Removal of antibiotics and antibiotic resistance genes in veterinary hospital effluent by alternative fungal treatment

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Antibiotic compounds have been widely used for many years, not only to treat infectious diseases in human and veterinary medicine, but also as growth promoters in animal production. Despite their usefulness, there are certain facts regarding these compounds, which convert them into one of the biggest health concerns. First of all, their overuse and low degradation rates usually observed in some of them during wastewater treatment have led to a situation in which antibiotics are continuously released into aquatic ecosystems [1]. It is also known that, even at low concentrations, antibiotics could lead to the emergence and spread of antibiotic-resistant bacteria, compromising the effectiveness of antimicrobial therapy because the infectious organisms are becoming resistant to commonly prescribed antibiotics.

Given this scenario, the need to develop new technologies to achieve better removal rates for the antibiotics emerges. One of these new technologies is the fungal treatment of wastewater, which includes the use of the white-rot fungus Trametes versicolor. Although this technology has previously shown quite good removal rates for other pharmaceutical compounds, in this study the fungal treatment has been tested for the removal of a large group of antibiotics, including representatives of the most common used (macrolides, tetracyclines, β-lactams, sulfonamides, quinolones and fluoroquinolones). The effluent treated was from a veterinary hospital, where antibiotic concentrations are relatively high. The efficiency of the fungal treatment was also analyzed from a microbiological point of view, analyzing the behavior of different antibiotic resistance genes (ARGs), such as ermB (resistance to macrolides), tetW (resistance to tetracyclines), blaTEM (resistance to β-lactams), sul I (resistance to sulfonamides) and qnrS (reduced susceptibility to fluoroquinolones).

Based on removal rates of both antibiotics and ARGs, the fungal treatment emerges as a good technology, specially comparing the removal rates with those obtained from conventional wastewater treatment plants (WWTPs). Moreover, the fungal treatment showed very good removal rates for some compounds such as ciprofloxacin, enrofloxacin, marbofloxacin and ampicillin which are quite recalcitrant in conventional WWTPs [1]. In the case of the relative number of ARGs, the fungal treatment showed better removal rates than those obtained in conventional WWTPs [2].

Comparison of relative removal rates of ARGs analyzed between this study and previous reports.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>ermB</th>
<th>qnrS</th>
<th>sul I</th>
<th>tetW</th>
<th>blaTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fungal treatment</td>
<td>100%</td>
<td>-163%</td>
<td>56%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Conventional WWTP</td>
<td>82%</td>
<td>-302%</td>
<td>-58%</td>
<td>87%</td>
<td>-156%</td>
</tr>
</tbody>
</table>

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References