Supplementary Materials

The anaerobic biodegradation of emerging organic contaminants by horizontal subsurface flow constructed wetlands

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Supplementary materials 1: The design and operational factors and treatment performance of horizontal subsurface flow constructed wetland (HFCW) for the removal of emerging organic contaminants (EOCs) (pharmaceuticals-PhCs, personal care products-PCPs, and steroidal hormones-SHs).

Table S1. The performance of HFCW for pharmaceuticals removal.

<table>
<thead>
<tr>
<th>Scale/ type of treatment</th>
<th>WT</th>
<th>PhCs</th>
<th>Depth (m)/ Area (m² PE⁻¹)</th>
<th>T (°C)/pH</th>
<th>HLR (m³ m⁻² d⁻¹)/ OM</th>
<th>OLR (g COD m⁻² d⁻¹)</th>
<th>HRT (days)/ SA/ED (months)</th>
<th>Filter media (mm)/Plants</th>
<th>Effluent DO (mg L⁻¹)/ ORP (Inf/ Eff) (mV)</th>
<th>Influent/ Effluent conc. (μg L⁻¹)</th>
<th>Removal rate (mg m⁻² d⁻¹)/Removal (%)</th>
<th>Author/ Country</th>
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<td>Lab/ Primary S</td>
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<td>Ibuprofen</td>
<td>0.5/NA</td>
<td>NA/NA</td>
<td>0.02/NA</td>
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<td>8.6/4.0/1.0</td>
<td>35 cm Gravel (3.5)/ Phragmites australis</td>
<td>&lt; 0.05/NA</td>
<td>25/12</td>
<td>0.2/52</td>
<td>Matamoros et al. (2008)/ Spain</td>
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<td>35 cm Gravel (3.5)/ Phragmites australis</td>
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<td>0.04/NA</td>
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<td>Dordio et al. (2010)/ Portugal</td>
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<th>Depth (m)/ Area (m² PE⁻¹)</th>
<th>T (°C)/pH</th>
<th>HLR (m³ m⁻² d⁻¹)/OM</th>
<th>OLR (g COD m⁻³ d⁻¹)</th>
<th>HRT (days)/ SA/ED (months)</th>
<th>Filter media (mm)/Plants</th>
<th>Effluent DO (mg L⁻¹)/ ORP (Inf/Eff) (mV)</th>
<th>Influent/ Effluent conc. (μg L⁻¹)</th>
<th>Removal rate (mg m⁻² d⁻¹)/Removal (%)</th>
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<td>Effluent DO (mg L⁻¹)/ORP (Inf/Eff) (mV)</td>
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Dan et al. (2013)/China
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<th>OLR (g COD m⁻³ d⁻¹)</th>
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8
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<td>T</td>
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<td>T (°C)</td>
<td>pH</td>
<td>HLR (m³ m⁻² d⁻¹)/OM</td>
<td>OLR (g COD m⁻³ d⁻¹)</td>
<td>HRT (days)/SA/ED (months)</td>
<td>Filter media (mm)/Plants</td>
<td>Effluent DO (mg L⁻¹)/ORP (Inf/Eff) (mV)</td>
<td>Influent/Effluent conc. (μg L⁻¹)</td>
<td>Removal rate (mg m⁻² d⁻¹)/Removal (%)</td>
<td>Author/Country</td>
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<td>0.8/5.0</td>
<td>NA/NA</td>
<td>0.03/NA</td>
<td>13</td>
<td>6.5/120/6</td>
<td>80 cm Gravel (4-8)/Phragmites australis</td>
<td>NA/NA</td>
<td>10/0.1</td>
<td>0.3/99</td>
<td>NA/NA</td>
<td>Chen et al. (2016b)/Czech Republic</td>
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<td>Naproxen</td>
<td>0.8/5.0</td>
<td>NA/NA</td>
<td>0.03/NA</td>
<td>13</td>
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<td>0.03/NA</td>
<td>13</td>
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<td>As above</td>
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<td>Depth (m)/ Area (m² PE⁻¹)</td>
<td>Temp (°C) / pH</td>
<td>HLR (m³ m⁻² d⁻¹)/ OM</td>
<td>OLR (g COD m⁻³ d⁻¹)</td>
<td>HRT (days)/ SA/ED (months)</td>
<td>Filter media (mm)/Plants</td>
<td>Effluent DO (mg L⁻¹)/ ORP (Inf/Eff) (mV)</td>
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<td>Removal rate (mg m⁻² d⁻¹)/Removal (%)</td>
<td>Author/ Country</td>
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<td>5.4/144/6</td>
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<td>Chen et al. (2016b)/ Czech Republic</td>
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<td>10/0.0</td>
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<td>Chen et al. (2016b)/ Czech Republic</td>
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<td>Ibuprofen</td>
<td>0.5/20 20/6.5</td>
<td>0.05/CF</td>
<td>6.0</td>
<td>3/36/3</td>
<td>45 cm Siliceous gravel (4.0)/Phragmites australis</td>
<td>0.2/(-100/-102)</td>
