BrightWater Environmental

Titanium AOP Water Purification

BRIGHTWATER

WRAS APPROVED PRODUCT

THE SOCIETY OF PUBLIC HEALTH ENGINEERS
INDUSTRIAL ASSOCIATE

Titanium Advanced Oxidation Process

Chemical free destruction of all contaminates, microbiological matter and organic compounds.

The Advanced Oxidation Process (AOP) offers unique new levels of performance for purification of drinking water supplies. It is chemical free and utilises “a non-selective” destruction mechanism that destroys all contaminates and microbiological matter present in the water. The non-selective “destroy-all” technology gives complete oxidation and purification of the water system and represents a watershed in the advancement of water treatment technology. The Titanium AOP will break down and de-decompose any organic matter present in the water to leave a truly purified water. Everything organic is decomposed back to H_2O, CO_2 and O_2.

Titanium AOP – Features & benefits

- Ensures the non-selective destruction of all organic matter quickly and easily
- Environmentally friendly
- Cost effective as expensive chemicals are not required.
- Eliminates risk of over dosing with chemicals and subsequent corrosion to pipework and valves
- Photocatalytic Oxidation and Hydroxyl Radicals have the highest Oxidation strength for the destruction of waterborne contminates of any system available for potable water systems.
- The Hydroxyl Radicals decompose organic and microbiological matter, contaminants, pollutants, hydrocarbons and help prevent biofilms forming.
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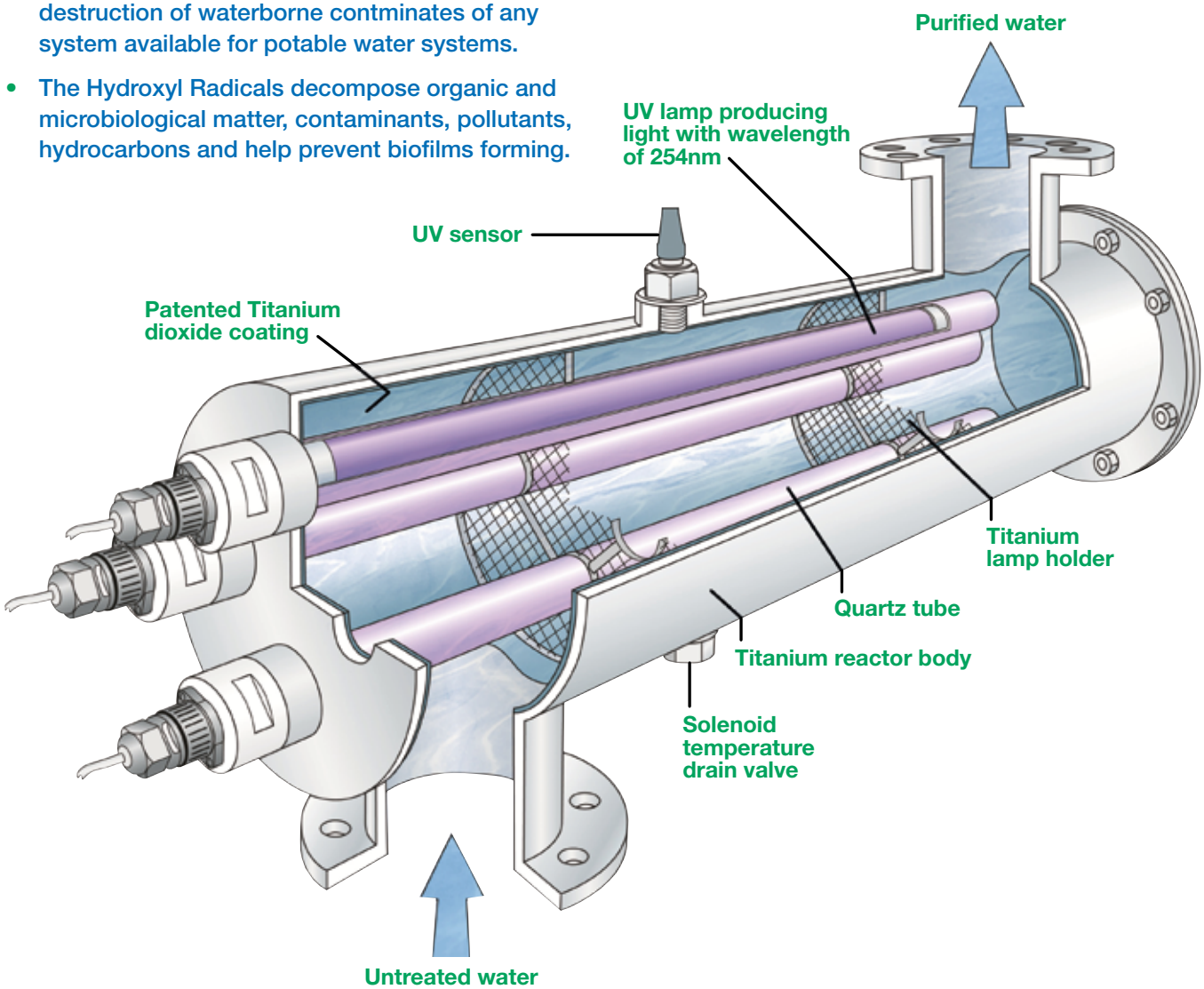
- Low energy consumption
- Simple, low cost maintenance procedures
- Proven track record – installed worldwide
- WRAS approved.



