



Adept Water Technologies A/S

About Adept Water Technologies



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Vision
Mission
& Values

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Adept Water Technologies - Facts

- Owned by some strongest private investors in Denmark
- 8 employees – 2 have a background from Veolia Water
- Located in Herlev, Denmark just outside Copenhagen with own production facility, storage and offices
- QA system in accordance with ISO 13 485



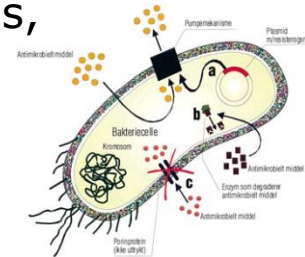
Why water disinfection?



- A lot of bacteria, viruses and parasites is dangerous to humans and give waterborne diseases or destroy food products
(Anaemia, Ascariasis, Botulism, Campylobacteriosis, Cholera, Cryptosporidiosis, Cyanobacterial toxins, Dengue, Diarrhoea, Dracunculiasis, Giardiasis, Hepatitis, Hookworm infection, Japanese encephalitis, Legionellosis, Leptospirosis, Lymphatic filariasis, Malaria, Methaemoglobinemia, Onchocerciasis, Polio, Ring Worm or Tinea, Scabies, Schistomiasis, Trichuriasis, Typhoid)
- Drinking water - bacteria, viruses and parasites – surface water
- Waste Water - bacteria, viruses and parasites – discharge in urban areas
- Process Water - bacteria, viruses and parasites – cooling water, food production, pharmaceuticals
- Others – Dentist chairs, drinking water coolers, ice cubes machines, under sink products, vending machines

Primary disinfection - Securing the water from the source

Secondary disinfection – Securing the water in the distribution system



How is water disinfected - methods?

Primary disinfection:

- Free chlorine (Added as a chemical) - Slow
- Ultra Violet Light - Fast
- Ozone (Added as a gas) - Fast
- Chlorine Dioxide (Added as a chemical) – Relative slow
- Others (Filtration, pasteurizing, Hypochlorous Acid)

Secondary disinfection:

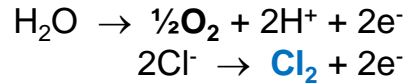
- Free chlorine (Added as a chemical) – Slow
- Chlorine Dioxide (Added as a chemical) – Relative slow
- Others (Hypochlorous Acid)



Electrochemical processes in BacTerminator®

Anode (+) Oxidation

Formation of Oxygen (pH 2-5):



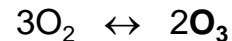
Chlorine gas will further react to Hypochlorous acid:



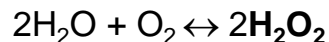
Hypochlorous acid is in equilibrium with Hypochlorite (ion), depending on pH:



Ozone is formed from Oxygen:

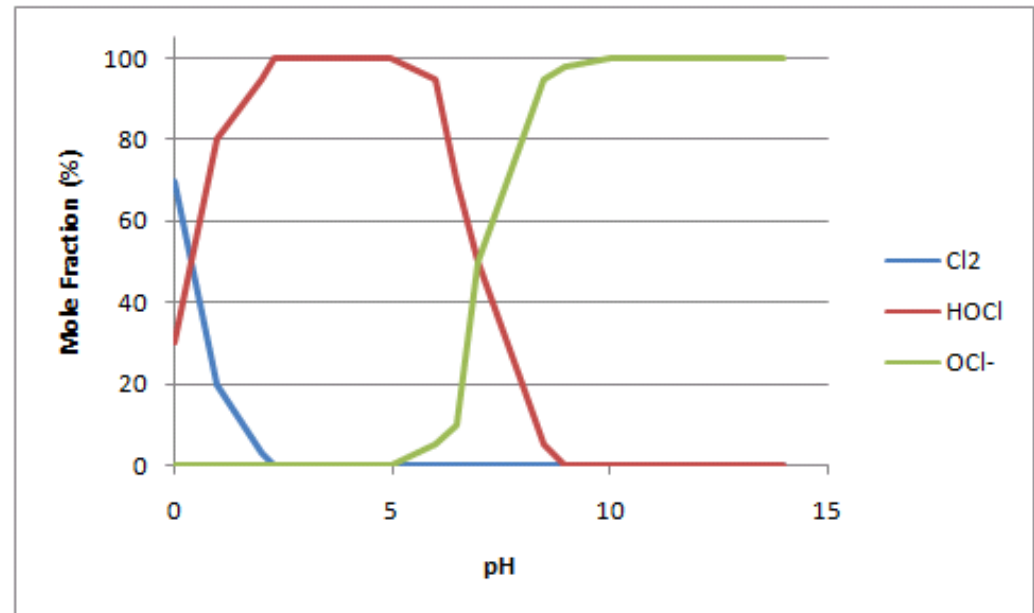
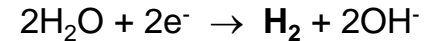