<td>10/9.2</td>
<td>0.06/12</td>
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<td>As above</td>
<td>1.7/0.7</td>
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<td>6.0</td>
<td>3/36/3</td>
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<td>As above</td>
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<td>0.05/CF</td>
<td>6.0</td>
<td>1.7/36/3</td>
<td>45 cm Siliceous gravel (4.0)/Unplanted</td>
<td>0.2/(-100/-155)</td>
<td>10/9.2</td>
<td>0.06/12</td>
<td>Hijosa-Valsero et al. (2016)/ Spain</td>
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<td>6.0</td>
<td>1.7/36/3</td>
<td>As above</td>
<td>As above</td>
<td>1.7/0.8</td>
<td>0.04/52</td>
<td>Hijosa-Valsero et al. (2016)/ Spain</td>
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<td>6.0</td>
<td>1.7/36/3</td>
<td>As above</td>
<td>As above</td>
<td>0.4/0.7</td>
<td>NR</td>
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<td>As above</td>
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<td>S</td>
<td>Ibuprofen</td>
<td>0.3/NA 29/6.5</td>
<td>0.25/CF</td>
<td>75</td>
<td>4/11/10</td>
<td>30 cm Gravel (20-24)/Typha angustifolia</td>
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<td>100/55</td>
<td>11/45</td>
<td>Li et al. (2016a)/ Singapore</td>
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<td>T</td>
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<td>Depth (m)/Area (m² PE⁻¹)</td>
<td>T (°C)/pH</td>
<td>HLR (m³ m⁻² d⁻¹)/OM</td>
<td>OLR (g COD m⁻³ d⁻¹)</td>
<td>HRT (days)/SA/ED (months)</td>
<td>Filter media (mm)/Plants</td>
<td>Effluent DO (mg L⁻¹)/ORP (Inf/Eff) (mV)</td>
<td>Influent/Effluent conc. (μg L⁻¹)</td>
<td>Removal rate (mg m⁻² d⁻¹)/Removal (%)</td>
<td>Author/Country</td>
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<td>T (°C)</td>
<td>HLR (m³ m⁻² d⁻¹)/OM</td>
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<td>Filter media (mm)/Plants</td>
<td>Effluent DO (mg L⁻¹)/ORP (Inf/Eff) (mV)</td>
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<td>Removal rate (mg m⁻² d⁻¹)/Removal (%)</td>
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<td>PhCs</td>
<td>Depth (m)</td>
<td>T (°C) / pH</td>
<td>HLR (m³ m⁻² d⁻¹)</td>
<td>OLR (g COD m⁻³ d⁻¹)</td>
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<td>Effluent DO (mg L⁻¹)/ ORP (Inf/Eff) (mV)</td>
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<td>Removal rate (mg m⁻² d⁻¹)/Removal (%)</td>
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<td>T</td>
<td>PhCs</td>
<td>Depth (m)/Area (m² PE⁻¹)</td>
<td>T (°C)/pH</td>
<td>HLR (m³ m⁻² d⁻¹)/OM</td>
<td>OLR (g COD m⁻³ d⁻¹)</td>
<td>HRT (days)/SA/ED (months)</td>
<td>Filter media (mm)/Plants</td>
<td>Effluent DO (mg L⁻¹)/ORP (Inf/Eff) (mV)</td>
<td>Influent/Effluent conc. (μg L⁻¹)</td>
<td>Removal rate (mg m⁻² d⁻¹)/Removal (%)</td>
<td>Author/Country</td>
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<td>OLR (g COD m⁻³ d⁻¹)</td>
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<td>Filter media (mm)/Plants</td>
<td>Effluent DO (mg L⁻¹)/ORP (Inf/Eff) (mV)</td>
<td>Influuent/Effluent conc. (µg L⁻¹)</td>
<td>Removal rate (mg m⁻² d⁻¹)/Removal (%)</td>
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<td>3.4/NA</td>
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<td>32/7.2</td>
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<td>T (°C)</td>
<td>pH</td>
<td>HLR (m³ m⁻² d⁻¹)/OM</td>
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<td>HRT (days)/SA/ED (months)</td>
<td>Filter media (mm)/Plants</td>
<td>Effluent DO (mg L⁻¹)/ORP (Inf/Eff) (mV)</td>
<td>Influent/Effluent conc. (μg L⁻¹)</td>
<td>Removal rate (mg m⁻² d⁻¹)/Removal (%)</td>
<td>Author/Country</td>
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<td>As above</td>
<td>As above</td>
<td>As above</td>
<td>6.0/4.5</td>
<td>0.05/25</td>
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**Aerated HFCW**
<table>
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<tr>
<th>Scale/type of treatment</th>
<th>WT</th>
<th>PhCs</th>
<th>Depth (m)/Area (m² PE⁻¹)</th>
<th>T (°C) /pH</th>
<th>HLR (m³ m⁻² d⁻¹)/OM</th>
<th>OLR (g COD m⁻³ d⁻¹)</th>
<th>HRT (days)/SA/ED (months)</th>
<th>Filter media (mm)/Plants</th>
<th>Effluent DO (mg L⁻¹)/ ORP (Inf/Eff) (mV)</th>
<th>Influent/Effluent conc. (μg L⁻¹)</th>
<th>Removal rate (mg m⁻² d⁻¹)/Removal (%)</th>