The Chemistry at work

The Advanced Oxidation Process uses a Titanium vessel with a patented titanium dioxide crystal coating on the internal surface. This surface reacts with UV light at 254nm to produce two very powerful Oxidation reactions – Photocatalytic Oxidation and Hydroxyl Radical Oxidation. The rate of destruction for organic contaminates utilizing these two reactions is higher than all other commercially available oxidation systems.

To demonstrate the effectiveness of the two reactions Photocatalytic Oxidation and Hydroxyl Radical Oxidation we have set out in the table below the simple performance comparison of the various oxidation methods.

Oxidant	Formula	Oxidation Strength (eV)
Photocatalytic Oxidation	**TiO2 + (UV at 254nm)**	**3.21**
Fluorine	F2	2.87
Hydroxyl Radical	**OH•**	**2.8**
Single Oxygen	O (1D)	2.42
Ozone	O_3	2.07
Hydrogen Peroxide	H_2O_2	1.78
Permanganate	MNO_4	1.67
Hypochlorous Acid	HCOI	1.48
Monochloromine	NH_2Cl	1.4
Chlorine	Cl_2	1.36
Hypobromus Acid	HOBr	1.33
Oxygen	O_2	1.23
Bromide	Br_2	1.07
Chlorine Dioxide	ClO_2	0.95

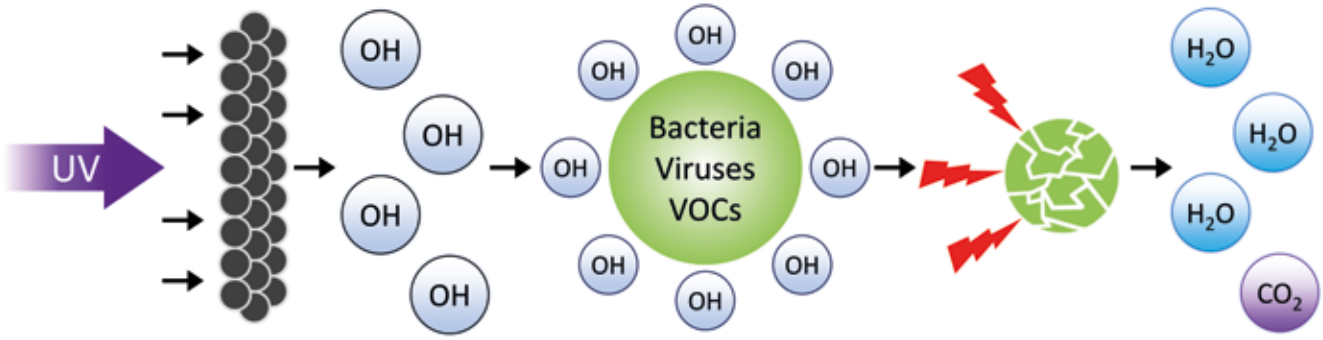
The Titanium AOP System works by a physical process. It exploits the effect of UV light at 254nm upon a Titanium Dioxide surface in the presence of water. The resultant Hydroxyl Radicals are highly reactive, attacking and eradicating any organic contaminates and pollutants present.

