up to 400 liters/hour. The power supply, modulator, and controls are in the cabinet on the right. Treatment chambers are in the enclosure on the left.

Wastewater Treatment

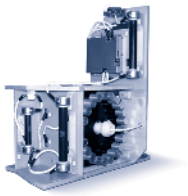
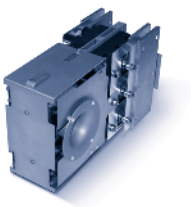
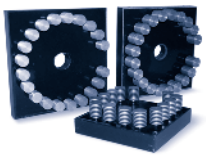
Pulsed electric fields are being applied to the processing of wastewater biosolids with the goals of killing pathogens, reducing the volume of solids requiring disposal, and increasing the amount of material available to be converted to energy through cogeneration.

DTI recently developed a high volume, commercial scale PEF system for wastewater processing capable of 10,000 liters / hour throughput. In practice, the PEF system is placed line with the solid flow prior to its digesting and dewatering. By rupturing the cell walls of the biosolids with PEF at this point in the process, the amount of methane produced by the digesters is increased by as much as 75%*, and the volume of biosolids needing disposal is cut by up to 50%*.

The system is designed with the modulator and treatment chambers in a NEMA 4 enclosure, allowing placement in areas where washdown is required. The DC power supply and controls may be located remotely, typically in the plant's control center.

All DTI systems employ the inherent advantages of solid state electronics such as long system lifetime, high efficiency and low operating costs.

*Source: OpenCELL, LLC. website. www.opencel.com

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