Industrial Wastewater Treatment Using Biofilm Technology

The following is an overview of “A Study On the Biochemical Effects of Using BioCord™ to Treat Wastewater from the Production of Spandex Fibers” and “A Study of the effect of BioCord™ on Sludge Reduction in Spandex Fiber Production Wastewater Treatment”. National Conference on the Research of Sludge Treatment Technology and Resource Reuse.

The Challenge

The Hangzhou Yibang Spandex Co. plant in Hangzhou, China manufacturers Spandex fibers using a technique called dry spinning, where a liquid organic polymer methylene diphenyl diisocyanate (MDI) is extruded in a heated chamber to form a solid fiber. The resultant wastewater, as well as the byproduct from distilling and refining the MDI, gives an effluent that is heavy in organics, especially nitrogen.

The factory operated a traditional anoxic/aerobic activated sludge treatment process, where after a primary clarifier, the wastewater is sent to an anoxic tank used for denitrification, then aerobic tank for nitrification and organics removal. The system suffered from sludge bulking problems, excessive sludge production with high disposal costs, dirty looking effluent, and could not consistently meet discharge standards.

In February 2012, the plant decided to replace their existing activated sludge process with Biofilm Treatment using BioCord™ Technology.

Installation and Upgrade

The existing treatment system consisted of two trains, East and West. From day 1 to 13, the East train was shut down and retrofitted with BioCord™. From day 14 to 28, the West train was shut down for retrofitting, and the entire wastewater flow was directed through the East train. During this time, the system was able to meet BOD and TSS discharge standards. On day 28, both trains were restarted, and by day 31 the flow rate was increased from 12m³/h to 16m³/h. By day 34, the ammonia concentration in the effluent was less than 1mg/L, achieving regulatory standards.

Retrofit of Existing Treatment Tank
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**Effluent Results**

The addition of BioCord™ Reactors shows a considerable improvement in all effluent parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Influent (mg/L)</th>
<th>Effluent Before BioCord Retrofit (mg/L)</th>
<th>Effluent After BioCord Retrofit (mg/L)</th>
<th>Discharge Standards (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD</td>
<td>1045-4890</td>
<td>50-100</td>
<td>13-31</td>
<td>50</td>
</tr>
<tr>
<td>TSS</td>
<td>350-400</td>
<td>210-260</td>
<td>&lt;10</td>
<td>10</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>126-353</td>
<td>50-150</td>
<td>&lt;1</td>
<td>15</td>
</tr>
<tr>
<td>Ammonia</td>
<td>126-351</td>
<td>30-120</td>
<td>&lt;1</td>
<td>5</td>
</tr>
</tbody>
</table>

The efficient BioCord denitrification process has allowed the plant to reduce the denitrification return rate and eliminate having to dose the system with a carbon source and alkali, saving the operator $260,000 USD per year.

Since the end of the retrofit period, plant operation has been stable and without any issues.

**Sludge Reduction**

With the replacement of the activated sludge process with Biofilm treatment, there was a substantial reduction in the amount of sludge the plant had to waste every month, from 15 tons to 2.5 tons. This results in a saving of sludge production:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before Retrofit</th>
<th>After Retrofit</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sludge Production Yield Constant (kgMLSS/ kgCOD)</td>
<td>0.5187</td>
<td>0.067</td>
<td>86%</td>
</tr>
<tr>
<td>Waste Sludge per month (tons)</td>
<td>15</td>
<td>2.5</td>
<td>84%</td>
</tr>
</tbody>
</table>

**Advantages of Biofilm Treatment**

- Up to a 84% reduction in waste sludge generation, reduced disposal costs
- Easy to achieve nutrient removal, including ammonia and total nitrogen discharge regulations
- Simple, quick implementation with existing treatment basin and aeration system
- Reduced cost over new treatment basin construction
- Efficient denitrification that requires no addition of alkali or carbon source

**For further information or project evaluation contact Bishop Water Technologies**

www.bishopwater.ca
Phone: 343-361-0943
Fax: 1-844-722-0102

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