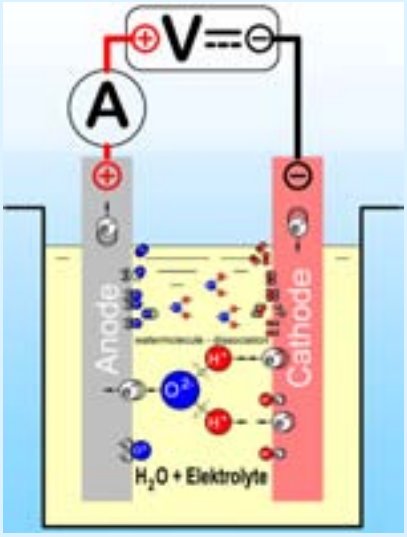
OZONE-MICRO-CELL

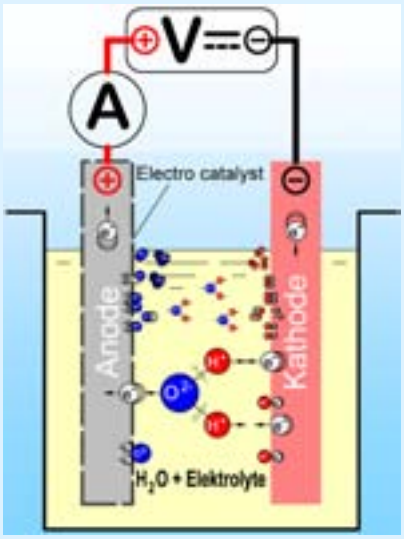
The worlds 1st ultra compact low-voltage ozone generator for reducing algae & germs.

There are 3 methods for generating ozone:

1. UV light. An ultraviolet lamp generates ultraviolet light (on a wavelength of 185 nm) and irradiates the air. The irradiation process converts oxygen in the air into ozone.
2. Electrical discharge. This method uses an electronic device that produces high voltage electrical discharges. By passing air (or oxygen) through this device ozone is generated from the oxygen in the air.
3. Electrolysis. Electrolysis cells produce ozone using direct current (low voltage). Production of ozone is ***in situ*** as the water to be treated also acts as the fuel. In other words, no other supplements are required (e.g. gasses).



The principle of electrolysis of water
Electrolysis of water is an electrolytic process that converts water into oxygen and hydrogen gas with the aid of an electrical current. The electrolysis cell consists of two electrodes submerged in an electrolyte connected to opposite poles of the source of direct current. The electrical current converts water molecules into hydrogen and oxygen. Within the electrolytic cell of the cathode, hydrogen ions accept electrons in a reduction reaction thus forming hydrogen gas. At the anode, hydroxide ions undergo an oxidation reaction and provide electrons to the anode to complete the circuit and create water and oxygen gas. The mass of a substance produced by an electrode during electrolysis is proportional to the quantity of electrical charge transferred at that electrode. (Faraday's Law)



Electrolytic ozone production.

To produce ozone at the cathode, using water electrolysis, an electro-catalyst is required so the energy increases, with a rising current, and thereby creates an increase in the chemical reactivity of the absorbed oxygen that is formed as a by-product during the oxygen development.

With an electrode potential above 2,3 V, theoretically, free oxygen atoms can be formed. Free oxygen atoms are very reactive and can react with molecular oxygen (O^2) to form ozone (O^3). Because of the low temperatures, the electrolytic ozone production unit produces a far greater ozone concentration than conventional gas discharge units.

The electrolytic cells used do not use dangerous liquid electrolytes, as "solid electrolytes" are used. The electrolytic ozone production in these Polymer-Electrolyte-Membrane (PEM) electrolytic cells function as follows:

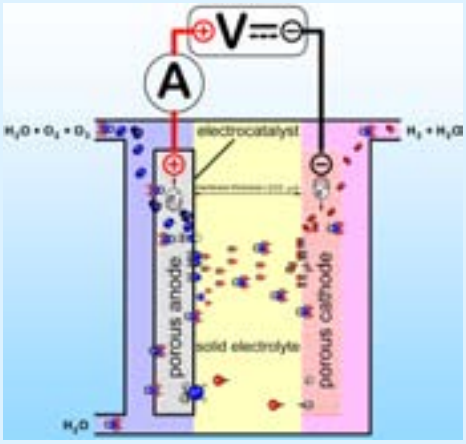
Ozone production in a PEM-electrolytic cell
Instead of a liquid electrolyte, which is required for the electrolysis of water, a solid electrolyte is used. This consists of a polymer with the characteristics of an electrolyte, i.e. passing electrical charges. In this case the electrical charges are hydrogen ions/protons* (→ cations-exchange membrane):

Anode → oxygen + ozone

Cathode → hydrogen

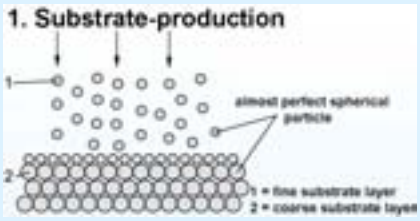
(*The protons carry these levels, together with a nett transport of water molecules in a ratio of about 1:5)

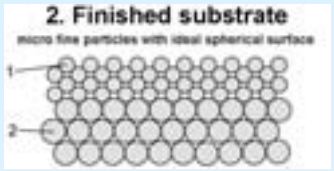
This PEM-technology originates back to 1958 and was used in fuel cells for space travel programmes, including the Gemini project. The PEM cells in the Micro-Ozone-cells have also proved extremely successful over the past 20 years in more than 700 industrial water treatment processes, mainly within the pharmaceutical industry.