<th>Author/Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot/Secondary</td>
<td>D</td>
<td>Diclofenac</td>
<td>0.8/2.5 15/7.2 0.3/IF</td>
<td>48</td>
<td>1/2/0.2</td>
<td>80 cm Gravel (8-16)/P. australis</td>
<td>As above</td>
<td>As above</td>
<td>8.1/NA</td>
<td>0.5/0.3</td>
<td>0.07/47</td>
<td>Auvinen et al. (2017) /Belgium</td>
</tr>
<tr>
<td>Pilot/Secondary</td>
<td>D</td>
<td>Diclofenac</td>
<td>0.8/1.0 16/7.0 0.5/IF</td>
<td>121</td>
<td>As above</td>
<td>As above</td>
<td>8.3/NA</td>
<td>0.7/0.6</td>
<td>1.1/18</td>
<td>Auvinen et al. (2017) /Belgium</td>
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</tr>
<tr>
<td>Pilot/Secondary</td>
<td>H</td>
<td>Diclofenac</td>
<td>0.8/1.1 12/7.3 0.2/IF</td>
<td>107</td>
<td>2/9/0.5</td>
<td>As above</td>
<td>8.9/NA</td>
<td>5.2/3.3</td>
<td>0.3/36</td>
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<tr>
<td>Pilot/Secondary</td>
<td>H</td>
<td>Sulfamethoxazole</td>
<td>0.8/1.1 12/7.3 0.2/IF</td>
<td>107</td>
<td>2/9/0.5</td>
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<td>8.9/NA</td>
<td>0.06/0.03</td>
<td>0.005/50</td>
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<tr>
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<td>H</td>
<td>Diclofenac</td>
<td>0.8/4.5 7.0/7.2 0.2/IF</td>
<td>27</td>
<td>2/9/0.5</td>
<td>As above</td>
<td>8.7/NA</td>
<td>2.4/1.4</td>
<td>0.2/40</td>
<td>Auvinen et al. (2017) /Belgium</td>
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<tr>
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<td>H</td>
<td>Sulfamethoxazole</td>
<td>0.8/4.5 7.0/7.2 0.2/IF</td>
<td>27</td>
<td>2/9/0.5</td>
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<td>8.7/NA</td>
<td>0.2/0.05</td>
<td>0.03/76</td>
<td>Kahl et al. (2017) /Germany</td>
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<tr>
<td>Pilot/Secondary</td>
<td>D</td>
<td>Ibuprofen</td>
<td>1.0/1.4 21/NA 0.1/CF</td>
<td>87</td>
<td>5.5/60/12</td>
<td>10/-277/4208</td>
<td>24/0.3</td>
<td>3.3/99</td>
<td>Nivala et al. (2019) /Germany</td>
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<tr>
<td>Pilot/Secondary</td>
<td>D</td>
<td>Naproxen</td>
<td>1.0/1.4 21/NA 0.1/CF</td>
<td>87</td>
<td>5.5/60/12</td>
<td>As above</td>
<td>3.0/0.05</td>
<td>0.4/98</td>
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<tr>
<td>Pilot/Secondary</td>
<td>D</td>
<td>Diclofenac</td>
<td>1.0/1.4 21/NA 0.1/CF</td>
<td>87</td>
<td>5.5/60/12</td>
<td>As above</td>
<td>6.0/1.5</td>
<td>0.6/75</td>
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<td>Ibuprofen</td>
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<td>90</td>
<td>5.5/60/12</td>
<td>10/-270/4183</td>
<td>25/0.3</td>
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<tr>
<td>Pilot/Secondary</td>
<td>D</td>
<td>Naproxen</td>
<td>1.0/1.3 12/6.9 0.1/CF</td>
<td>90</td>
<td>5.5/60/12</td>
<td>As above</td>
<td>4.0/0.04</td>
<td>0.5/99</td>
<td>Nivala et al. (2019) /Germany</td>
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<tr>
<td>Pilot/Secondary</td>
<td>D</td>
<td>Diclofenac</td>
<td>1.0/1.3 12/6.9 0.1/CF</td>
<td>90</td>
<td>5.5/60/12</td>
<td>As above</td>
<td>6.0/1.8</td>
<td>0.6/70</td>
<td>Nivala et al. (2019) /Germany</td>
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</table>

Note: Horizontal subsurface flow constructed wetland (HFCW); Wastewater type (WT); Domestic (D); Synthetic (S); Landfill leachate (L); Healthcare facility/hospital (H); Pharmaceuticals (PhCs); Temperature (T); Hydraulic loading rate (HLR); Operation mode (OM); Intermittently fed (IF); Continuously fed (CF); Organic loading rate (OLR); Chemical oxygen demand (COD); Hydraulic retention time (HRT); System age (SA); Experiment duration (ED); Dissolved oxygen (DO); Light expanded clay aggregates (LECA); Not available (NA); Not removed (NR). Domestic (55%) and Industrial discharge (45%) (*); The Population equivalent (PE) is calculated based on the common relation 1 PE = 60 g BOD d⁻¹. BOD values were approximated using the ratio COD/BOD = 2 in the studies where BOD was not reported (Dan et al., 2013; Matamoros et al., 2017; Auvinen et al., 2017), and COD values were approximated using the ratio COD = 2BOD in the studies where COD was not reported (Hijosa-Valsero et al., 2016; Kahl et al., 2017; Nivala et al., 2019).