Hydrogen Peroxide is in equilibrium as follows:



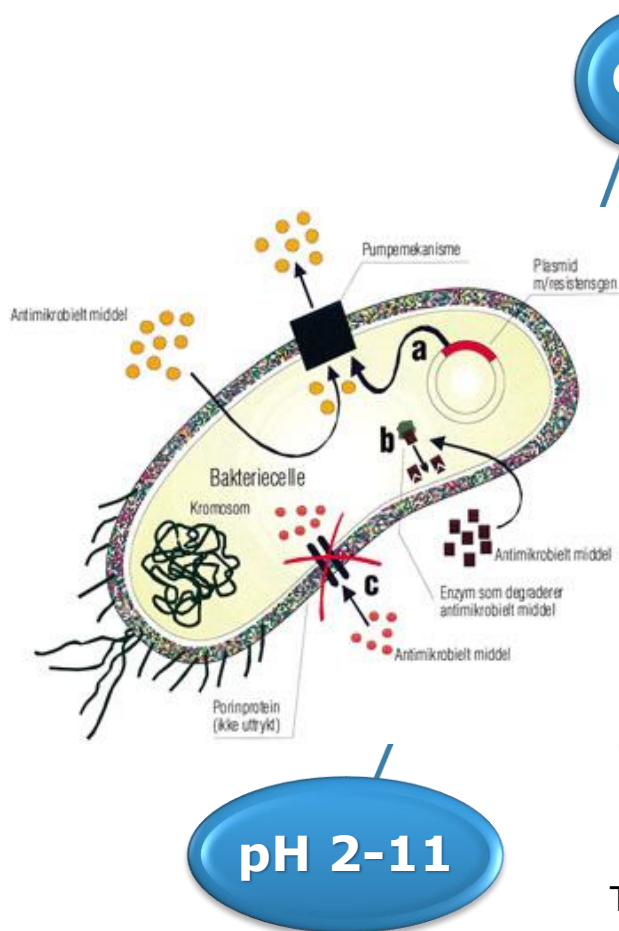
Cathode (-) Reduction

Formation of Hydrogen (pH 9-12):



Primary treatment

6 Killing Effects in 6 Seconds



Chlorine gas - is produced electrochemically and is highly biocidal. The gas is dissolved in water and reacts to the following two biocides:

Hypochlorous acid – the primary biocide in the disinfection process – is neutrally charged and is 50-100 times as effective as hypochlorite. Hypochlorous acid penetrates the cell membranes and destroys the metabolism of the cells

The hypochlorite – the secondary biocide in the process – is negatively charged and requires an ion channel to penetrate the cell membrane

Ozone - an oxidizing agent

Hydrogen peroxide - is also an oxidizing agent

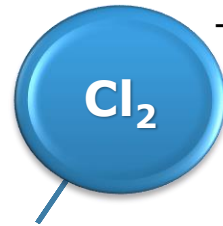
The big difference in pH values between the anode and the cathode destroy the cell wall of bacteria's and make the oxidizing processes more effective

Secondary treatment

3 Killing Effects

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The gas is dissolved in water and reacts to the following two biocides:

