Terramycin Wastewater Treatment with Combination Hydrolysis Denitrification Nitrification

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Abstract: Successive hydrolysis-denitrification nitrification process is adopted to treat terramycin wastewater in lab scale for 70 days. Two sludge bed reactors are used respectively for hydrolysis and denitrification, and two biofilm reactors are used for nitrification. When the COD and NH₄⁺-N concentrations in influent were 2 200 - 3 000 mg/L and 400 - 460 mg/L, more than 80% COD and TN removals were achieved under a total HRT of 56h. The COD of the effluent was reduced to 293 mg/L through coagulation under a polyferic sulfate dose of 48 mg/L as Fe³⁺.

Key words: terramycin wastewater; hydrolysis; denitrification; nitrification; nitrogen removal

Table 1  Characteristics of Terramycin wastewater / mg·L⁻¹

<table>
<thead>
<tr>
<th>COD</th>
<th>BOD₅</th>
<th>TN</th>
<th>NH₄⁺-N</th>
<th>NO₃⁻-N</th>
<th>SO₄²⁻</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 000 - 12 000</td>
<td>2 400 - 2 800</td>
<td>1 800 - 2 100</td>
<td>1 600 - 1 800</td>
<td>1 100 - 1 300</td>
<td>4 000 - 5 000</td>
</tr>
</tbody>
</table>

1. Method

1.1 Reactor characteristics

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

1.2 Experimental conditions

20 °C ± 1 °C

References: 2003-12-18; 2004-02-16; 2009-02-12; 2009-12-18 (863) @ (2002 AA601310)
(d = 80 mm, h = 800 mm)  
(d = 80 mm, h = 600 mm)  
(d = 120 mm, h = 1700 mm)  
(d = 120 mm, h = 1200 mm)  
(USB)  
2 RPM  
30 RPM  

100 mm, 25 mm.

4  
5  

(NUR)

2  

500 mL  

125 mL  

NO$_3^-$ - N  

Fig. 1 Schematic diagram of test process

1.3

COD$_C$, BOD$_5$, NH$_4^+$ - N, NO$_3^-$, NO$_2^-$, SO$_4^{2-}$, pH, CTL-12, OXI TOP 12, BOD, NH$_4^+$ - N, NO$_3^-$, NO$_2^-$, SO$_4^{2-}$, pH, CTL-12, OXI TOP 12, BOD,  

IC100, YE W YOKOGAWA HOKUSHIN ELECTRIC. pH H M-14P pH H M-14P  

722S  

2  

2.1

COD, NH$_4^+$ - N  

2  

3  

COD, NH$_4^+$ - N  

2 200 ~ 3000 mg/ L 400 ~ 460 mg/ L  

COD  

450 ~ 550 mg/ L  

NH$_4^+$ - N  

4 mg/ L, COD  

TN  

80 %

Fig. 2 Variation of COD concentrations

Fig. 3 Variation of NH$_4^+$ - N concentrations

4  

pH  

NH$_4^+$ - N  

pH  

2 mg/ L  

pH  

NH$_4^+$ - N  

pH  

NO$_3^-$ - N  

5  

33 %  

60 %  

COD  

67 %  

BOD$_5$  

SO$_4^{2-}$  

H$_2$S  

70 %  

SO$_4^{2-}$  

COD  

COD  

COD  

COD
Table 2 COD, BOD$_5$, NH$_4^+$, NO$_2^-$, NO$_3^-$, SO$_4^{2-}$, alkalinities and terramycin concentrations in different reactors/ mg·L$^{-1}$

<table>
<thead>
<tr>
<th></th>
<th>COD</th>
<th>BOD$_5$</th>
<th>NO$_2^-$</th>
<th>NO$_3^-$</th>
<th>SO$_4^{2-}$</th>
<th>Alk</th>
<th>Terramycin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactor 1</td>
<td>3013</td>
<td>1025</td>
<td>457</td>
<td>0</td>
<td>345</td>
<td>17</td>
<td>2887</td>
</tr>
<tr>
<td>Reactor 2</td>
<td>2830</td>
<td>1300</td>
<td>508</td>
<td>0</td>
<td>25</td>
<td>109</td>
<td>3125</td>
</tr>
<tr>
<td>Reactor 3</td>
<td>646</td>
<td>90</td>
<td>98</td>
<td>0</td>
<td>198</td>
<td>6</td>
<td>1270</td>
</tr>
<tr>
<td>Reactor 4</td>
<td>503</td>
<td>25</td>
<td>2</td>
<td>97</td>
<td>205</td>
<td>4</td>
<td>512</td>
</tr>
<tr>
<td>Reactor 5</td>
<td>483</td>
<td>20</td>
<td>1</td>
<td>98</td>
<td>213</td>
<td>2</td>
<td>494</td>
</tr>
</tbody>
</table>

80% \(\text{COD} \leq 48 \text{mg/L} \), PFS \(\text{COD} \leq 300 \text{mg/L}\).

Fig. 4 Effects of pH on effluent NH$_4^+$ concentration.

Fig. 5 Effects of hydrolysis on wastewater denitrification potential.

2.2 Effects of PFS and PACI dosage in nitrification effluent:

- (2) \(\text{SO}_4^{2-}\):
- (3) \(\text{pH} = 7.9\)

3.1

(1) 4\(\text{COD} \leq \text{NH}_4^+\) \(\leq 2\) mg/L, COD \(\leq 2\) mg/L, COD \(\leq \text{TN} \leq 2\) mg/L.