Table S2. The performance of HFCW for personal care products removal.

<table>
<thead>
<tr>
<th>Scale/type of treatment</th>
<th>W</th>
<th>T</th>
<th>PCPs</th>
<th>Depth (m)/Area (m² PE⁻¹)</th>
<th>T (°C)/pH</th>
<th>HLR (m³ m⁻² d⁻¹)/OM</th>
<th>OLR (g COD m⁻² d⁻¹)</th>
<th>HRT (days)/SA/ED (months)</th>
<th>Filter media (mm)/Plants</th>
<th>Effluent DO (mg L⁻¹)/ORP (Inf/Eff) (mV)</th>
<th>Influent/Effluent conc. (μg L⁻¹)</th>
<th>Removal rate (mg m⁻² d⁻¹)/Removal (%)</th>
<th>Author/Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot/Secondary</td>
<td>D</td>
<td>Triclosan</td>
<td>0.5/8.4</td>
<td>NA/7.6</td>
<td>0.03/IF</td>
<td>14</td>
<td>5.5/NA/6</td>
<td>Gravel (8-32)/Phragmites australis</td>
<td>0.3/-91/48</td>
<td>1.0/0.9</td>
<td>0.003/8.0</td>
<td>Carranza-Diaz et al. (2014)/Germany</td>
<td></td>
</tr>
<tr>
<td>Pilot/Secondary</td>
<td>D</td>
<td>Triclosan</td>
<td>0.5/8.4</td>
<td>NA/7.7</td>
<td>0.03/IF</td>
<td>14</td>
<td>5.5/NA/6</td>
<td>As above/Unplanted</td>
<td>0.8/-91/ -84</td>
<td>1.0/0.95</td>
<td>0.001/2.0</td>
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<tr>
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<td>S</td>
<td>Triclosan</td>
<td>0.5/6.7</td>
<td>NA/NA</td>
<td>0.3/IF</td>
<td>18</td>
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<td>25 cm (0-3)/Typha angustifolia</td>
<td>NA/NA</td>
<td>60/5.1</td>
<td>16/91</td>
<td>Zhao et al. (2015)/China</td>
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<tr>
<td>Lab/Primary</td>
<td>S</td>
<td>Triclosan</td>
<td>0.5/6.7</td>
<td>NA/NA</td>
<td>0.3/IF</td>
<td>18</td>
<td>5/5/1</td>
<td>25 cm (0-3)/Salvinia natans</td>
<td>NA/NA</td>
<td>60/8.0</td>
<td>15/87</td>
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</tr>
<tr>
<td>Lab/Primary</td>
<td>S</td>
<td>Triclosan</td>
<td>0.5/6.7</td>
<td>NA/NA</td>
<td>0.3/IF</td>
<td>18</td>
<td>5/5/1</td>
<td>25 cm (0-3)/Hydrilla verticillata</td>
<td>NA/NA</td>
<td>60/11</td>
<td>14/81</td>
<td>Zhao et al. (2015)/China</td>
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<tr>
<td>Full/Secondary</td>
<td>D</td>
<td>Triclosan</td>
<td>0.8/5.0</td>
<td>NA/NA</td>
<td>0.03</td>
<td>13</td>
<td>6.5/120/6</td>
<td>80 cm Gravel (4-8)/Phragmites australis</td>
<td>NA/NA</td>
<td>0.1/0.01</td>
<td>0.003/91</td>
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<tr>
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<td>0.8/9.4</td>
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<td>3.4</td>
<td>13/36/6</td>
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<td>0.1/0.01</td>
<td>0.003/91</td>
<td>Zhao et al. (2015)/China</td>
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<tr>
<td>Full/Secondary</td>
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<td>Triclosan</td>
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<td>7.3</td>
<td>5.4/144/6</td>
<td>80 cm Gravel (4-16)/Phragmites australis</td>
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<td>0.1/0.01</td>
<td>0.003/91</td>
<td>Zhao et al. (2015)/China</td>
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<tr>
<td>Full/Tertiary</td>
<td>*</td>
<td>Triclosan</td>
<td>0.7/8.6</td>
<td>18/NA</td>
<td>0.003/IF</td>
<td>14</td>
<td>NA/120/1</td>
<td>Granitic gravel (6-25)/Phragmites australis</td>
<td>0.4/NA</td>
<td>0.7/0.2</td>
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<tr>
