Advanced Wastewater Treatment

Xogen technologies inc.
Technology Overview

- **XOGEN®** Wastewater Treatment Systems combines:
  - Electro-oxidation
  - Electro-flotation
  - Electro-coagulation
  - Disinfection into one unit process.

- **Xogen’s** patented technology is proven effective for the wastewater treatment for organics, BOD, COD, Ecoli, ammonia, cyanides, nitrates, metals, oil and grease and suspended solids reduction.
How the technology works

Electro decomposition gases $\text{H}_2$, $\text{O}_2$
$\text{CO}_2$, $\text{N}_2$, etc

Current Cathode - Feed

Waste Water Feed

Fenton & pH Reagents

Xogen Advanced Electro Oxidation Reactor

Current Anode + Drain

Oxidized Waste Water, Salts & Metals

Xogen
Xogen Pilot Plant and Process
Treatment

- Treatment depends on current (amps), surface area of electrode (anode) vs Volume of water (Litres or m³)
- Electrode coating
- Balance between efficiency and effective removal
- Treatment for most compounds is concentration dependant except for COD
Key Benefits of the Xogen System

- **Modular**: Multiple small modules can be either stacked or cascaded to easily build small (5 m³ per day) up to very large (40,000 m³ per day) installations.
- **Minimal By-Products**: Process is odorless; up to 50% less solids than biological treatment and requires minimal addition of reagents.
- **Robust Process**: ON/OFF, temperature stable, long lasting electrodes.
- **Cost Effective**: OPEX approximately $1.84/m³; similar to CAS and less than MBR.
- **Hygenic Outflow**: Electrochemical/oxidation lowers bacterial count and disinfects like UV, chlorination, and ozonation.
- **Process Control**: Can respond to changes in contamination loading.
- **Fast Processing**: Single pass operation, retention time in minutes (versus 8 – 12 hours in biological systems).
- **Smaller Footprint**: Plants are up to 75% smaller than incumbent technologies.
- **Rapid Start-up**: Process can be brought into operation in minutes allowing mobile or on-demand applications.
Conventional Wastewater Treatment

Screened Raw Sewage → Primary Clarifier → Sludge

Aeration → Recycle

Waste Sludge → Digester

Gas → Methane → Dewatering → Agricultural Disposal

Clarifier → Disinfection → To River
Xogen’s technology replaces the Primary Clarifier, Aeration Tanks and Digester
Summary of the time savings for treatment of determinants such as biochemical oxygen demand ("BOD"), suspended solids ("SS"), ammonia ("NH3"), phosphorous ("PTOTAL") and pathogens kill such as Escherichia coli ("E.Coli"); PCPs and pharmaceuticals.
Up to 75% Smaller Footprint / NO Bio-solids

Reduces Capital Costs and Allows for Plant Installations and Expansions in Densely Populated Areas
Typical Municipal Contaminant Removals

- **BOD**: 93%
- **Phosphorus**: 98%
- **Ammonia**: 100%
- **E. Coli**: 100%
- **TSS**: 98%
Pharmaceuticals

- Large complex molecules present in Municipal Wastewater
  - Types: Hormones (ie birth control), analgesics, antibiotics, antipsychotics etc
  - Mechanism: Electro-oxidation
  - Effectiveness: 80-99% removal
  - Dependant upon concentration and molecule type
- Trace amounts in water supply, lakes, rivers
- Difficult to remove with biological processes
# Pharmaceutical Removal Efficacy

<table>
<thead>
<tr>
<th>Compound Name</th>
<th>Units</th>
<th>Raw</th>
<th>Treated</th>
<th>RDL</th>
<th>% Removal</th>
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<tbody>
<tr>
<td>Acetaminophen</td>
<td>(µg/L)</td>
<td>61</td>
<td>&lt;0.01</td>
<td>0.01</td>
<td>99.98</td>
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<td>Benzaflbrate</td>
<td>(µg/L)</td>
<td>0.288</td>
<td>&lt;0.0001</td>
<td>0.0001</td>
<td>99.97</td>
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<tr>
<td>Caffeine</td>
<td>(µg/L)</td>
<td>37.1</td>
<td>&lt;0.0005</td>
<td>0.0005</td>
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<tr>
<td>Carbamazepine</td>
<td>(µg/L)</td>
<td>3.19</td>
<td>&lt;0.0001</td>
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<tr>
<td>Pentoxyfilline</td>
<td>(µg/L)</td>
<td>0.0272</td>
<td>&lt;0.0001</td>
<td>0.0001</td>
<td>99.63</td>
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<tr>
<td>Sulfamethoxazole</td>
<td>(µg/L)</td>
<td>0.204</td>
<td>&lt;0.0005</td>
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<td>Trimethoprim</td>
<td>(µg/L)</td>
<td>0.329</td>
<td>&lt;0.0001</td>
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<td>Miconazole</td>
<td>(µg/L)</td>
<td>0.0515</td>
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<td>Diphényllhydramine</td>
<td>(µg/L)</td>
<td>0.421</td>
<td>0.000169</td>
<td>0.0001</td>
<td>99.96</td>
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<td>Azithromycin</td>
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<td>Ciprofloxacin</td>
<td>(µg/L)</td>
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<td>0.066</td>
<td>0.02</td>
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<td>Ofloxacin</td>
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<td>0.0117</td>
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<td>Erythromycin</td>
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<td>Ibuprofen</td>
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<td>Naproxen</td>
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<td>Diclofenac</td>
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<td>Irgasan</td>
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<td>Triclocarban</td>
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<td>Tetracycline</td>
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<td>0.975</td>
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<td>94.87</td>
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Contact

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