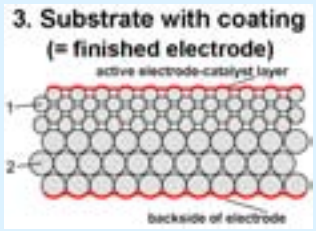


Apart from replacing the liquid electrolyte solution with a PEM - membrane the other issue during development were the electrodes.
Electrodes determine how efficient the PEM - electrolysis cells perform and therefore determine the function / power consumption.

The ***microsphere***® electrodes – For a PEM-cell to function correctly it is essential to ensure that the electrodes have a porous surface for a sufficient supply of water and electrical current, and are able to cope with the discharge of electrolytic products. The electrode material requires high demands with regard to chemical stability. To realise an equal charge electrical division, even with larger membrane surfaces, it is necessary to produce the electrodes with a minimum tolerance to have good contact with all surfaces of the membrane. Dirt collection at the membrane or on the membrane surface must be avoided as much as possible. The microsphere electrodes fulfil this function perfectly. Their specially designed layered porosities perfectly supply the electrodes with water with minimal capillarity.







On the anode side the microsphere® electrodes have a special "electro-catalyst" that supplies the correct current necessary for the production of ozone/oxygen. The ozone production from these electrodes is about 10 to 15 weight % at an optimum operational temperature, that is just above room temperature.

microsphere®- is a registered trademark, the electrodes are patented under the following numbers:
German Patent DE 196 19 333 / Swiss Patent CH 691 309 / U.S. Patent US 5,873,988

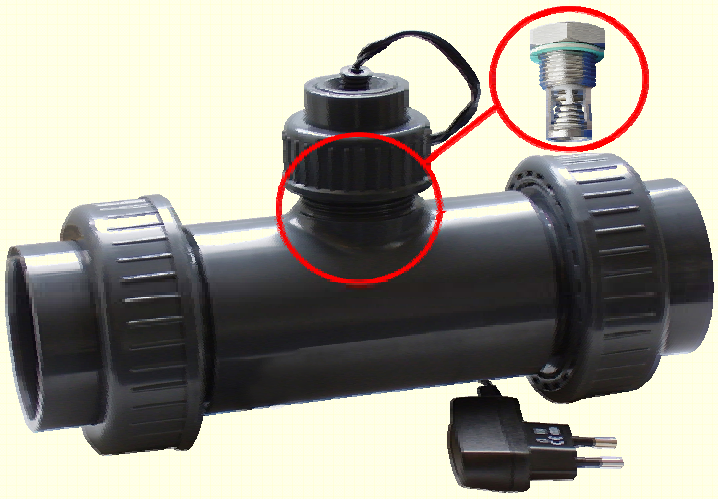
Product description OZONE-MICRO-CELL

For the OZONE-MICRO-CELL the water to be treated is also the fuel source. No other supplements are required. To produce ozone, only electrical energy is required to supply the cell core with power.

Dependent on water quality (hardness/pollution) the cell core needs to be replaced (on average 3 - 4 times a year). Changing the cell is a simple process, similar to changing batteries. Replacement cell cores are available in an economically priced spares set.

Cell core spare part set
Consists of 5 cell cores

The OZONE-MICRO-CELL comes as an easy to install unit (28cm wide) with Ø2" and Ø1½" connections. A power supply unit is also provided.
As there is no maximum flow rate it can run with any pump.



	1 cell	2 cells
Ozone capacity [max. O3/h]	20 mg	40 mg
Ozone concentration in the water phase	max. 750 ppb (= 0,75 mg.)	
Electrolysis current	6 VDC	12 VDC
Electrolysis power	nominal 200 mA	
Pressure	max. + 6 bar (PN 6)	
Power consumption	2 watt	4 watt
Retail price (incl. 17,5% VAT)	£ 267.00	£ 297.00
Retail price cell core part set (5 pcs.)	£ 79.70 (incl. 17,5% VAT)	

Trade only
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Advantages of the OZONE-MICRO-CELL

- Slow development of an increased redox-potential – optimum levels of all water parameters are maintained through the continuous presence of oxygen.
- Permanent micro-disinfection prevents a one-sided increase of e.g. pathogenic germs like Aeromonas salmonicidae, that have a detrimental effect on the equal expansion of an aerobe environment.
- No immediate threat to fish from increased ozone input compared to an ozone generator with electrical discharge.
- Toxic reactions from overdose levels do not occur.
- No surplus ozone produced.
- No personal risks in enclosed filter areas, as tolerated levels are never achieved.
- Capacity can be adapted according to pond size by using multiple OZONE-MICRO-CELLS.
- Maintenance, requires only the replacement of the reasonably priced cell cores (2 - 4 times a year, dependant on water quality/hardness/pollution).
- This method of ozone production does not require dried air which produces sulphuric acid in the electrode chamber that often causes the pH to drop into the acid range.
- Ozone produced by electrolysis is highly efficient and effective.