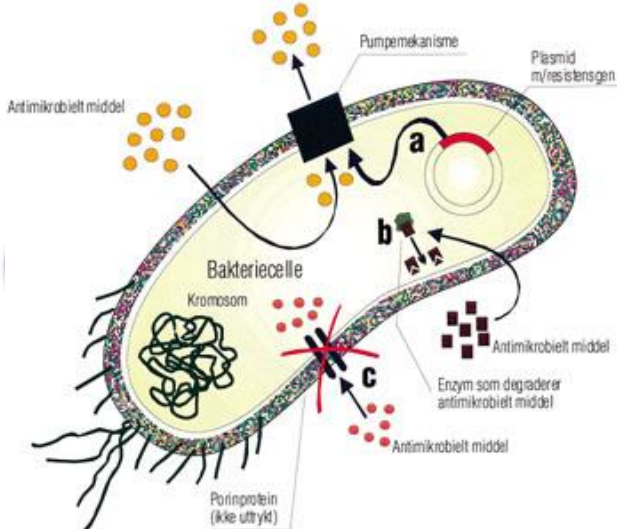


HOCl

Hypochlorous acid – the primary biocide in the disinfection process – is neutrally charged and is 50-100 times as effective as hypochlorite. Hypochlorous acid penetrates the cell membranes and destroys the metabolism of the cells

OCl^-

The hypochlorite – the secondary biocide in the process – is negatively charged and requires an ion channel to penetrate the cell membrane



BacTerminator® InLine electrolysis - a real alternative to Cl_2 and OCl^-



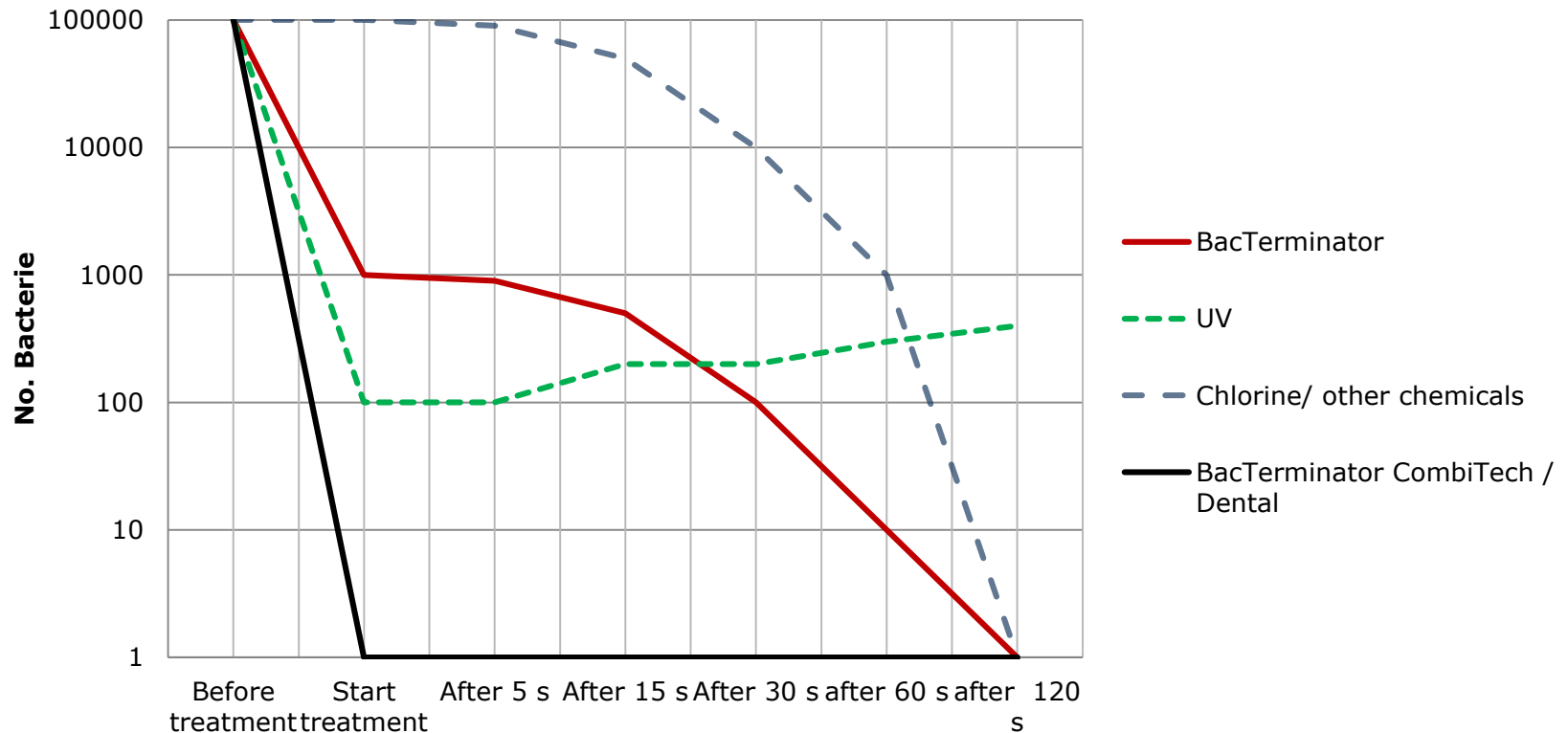
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BacTerminator®