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<td>Triclosan</td>
<td>0.7/3.2</td>
<td>23/NA</td>
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<td>38</td>
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<td>0.5/NA</td>
<td>0.7/0.2</td>
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<td>Matamoros et al. (2017)/Spain</td>
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</tr>
<tr>
<td>Scale/ type of treatment</td>
<td>W</td>
<td>PCPs</td>
<td>Depth (m) Area (m² PE⁻¹)</td>
<td>T (°C) /pH</td>
<td>HLR (m³ m⁻² d⁻¹) / OM</td>
<td>OLR (g COD m⁻² d⁻¹)</td>
<td>HRT (days) /SA/ED (months)</td>
<td>Filter media (mm)/Plants</td>
<td>Effluent DO (mg L⁻¹)/ ORP (Inf/Eff) (mV)</td>
<td>Influent/ Effluent conc. (μg L⁻¹)</td>
<td>Removal rate (mg m⁻² d⁻¹)/ Removal (%)</td>
<td>Author/ Country</td>
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<td>Triclosan</td>
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<td>NA/264/12</td>
<td>Crushed rock (4-8)/ Phragmites australis</td>
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<td>Gravel (4-8)/ Phragmites australis</td>
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<td>NA/NA</td>
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<td>NA/192/12</td>
<td>Gravel (4-8)/ Phragmites australis Phragmites arundinacea</td>
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<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/120/12</td>
<td>Gravel (8-16)/ Phragmites australis Phragmites arundinacea Steel slag/ Phragmites australis</td>
<td>NA/NA</td>
<td>0.5/0.1</td>
<td>NA/73</td>
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<td>D</td>
<td>Triclosan</td>
<td>NA/NA 16/8.6</td>
<td>3.4/NA</td>
<td>NA/NA</td>
<td>14/NA/2</td>
<td>Steel slag/ Phragmites australis Gravel/ Phragmites australis</td>
<td>6.0/NA</td>
<td>0.1/0.1</td>
<td>NR</td>
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<td>Triclosan</td>
<td>NA/NA 16/8.0</td>
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<td>14/NA/2</td>
<td>Gravel/ Phragmites australis Gravel/ Phragmites australis</td>
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<td>0.13/0.1</td>
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<td>Triclosan</td>
<td>NA/NA 16/8.2</td>
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<td>NA/NA</td>
<td>14/NA/12</td>
<td>Gravel/ Phragmites australis Gravel/ Phragmites australis NA/Typha angustifolia; Chrysopogon zizanioides; Cyperus papyrus</td>
<td>6.0/NA</td>
<td>0.13/0.1</td>
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<td>Petrie et al. (2018)/ UK</td>
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<tr>
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<td>Triclosan</td>
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<td>L</td>
<td>Triclosan</td>
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<td>NA/NA</td>
<td>NA/NA/1.0</td>
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<td>0.003/0.002</td>
<td>NA/29</td>
<td>Wang et al. (2019)/ Singapore</td>
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</table>
Domestic (55%) and Industrial discharge (45%) (*); The Population equivalent (PE) is calculated based on the common relation 1 PE = 60 g BOD d\(^{-1}\). BOD values were approximated using the ratio COD/BOD = 2 in the studies where BOD was not reported (Zhao et al., 2015; Matamoros et al., 2017).
Table S3. The performance of HFCW for steroidal hormones removal.