The high energy UV photons generated in the rector drive two major processes:

The first process is a Photocatalytic Oxidation reaction that occurs at the reactor surface when UV light at 254nm hits the Titanium Dioxide surface. This reaction will immediately oxidise any organic matter at the surface of the reactor with an Oxidation Strength of 3.21(eV) this is the strongest possible Oxidation strength possible in a potable water supply. This happens by the UV light promoting electrons at the reactor surface to a higher energy level creating an electron / hole (TiO_2e-h+) pair. Most promoted electrons will return to their lower energy level state by emitting light.

The second reaction caused by the Titanium Dioxide and UV light at 254nm is reaction of generating Hydroxyl Radicals (OH).The Hydroxyl Radical OH will also oxidise any organic contaminates present by removing the Hydrogen atom. If no organic matter exists the Hydroxyl Radical will recover hydrogen to reform into water. The Titanium AOP system does not affect pH, proving that all Hydrogen atoms are converted back to water within the chamber. The Hydroxyl Radical has an Oxidation Strength of 2.87(eV).

By the action of water flow passing through the reactor (an oxidation hot zone) the whole liquid volume has all organic and microbiological matter destroyed and decomposed. Due to their extreme reactivity Hydroxyl Radicals only exist for a matter of milliseconds before reverting back to water. As a result all reactions only take place within the titanium reactor.



UV light at 254nm

Reaction with patented titanium dioxide

Creation of Hydroxyl Radicals

Radicals seek out and destroy all organic compounds and microbiological matter

Formation of harmless water and carbon dioxide

Specifying Titanium AOP

- The water purification unit shall break down and destroy all waterborne organic matter, to include fungi, yeast, amoebae and viruses by the use of Hydroxyl Radicals.
- The purification process will take place by means of an Advanced Oxidation Process
- Hydroxyl Radicals to be created by photonic energy at wave-length of 254nm combined with the photo-catalysis Titanium Dioxide.
- The body of the unit shall be of Titanium Dioxide construction with a Titanium Dioxide Crystal coating applied to the internal surfaces of the reactor body to maximise the photo-catalytic reaction creating Hydroxyl Radicals.
- The Hydroxyl Radicals will have a Redox Potential of 2.8 to ensure complete oxidation of waterborne contaminates.
- No additives shall be used in the process and no harmful residuals shall be formed.
- The unit shall include a full controls system that runs form a 230V 50Hz fused spur supply.

- The controls should include facilities for a UV intensity monitor and remote BMS alarm.
- Water purification system shall be Titanium AOP from Brightwater Environmental Ltd or equal and approved subject to a technical submittal demonstrating compliance with the above criteria.

Model	AOP 1	AOP 5	AOP 10	AOP 20	AOP 50	AOP 100
Throughput						
Maximum flow (L/sec)	0.30	1.40	2.80	5.5	13.9	27.7
Maximum flow (m3/hr)	1	5	10	20	50	100
Water pressure drop (bar)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Electrical specifications						
Voltage (V)	230	230	230	230	230	230
Power consumption (W)	26	100	200	380	700	1300
Fuse rating (A)	3	3	3	3	5	13
Number of lamps	1	1	2	4	8	14
Reactor						
Diameter x length (mm)	74x475	75x895	120x890	160x960	225x955	305x955
Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Connections	¾" BSP male	1½" BSP male	2" BSP male	DN100 Flange	DN125 Flange	DN150 Flange
Controls Cabinet Dimensions (mm)	300 x 300 x 200	400 x 600 x 250	400 x 600 x 250	600 x 600 x 250	600 x 600 x 250	1000 x 800 x 250
Weight (kg)	11	20	26	28	30	48

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