Compressible Media Filter 
(Schreiber Fuzzy Filter)

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Presentation Outline

• Compressible Media Filtration Technology
• Fuzzy Filter for Tertiary Phosphorus Removal
• Fuzzy Filter for Carbon Diversion
• Discussion
High-Rate Filtration Technology

- Tertiary treatment
- Water reuse (Title 22)
- CSO treatment
- Industrial applications
- Primary effluent filtration

Schreiber Fuzzy Filter

Compressible Synthetic Media
Filter Media Properties

- Made from a high grade Polymer – PPS polyphenylene sulfide
- Resistant to heat, acids, bleaches, aging, sunlight, and abrasion
- Easy to clean
- Highly porous with 85 % void ratio
- Proven Life of 10+ years!

Simple Filter Design
Design Features

- High filtration rate (30 to 40 gpm/ft²)
- Inlet pressure < 8 psi - Gravity effluent discharge
- Solids storage capacity 1.2 lbs solids / cu. ft of media
- Influent water is used for washing filter media
- Low reject wash water (< 5%)
- Media compression up to 40% - High removal efficiency of small particles (5 microns)

Media Compression

Compression changes porosity in filter bed

More compression = Smaller voids to capture Small particles

Less compression = Larger voids to capture Large particles

\[
\text{Media Compression Ratio (CR)} = 1 - \frac{\text{Compressed Media Depth}}{\text{Uncompressed Media Depth}}
\]
Reject Wash Water Ratio

\[
RWW \ ratio \ % = \frac{W_W}{(W_W + W_F)} \times 100\%
\]

Where \( W_B \) is wash water and \( W_F \) is total filtered water

- Conventional filters RWW ratio is 6-15%
- Fuzzy filter RWW ratio is 2-4%

Max. Operating Headloss

[Diagram showing solids accumulation, typical headloss, clean media, and max. headloss, along with wash water and air flow paths.]
Standard Filter Vessel

### Filter Model

<table>
<thead>
<tr>
<th>Filter Model</th>
<th>Design Flow @ 30 gpm/ft²</th>
<th>gpm</th>
<th>mgd</th>
</tr>
</thead>
<tbody>
<tr>
<td>18” x 18”</td>
<td>67</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>2’ x 2’</td>
<td>120</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>3’ x 3’</td>
<td>270</td>
<td>0.39</td>
<td></td>
</tr>
<tr>
<td>4’ x 4’</td>
<td>480</td>
<td>0.69</td>
<td></td>
</tr>
<tr>
<td>5’ x 5’</td>
<td>750</td>
<td>1.08</td>
<td></td>
</tr>
<tr>
<td>6’ x 6’</td>
<td>1080</td>
<td>1.56</td>
<td></td>
</tr>
<tr>
<td>7’ x 7’</td>
<td>1470</td>
<td>2.12</td>
<td></td>
</tr>
<tr>
<td>8’ x 8’</td>
<td>1920</td>
<td>2.76</td>
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</tbody>
</table>

- Vessel material:
  - Hot dip galvanized steel
  - Epoxy coated carbon steel
  - 304 stainless steel

Standard 7’x7’ Filter

![Standard 7’x7’ Filter Diagram]
Standard 7’x7’ Filter

Inlet Strainer

Stainless steel strainer (with 0.25” openings) traps larger solids to protect filter media
Filters shipped assembled
With media loaded!

Offload Filter
Place on Pad

Make Piping & Electrical Connections.
Filter is Ready for Start-up!
Termination of Filtration Cycle

- Medium head loss reaches a preset level (e.g. 7 psi)
- Effluent Turbidity reaches a preset value (e.g. 1.9 NTU)
- Preset filtration cycle time (e.g. 8 hours) is met

Wash Cycle

- Media Wash (20 minutes)
- Purge (10 minutes)
Filter Media Maintenance

- Media deep cleaning with bleach and detergent is highly recommended every 12 months
- Customized detergent formulation determined through lab testing
Limits of Phosphorus Removal

<table>
<thead>
<tr>
<th>Phosphorus Removal Process</th>
<th>Effluent TP Concentration</th>
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<tbody>
<tr>
<td>Biological phosphorus removal</td>
<td>TP &gt; 1.0 mg/L</td>
</tr>
<tr>
<td>Chemical addition before secondary clarifier (co-precipitation)</td>
<td>TP &lt; 1.0 mg/L and &gt; 0.5 mg/L</td>
</tr>
<tr>
<td>Co-precipitation followed by tertiary phosphorus removal technology</td>
<td>TP &lt; 0.5 mg/L and &gt; 0.1 mg/L</td>
</tr>
<tr>
<td>Chemical treatment after secondary clarifier followed by tertiary phosphorus removal technology (post-precipitation)</td>
<td>TP &lt; 0.1 mg/L and &gt; 0.05 mg/L</td>
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</tbody>
</table>