<table>
<thead>
<tr>
<th>Scale/type of treatment</th>
<th>W</th>
<th>T</th>
<th>SHs Type</th>
<th>Depth (m)/Area (m² PE⁻¹)</th>
<th>T (°C)/pH</th>
<th>HLR (m³ m⁻² d⁻¹)/OM</th>
<th>OLR (g COD m⁻² d⁻¹)</th>
<th>HRT (days)/SA/ED (months)</th>
<th>Filter media (mm)/Plants</th>
<th>Effluent DO (mg L⁻¹)/Infl/Effluent conc. (μg L⁻¹)</th>
<th>Removal rate (mg m⁻² d⁻¹)/Removal (%)</th>
<th>Author/Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full/Secondary</td>
<td>D</td>
<td>Estrone</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>3/NA/1</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>0.02/0.005</td>
<td>NA/69</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>17β-estradiol</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>3/NA/1</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>0.003/0.001</td>
<td>NA/60</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>Estriol</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>3/NA/1</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>0.01/0.002</td>
<td>NA/73</td>
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<tr>
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<td>D</td>
<td>17α-ethinylestradiol</td>
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<td>NA/NA</td>
<td>NA/NA</td>
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<td>3/NA/1</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>0.013/0.011</td>
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<tr>
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<td>D</td>
<td>Estrone</td>
<td>0.8/5.0</td>
<td>NA/NA</td>
<td>0.03/NA</td>
<td>7.7</td>
<td>8.1/204/3</td>
<td>80 cm Gravel (8-16)/Phragmites australis, Phalaris arundinacea.</td>
<td>NA/NA</td>
<td>0.04/0.006</td>
<td>0.001/85</td>
<td>Vymazal et al. (2015)/Czech Republic</td>
</tr>
<tr>
<td></td>
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<td>17β-estradiol</td>
<td>0.8/5.0</td>
<td>NA/NA</td>
<td>0.03/NA</td>
<td>7.7</td>
<td>8.1/204/3</td>
<td>As above</td>
<td>NA/NA</td>
<td>0.006/0.001</td>
<td>0.0001/84</td>
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<td>D</td>
<td>Estriol</td>
<td>0.8/5.0</td>
<td>NA/NA</td>
<td>0.03/NA</td>
<td>7.7</td>
<td>8.1/204/3</td>
<td>As above</td>
<td>NA/NA</td>
<td>0.02/0.01</td>
<td>0.0002/38</td>
<td></td>
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<tr>
<td></td>
<td>D</td>
<td>17α-ethinylestradiol</td>
<td>0.8/5.0</td>
<td>NA/NA</td>
<td>0.03/NA</td>
<td>7.7</td>
<td>8.1/204/3</td>
<td>As above</td>
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<td>0.006/0.002</td>
<td>0.0001/67</td>
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</tr>
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<td>Testosterone</td>
<td>0.8/5.0</td>
<td>NA/NA</td>
<td>0.03/NA</td>
<td>7.7</td>
<td>8.1/204/3</td>
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<td>NA/NA</td>
<td>0.003/0.005</td>
<td>0.0001/82</td>
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</tr>
<tr>
<td>Full/Primary</td>
<td>D</td>
<td>Estrone</td>
<td>0.8/6.6</td>
<td>NA/NA</td>
<td>0.03/NA</td>
<td>18</td>
<td>7.1/156/3</td>
<td>80 cm Gravel (4-8)/Phragmites australis</td>
<td>NA/NA</td>
<td>0.03/0.001</td>
<td>0.001/96</td>
<td>Vymazal et al. (2015)/Czech Republic</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>17β-estradiol</td>
<td>0.8/6.6</td>
<td>NA/NA</td>
<td>0.03/NA</td>
<td>18</td>
<td>7.1/156/3</td>
<td>As above</td>
<td>NA/NA</td>
<td>0.004/0.001</td>
<td>0.0001/76</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>Estriol</td>
<td>0.8/6.6</td>
<td>NA/NA</td>
<td>0.03/NA</td>
<td>18</td>
<td>7.1/156/3</td>
<td>As above</td>
<td>NA/NA</td>
<td>0.013/0.01</td>
<td>0.0001/22</td>
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</tr>
<tr>
<td></td>
<td>D</td>
<td>17α-ethinylestradiol</td>
<td>0.8/6.6</td>
<td>NA/NA</td>
<td>0.03/NA</td>
<td>18</td>
