Applicability of biological phosphorus removal (BPR) process for Kraft pulp mill wastewater treatment

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Why BPR

• BPR is widely used for the removal phosphorus from municipal wastewater
• BRR is a cost effective process, require less air supply and no chemical use
• An existing activated sludge plant can be easily modified to an BPR process
• Kraft pulp mill wastewater characteristics are Suitable for BPR (BOD:P ratio)
Basic BPR Process

ACTIVATED SLUDGE PROCESS

INFLUENT → AERATION TANK → CLARIFIER → EFFLUENT → RETURN ACTIVATED SLUDGE → SLUDGE

BIOLOGICAL PHOSPHORUS REMOVAL PROCESS

INFLUENT → ANAEROBIC TANK → AERATION TANK → CLARIFIER → EFFLUENT → RETURN ACTIVATED SLUDGE → SLUDGE

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LAB SCALE SYSTEM

• 4 Sequencing batch reactors (SBRs) with 1L volume each
• Each SBR had a cycle time 12 H, 2 cycle per day
• 3 SBRs (R1, R2, R4) had anaerobic-aerobic sequence (BPR)
• 1 SBR had only aerobic stage (Activated Sludge process)
• Experiments were conducted for 3 months
SBR Stages

1. Filling
2. Anaerobic
3. Aerobic
4. Settling
5. Decanting
# OPERATING CONDITIONS of LAB SCALE SYSTEM

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SBR Reactors</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>R0</td>
</tr>
<tr>
<td>HRT anaerobic (h)</td>
<td>0</td>
</tr>
<tr>
<td>HRT aerobic (h)</td>
<td>10</td>
</tr>
<tr>
<td>Settling (h)</td>
<td>2</td>
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<tr>
<td>Temperature (°C)</td>
<td>35</td>
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<tr>
<td>MLSS (mg/L)</td>
<td>3150</td>
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<td>MLVSS (mg/L)</td>
<td>2767</td>
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</table>
# EXPERIMENTAL RESULTS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Influent (mg/L)</th>
<th>Effluent (mg/L)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>R0</td>
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<tr>
<td>COD</td>
<td>903,5</td>
<td>441</td>
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<td>BOD</td>
<td>360</td>
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<tr>
<td>P total</td>
<td>0,9</td>
<td>0,65</td>
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</tbody>
</table>

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Influent and effluent BOD contents of Lab scale SBR reactors

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Influent and effluent COD contents of Lab scale SBR reactors

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Influent and effluent total phosphorus contents of Lab scale SBR reactors

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OTHER EFFLUENT PARAMETERS

- AOX Below 3mg/L
- pH 7.8
- Effluent soluble phosphorus (R1) below 0.3 mg/L
Conclusions

• Phosphorus content of BPR reactor effluents were lower than that of Activated sludge reactor and mill activated sludge wastewater treatment process.

• The values of other major effluent parameters such as COD, BOD, AOX, were very similar for all the reactors and actual waste water treatment plant.

• Biological phosphorus removal process may be applied for the treatment of Kraft pulp mill waste water treatment. More research is necessary.
Thanks