Tertiary P Removal Technologies

<table>
<thead>
<tr>
<th>Tertiary Phosphorus Removal Technology</th>
<th>Commercial Name</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressible Media Filter</td>
<td>• Fuzzy Filter</td>
<td>• Schreiber</td>
</tr>
<tr>
<td></td>
<td>• WWETCO FlexFilter</td>
<td>• Westech</td>
</tr>
<tr>
<td>High-Rate Clarification</td>
<td>• Actiflo</td>
<td>• Veolia</td>
</tr>
<tr>
<td></td>
<td>• AquDAF</td>
<td>• Suez</td>
</tr>
<tr>
<td></td>
<td>• CoMag</td>
<td>• Evoqua</td>
</tr>
<tr>
<td>Continuous Backwash Sand Filters</td>
<td>• Blue PRO</td>
<td>• Blue Water</td>
</tr>
<tr>
<td></td>
<td>• DynaSand</td>
<td>• Parkson</td>
</tr>
<tr>
<td>Cloth Media Filters and Disk Filters</td>
<td>• AquaDiamond</td>
<td>• Aqua Aerobic</td>
</tr>
<tr>
<td></td>
<td>• AquaDisk</td>
<td>• Aqua Aerobic</td>
</tr>
<tr>
<td></td>
<td>• Hydrotech Discfilter</td>
<td>• Veolia</td>
</tr>
</tbody>
</table>
Removal of Phosphorus

Forms of Phosphorus

- Phosphorus (P) occurs mostly as Phosphates (PO₄).
- These are classified as Orthophosphates (reactive phosphates), Condensed Phosphates (pyro, meta, and polyphosphates) and Organic Phosphates.

<table>
<thead>
<tr>
<th>Phosphorus Fraction</th>
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<tbody>
<tr>
<td>Total Phosphate (dissolved + solids)</td>
<td></td>
</tr>
<tr>
<td>Ortho-P Reactive (dissolved + solids)</td>
<td></td>
</tr>
<tr>
<td>Dissolved Total Phosphate</td>
<td></td>
</tr>
<tr>
<td>Dissolved Ortho-P Reactive</td>
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</tr>
</tbody>
</table>

To achieve < 0.1 mg/L P in effluent, dissolved (soluble) reactive P should be converted into solid before filtration.

Fuzzy Filter Pilot Unit

- Automated pilot trailer equipped with 18”x18” filter
- Flat topography is required
- Should be within 50’ of influent source and effluent drop point
- Requires 480/3/60 electrical supply at 40 Amps
- Influent flow 70 gpm at 8 psig max pressure
Pilot Accessories & Instruments

- Flex piping with quick disconnect couplings
- Submersible pump
- Power cord for 480/3/60 supply
- Turbidity meters
- Data logging system
- Magnetic flow meter
- Pressure sensor
- PLC with touch screen

Pilot Fuzzy Filter Rental Agreement

- Schreiber Technician – 3 to 5 days for set-up, start-up, operation & training
- Submit Test Report including data, graphs and operation & performance summary
- $5,000 plus Transportation Expense for 2 Week Test Program
Fuzzy Filter Installations

Northeast Water Reclamation Facility

- Customer: Clayton County
- Location: Georgia
- Operational: Fall 2001
- Number: 9 filters
- Size: 7 ft x 7 ft
- Capacity: 25 MGD
- Application: Tertiary

- Effluent phosphorus limit of 0.17 mg/L
- Coagulation and flocculation tank upstream of Fuzzy Filters

Fuzzy Filter Installations

Lakes Area Sewer Authority WWTP

- Customer: Cass County
- Location: Michigan
- Operational: Fall 2010
- Number: 2 filters
- Size: 3 ft x 3 ft
- Capacity: 0.25 MGD
- Application: Tertiary

- Effluent phosphorus limit of 0.2 mg/L
- Co-precipitation followed by Fuzzy Filter
Fuzzy Filter Installations

Upper Montgomery Joint Authority WWTP

- Customer: Montgomery
- Location: Pennsylvania
- Construction: 2017
- Number: 4 filters
- Size: 7 ft x 7 ft
- Capacity: 9 MGD
- Application: Tertiary

- Effluent phosphorus limit of 0.1 mg/L
- Coagulation and flocculation tank upstream of Fuzzy Filters

Fuzzy Filter Modular Design
Fuzzy Filter Modular Design

Primary Effluent Filtration (PEF) using Fuzzy Filter for Carbon Diversion
Pilot-Scale Demonstration Project

• Two year PEF demonstration project at Linda WWTP in California evaluating 5 filtration technologies

Advantages of PEF for Carbon Diversion

• Increases digester gas flow by 35 to 40%
• Reduces blower power requirement by 20 to 25%
• Increases secondary process capacity by 30 to 35%
Benefits of Fuzzy Filter

- High rate filtration up to 40 gpm/SF
- Small footprint - Use of existing structures
- Low backwash reject water
- Easy maintenance
- Reliable tertiary treatment - Effluent P < 0.1 mg/L
- PEF for carbon diversion

Thank you for your time!

QUESTIONS?

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