<td>7.1/156/3</td>
<td>As above</td>
<td>NA/NA</td>
<td>0.003/0.002</td>
<td>0.00002/29</td>
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<tr>
<td></td>
<td>D</td>
<td>Testosterone</td>
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<td>NA/NA</td>
<td>0.03/NA</td>
<td>18</td>
<td>7.1/156/3</td>
<td>As above</td>
<td>NA/NA</td>
<td>0.01/0.005</td>
<td>0.0003/95</td>
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</tr>
<tr>
<td>Full/Primary</td>
<td>D</td>
<td>Estrone</td>
<td>0.8/5.0</td>
<td>NA/NA</td>
<td>0.02/NA</td>
<td>11</td>
<td>8.7/132/3</td>
<td>80 cm Gravel (4-8)/Phragmites australis</td>
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<td>0.06/0.001</td>
<td>0.001/98</td>
<td>Vymazal et al. (2015)/Czech Republic</td>
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<tr>
<td>Scale/Type of treatment</td>
<td>W</td>
<td>T</td>
<td>SHs Type</td>
<td>Depth (m)/Area (m² PE⁻¹)</td>
<td>T (°C)/pH</td>
<td>HLR (m³/m² d⁻¹)/OM</td>
<td>OLR (g COD m⁻² d⁻¹)</td>
<td>HRT (days)/SA/ED (months)</td>
<td>Filter media (mm)/Plants</td>
<td>Effluent DO (mg L⁻¹)/ORP (Inf/Eff) (mV)</td>
<td>Influent/effluent conc. (μg L⁻¹)</td>
<td>Removal rate (mg m⁻² d⁻¹)/Removal (%)</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---</td>
<td>---</td>
<td>----------</td>
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<td>----------</td>
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<td>--------------------------</td>
<td>--------------------------</td>
<td>----------------------------------</td>
<td>-----------------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Lab/Primary*</td>
<td>P</td>
<td>Estrone</td>
<td>0.17/NA</td>
<td>NA/NA 0.4/NA NA</td>
<td>7/NA/NA</td>
<td>As above 3 cm Sand (&lt; 1.0) 2 cm Gravel (3-4)/Lemma Perpusilla Steel slag/Phragmites australis</td>
<td>6.0/NA 0.03/0.02 0.03/38</td>
<td>Petrie et al. (2018)/UK</td>
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</tr>
<tr>
<td>Full/Tertiary</td>
<td>D</td>
<td>Estrone</td>
<td>NA/NA 16/8.6 3.4/NA NA</td>
<td>14/NA/2</td>
<td>Gravel/Phragmites australis Gravel/Phragmites australis</td>
<td>5.5/NA 0.03/0.001 0.08/96</td>
<td>Petrie et al. (2018)/UK</td>
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<tr>
<td>Full/Tertiary</td>
<td>D</td>
<td>Estrone</td>
<td>NA/NA 16/8.0 3.4/NA NA</td>
<td>14/NA/2</td>
<td>Gravel/Phragmites australis</td>
<td>6.0/NA 0.03/0.001 0.08/96</td>
<td>Petrie et al. (2018)/UK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full/Tertiary</td>
<td>D</td>
<td>Estrone</td>
<td>NA/NA 16/8.2 3.4/NA NA</td>
<td>14/NA/12</td>
<td>Gravel/Phragmites australis 20 cm Bamboo charcoal (9-39) 5 cm Gravel (19-25)/Cyperus isocladus</td>
<td>16/0.6 0.9/96</td>
<td>Campos et al. (2019)/Brazil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab/Primary</td>
<td>S</td>
<td>17α-ethinylestradiol</td>
<td>0.32/NA</td>
<td>NA/NA 0.06/NA NA</td>
<td>2/24/3.2</td>
<td>25 cm Gravel (9.5-19)/Cyperus isocladus</td>
<td>18/3.4 0.8/81</td>
<td>Campos et al. (2019)/Brazil</td>
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<td></td>
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<tr>
<td>Lab/Primary</td>
<td>S</td>
<td>17α-ethinylestradiol</td>
<td>0.32/NA</td>
<td>NA/NA 0.06/NA NA</td>
<td>2/24/3.2</td>
<td>25 cm Gravel (9.5-19)/Cyperus isocladus</td>
<td>18/10 0.4/43</td>
<td>Campos et al. (2019)/Brazil</td>
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<tr>
<td>Lab/Primary</td>
<td>S</td>
<td>17α-ethinylestradiol</td>
<td>0.32/NA</td>
<td>NA/NA 0.06/NA NA</td>
<td>4/24/3.2</td>
<td>25 cm Gravel (9.5-19)/Unplanted</td>
<td>18/11 0.3/31</td>
<td>Campos et al. (2019)/Brazil</td>
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<td></td>
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<tr>
<td>Lab/Primary</td>
<td>S</td>
<td>17α-ethinylestradiol</td>
<td>0.32/NA</td>
<td>NA/NA 0.06/NA NA</td>