The most effective disinfection in the market

Bacteria log reduction vs. Time



Can we make enough chlorine?

Energy W^h to produce 0,3 ppm active chlorine in 1 m³ of water

Conductivity	100 μS/cm	200 μS/cm	400 μS/cm	600 μS/cm	1000 μS/cm	1500 μS/cm	2000 μS/cm
Chloride							
20 mg/L Cl ⁻	108	143					
30 mg/L Cl ⁻		85	110	152	127		
40 mg/L Cl ⁻		57	75	98	94	120	143
50 mg/L Cl ⁻		28	39	44	61	51	60
75 mg/L Cl ⁻			23	27	28	27	31
100 mg/L Cl ⁻			24	21	22	20	19
125 mg/L Cl ⁻				15	18	17	16
175 mg/L Cl ⁻					14	14	14

Running cost for a inline BacTerminator® system. Example of a 110 m³ system



- Flow rate – 110 m³/h (constant 24/7), Pressure – 80 m
- Free chlorine (after treatment) – 0.6-1 mg/l
- 160 mg chloride/l, 1005 µS/cm, Alkalinity 203 mg/l as CaCO₃
- Electrode lifetime 6 – 12 months – new stack end user price 13.200,- €
- In both cases with a kWh price of app. 0,1 € it would cost **0,020 – 0,035 € to disinfect 1 m³ of water in running cost incl. change of electrodes.**
- We expect lifetime of the system of at least 10 years with service of spare parts of average 10% year. Depreciation incl. spare parts would be **0,003 – 0,006 €/m³.**
- Our big challenge in your case is water hardness. We would expect that the system should be cleaned every 4 – 8 days. For this an automatic cleaning system is necessary (9.800,- €). We will for each cleaning use (citric acid or HCl) if HCl we will use 4 l per. cleaning (price 1 €/l). Cleaning would cost: 4 liters every 4 day = 4,- € = 0,0003€/m³ of water
Depreciation cleaning system (10 years) = 0,001€/m³ of water
- Total running cost with depreciation app. **0,021 – 0,042 €/m³ of water**

BacTerminator[®] Safe – an alternative solution On-site production of active chlorine

Chlorine is difficult to handle and store. An alternative is to make active chlorine on-site using NaCl, water and power.

- Example 230 g active chlorine pr. hour.
- System investment 35.000,- €
- Running cost
(NaCl, Power, Electrodes) - 0,3 €/g



Why choose BacTerminator®?

- get the combined advantages of chlorination, oxidation and UV without their limitations

Better disinfection

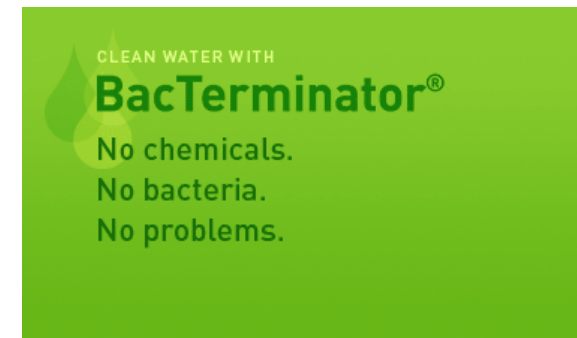
- 2 - 5 times higher effect than free chlorine
- Easy to control if system is working (power – active chlorine)

No chemicals

- No use, no storage and no handling of dangerous chemicals
- No chance for overdosing – less failures
- Better working environment for employees
- No added substances to process or drinking water
- Less impact on environment – Cleantech disinfection

Simpler handling

- Less chances for failures as overdosing or breakdown
- Better working environment
- Less use of working force
- Low operating cost



Contact information

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