In order to meet the stringent phosphorus and total suspended solids discharge limits for effluent polishing of wastewater treatment plants, Nijhuis Industries designed a proven and robust tertiary treatment solution (Tertiary i-DAF) to effectively remove phosphorus and suspended solids from wastewater to:

- Total phosphorus levels between 0.15 - 0.4 mg/l
- Total suspended solids < 20 mg/L
- BOD/COD removal of 60 - 80%

Based on the innovative and intelligent Nijhuis dissolved air flotation system (i-DAF), the solution works in combination with the Nijhuis intelligent dosing system (i-DOSE). In comparison to other tertiary treatment methods, the Nijhuis tertiary i-DAF solution minimizes chemical dosing and maximizing the removal efficiency of phosphorus, TSS and COD across fluctuating solids concentrations from post sedimentation tanks.

**APPLICATION**

Compact tertiary DAF treatment after post sedimentation (effluent polishing) for phosphorus and total suspended solids removal from wastewater, to meet stringent discharge limits.

**CUSTOMER BENEFITS**

1. Effective tertiary treatment removal of phosphorus and TSS
2. Minimized chemical dosing costs due to i-DOSE
3. Proven, compact and modular retrofit solution after existing post settlers or replacement of post sedimentation (activated sludge flotation + phosphorus removal)
4. Continuous process: no backwash water back to existing WWTP and no downtime
5. Reduced sludge processing costs due to high dry solids ratio from DAF (3-5%)
6. Extra safeguard against sludge washouts from post sedimentation
**TECHNICAL DESCRIPTION**

The Nijhuis Tertiary i-DAF comprises of a **reaction tank for coagulation** and a **reaction tank for flocculation**. A coagulant is added to precipitate phosphates and a polymer is added to flocculate the coagulated particles. The flocs are removed in the i-DAF by using **dissolved air flotation** resulting in relatively low phosphorus and suspended solids level in the wastewater effluent.

The effluent is partially recirculated and aerated under pressure to create the microbubbles which are the driving force of dissolved air flotation. The recirculated water is injected during the flocculation and DAF process in order to achieve the highest possible solid separation. Phosphate-rich sludge is thickened and skimmed of the top and can be further processed by dewatering or digestion.

**Intelligent dosing: double dosing control philosophy**

The i-DOSE real-time feed-forward and very slow real-time feed-back control strategy ensures an efficient precipitation of phosphates. Combined with an efficient flocculation and solid separation of the i-DAF, the total phosphorus removal is achieved at the lowest possible OPEX cost.

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**Results of the Nijhuis Tertiary i-DAF solution after Post Sedimentation Tanks (PST) of a WWTP in Engeland**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Effluent PST / Influent to Tertiary i-DAF</th>
<th>Effluent Tertiary i-DAF</th>
<th>Removal Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>average [min - max]</td>
<td>average [min - max]</td>
<td></td>
</tr>
<tr>
<td>TP</td>
<td>[mg/L]</td>
<td>5.09 [2.2 - 8.1]</td>
<td>0.36 [0.09 - 0.99]</td>
<td>93%</td>
</tr>
<tr>
<td>PO4-P</td>
<td>[mg/L]</td>
<td>4.2 [1.9 - 6.3]</td>
<td>0.10 [0.03 - 0.34]</td>
<td>98%</td>
</tr>
<tr>
<td>BOD</td>
<td>[mg/L]</td>
<td>14.3 [7.5 - 33.2]</td>
<td>3.1 [0.9 - 8.2]</td>
<td>78%</td>
</tr>
<tr>
<td>TSS</td>
<td>[mg/L]</td>
<td>29 [20 - 55]</td>
<td>7.5 [3 - 16]</td>
<td>74%</td>
</tr>
</tbody>
</table>

![Flowchart](image)

**Flowchart**

Nijhuis Tertiary i-DAF solution, polishing effluent after post sedimentation

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**Figure**

Results of the Nijhuis Tertiary i-DAF solution after Post Sedimentation Tanks (PST) of a WWTP in Engeland

![Graph](image)