1. Introduction

The Phos4You I6 work package tasked Munster Technological University (MTU) and Veolia with establishing, commissioning, and optimising a phosphorus recovery plant at an Irish Municipal Wastewater Treatment Plant (WWTP), with a design range of 500-50,000 population equivalent (PE). After extensive investigation Macroom WWTP (Figure 1) was selected as it is:

- Representative of a typical Irish WWTP (population served, influent type, treatment processes etc.)
- A design load of 5,230 PE.
- Standard treatment process comprised of primary screening, extended aeration tank and sedimentation.
- Chemical or biological P removal not practiced.

The fully automated Struvia TM Demonstrator with fluidised bed P-recovery plant and designed for struvite precipitation was modified to recover calcium phosphate from Macroom WWTP effluent (Figures 2, 3 and 5).

2. P-Recovery Methodology

Laboratory jar tests undertaken indicated that P removal from Macroom WWTP effluent occurred at or above pH 10.0 with the most efficient removal (< 1 mg/l PO 4-3 ) at pH of 10.8. The pilot plant was commissioned as follows:

- pH maintained at 10.8
- Hydraulic retention time of 30 minutes
- 0.4mg/l of cationic polymer dosed to improve flocculation
- Chemical sludge recirculated as seed material.
- Pilot plant operation at pH of 10.6, 10.4 and 10.0.
- Satisfactory removal rates were achieved for P, TN, COD and TSS (for pH of 10.8), see Table 1.
- The long-term sustainability of lime precipitation for large scale treatment plant use requires further study – issues include elevated effluent usage.

3. P-Rich Product Results

The process produced recovered Calcium Phosphate (Figure 4) with the following characteristics:

- 4.9% P 2 O 5
- 0.1% K 2 O
- 3.5% MgO
- 45% C 3 O
- 0.6% Total N

- Prior to pilot plant commissioning, all health and safety, environmental and legal requirements were completed.

4. Discussion

- Satisfactory removal rates were achieved for P, TN, COD and TSS (for pH of 10.8), see Table 1.
- Laboratory jar test results were not fully transferred to the pilot plant, with consistent PO 4-3 removal patterns only achieved at pH of 10.8.
- The Pilot Plant operated most effectively at a pH level of 10.8 with a P-removal efficiency of 60%; a simultaneous reduction in Total Nitrogen and COD was found.
- The effluent from the pilot plant had an elevated pH and alkalinity which requires further investigation.
- Approximately 60 kg of dry recycled calcium phosphate was recovered; some was used for growth trials on the MTU Campus and more for the Phos4You quality assessment work package.

5. Conclusions

- The Struvia TM pilot plant was commissioning and operated successfully at Macroom WWTP for 12 weeks.
- The Pilot Plant operated most effectively at a pH level of 10.8 with a P-removal efficiency of 60%; a simultaneous reduction in Total Nitrogen and COD was found.
- The effluent from the pilot plant had an elevated pH and alkalinity which requires further investigation.
- Approximately 60 kg of dry recycled calcium phosphate was recovered; some was used for growth trials on the MTU Campus and more for the Phos4You quality assessment work package.

Table 1: Pilot plant influent/effluent removal rates (pH of 10.8) with WWTP Emission Limit Value (ELV) (own Illustration)

<table>
<thead>
<tr>
<th>Units</th>
<th>ELV</th>
<th>Pilot Plant Influent (at pH 10.8)</th>
<th>Pilot Plant Effluent</th>
</tr>
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<tbody>
<tr>
<td>pH</td>
<td>pH units</td>
<td>6-9</td>
<td>6.81</td>
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<tr>
<td>COD</td>
<td>mg/l</td>
<td>125</td>
<td>88.10</td>
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<tr>
<td>TSS</td>
<td>mg/l</td>
<td>25</td>
<td>32.38</td>
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<tr>
<td>PO 4-P</td>
<td>mg/l</td>
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<tr>
<td>Ammonia</td>
<td>(as N)</td>
<td>2</td>
<td>N/A</td>
</tr>
</tbody>
</table>

References

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