<td>4/24/3.2</td>
<td>As above</td>
<td>18/16 0.1/10</td>
<td>Campos et al. (2019)/Brazil</td>
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<p>| Author/Country          | |
|-------------------------| |
| Hakk et al. (2018)/US   | |
| Petrie et al. (2018)/UK | |
| Campos et al. (2019)/Brazil | |
| Campos et al. (2019)/Brazil | |
| Campos et al. (2019)/Brazil | |</p>
<table>
<thead>
<tr>
<th>Scale/ type of treatment</th>
<th>W</th>
<th>T</th>
<th>SHs Type</th>
<th>Depth (m)/ Area (m² PE⁻¹)</th>
<th>T (°C)/pH</th>
<th>HLR (m³ m⁻² d⁻¹)/ OM</th>
<th>OLR (g COD m⁻² d⁻¹)</th>
<th>HRT (days)/ SA/ED (months)</th>
<th>Filter media (mm)/Plants</th>
<th>Effluent DO (mg L⁻¹)/ ORP (Inf/Eff) (mV)</th>
<th>Influent/ Effluent conc. (μg L⁻¹)</th>
<th>Removal rate (mg m⁻² d⁻¹)/ Removal (%)</th>
<th>Author/ Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab/ Primary</td>
<td>S</td>
<td>17α-ethinylestradiol</td>
<td>0.32/NA</td>
<td>NA/NA</td>
<td>0.06/NA</td>
<td>NA</td>
<td>NA</td>
<td>2/24/3.2</td>
<td>25 cm Gravel (9.5-19)/ Eichhornia crassipes</td>
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<td>16/8.3</td>
<td>0.4/47</td>
<td>Campos et al. (2019)/ Brazil</td>
</tr>
<tr>
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<td>0.32/NA</td>
<td>NA/NA</td>
<td>0.06/NA</td>
<td>NA</td>
<td>NA</td>
<td>4/24/3.2</td>
<td>As above</td>
<td>NA/NA</td>
<td>18/11</td>
<td>0.4/36</td>
<td>Campos et al. (2019)/ Brazil</td>
</tr>
<tr>
<td>Lab/ Primary</td>
<td>S</td>
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<td>0.32/NA</td>
<td>NA/NA</td>
<td>0.06/NA</td>
<td>NA</td>
<td>NA</td>
<td>2/24/3.2</td>
<td>20 cm Bamboo charcoal (9-39)/ 5 cm Gravel (19-25)/ Cyperus isocladus</td>
<td>NA/NA</td>
<td>94/11</td>
<td>4.8/88</td>
<td>Campos et al. (2019)/ Brazil</td>
</tr>
<tr>
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<td>0.32/NA</td>
<td>NA/NA</td>
<td>0.06/NA</td>
<td>NA</td>
<td>NA</td>
<td>4/24/3.2</td>
<td>As above</td>
<td>NA/NA</td>
<td>110/14</td>
<td>5.5/88</td>
<td>Campos et al. (2019)/ Brazil</td>
</tr>
<tr>
<td>Lab/ Primary</td>
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<td>17α-ethinylestradiol</td>
<td>0.32/NA</td>
<td>NA/NA</td>
<td>0.06/NA</td>
<td>NA</td>
<td>NA</td>
<td>2/24/3.2</td>
<td>25 cm Gravel (9.5-19)/ Cyperus isocladus</td>
<td>NA/NA</td>
<td>94/36</td>
<td>3.3/62</td>
<td>Campos et al. (2019)/ Brazil</td>
</tr>
<tr>
<td>Lab/ Primary</td>
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<td>17α-ethinylestradiol</td>
<td>0.32/NA</td>
<td>NA/NA</td>
<td>0.06/NA</td>
<td>NA</td>
<td>NA</td>
<td>4/24/3.2</td>
<td>As above</td>
<td>NA/NA</td>
<td>110/46</td>
<td>3.6/58</td>
<td>Campos et al. (2019)/ Brazil</td>
</tr>
<tr>
<td>Lab/ Primary</td>
<td>S</td>
<td>17α-ethinylestradiol</td>
<td>0.32/NA</td>
<td>NA/NA</td>
<td>0.06/NA</td>
<td>NA</td>
<td>NA</td>
<td>2/24/3.2</td>
<td>25 cm Gravel (9.5-19)/ Unplanted</td>
<td>NA/NA</td>
<td>94/51</td>
<td>2.5/46</td>
<td>Campos et al. (2019)/ Brazil</td>
</tr>
<tr>
<td>Lab/ Primary</td>
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<td>17α-ethinylestradiol</td>
<td>0.32/NA</td>
<td>NA/NA</td>
<td>0.06/NA</td>
<td>NA</td>
<td>NA</td>
<td>4/24/3.2</td>
<td>As above</td>
<td>NA/NA</td>
<td>110/70</td>
<td>2.3/36</td>
<td>Campos et al. (2019)/ Brazil</td>
</tr>
<tr>
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<td>17α-ethinylestradiol</td>
<td>0.32/NA</td>
<td>NA/NA</td>
<td>0.06/NA</td>
<td>NA</td>
<td>NA</td>
<td>2/24/3.2</td>
<td>25 cm Gravel (9.5-19)/ Eichhornia crassipes</td>
<td>NA/NA</td>
<td>94/42</td>
<td>3.0/55</td>
<td>Campos et al. (2019)/ Brazil</td>
</tr>
<tr>
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<td>17α-ethinylestradiol</td>
<td>0.32/NA</td>
<td>NA/NA</td>
<td>0.06/NA</td>
<td>NA</td>
<td>NA</td>
<td>4/24/3.2</td>
<td>As above</td>
<td>NA/NA</td>
<td>110/64</td>
<td>2.6/42</td>
<td>Campos et al. (2019)/ Brazil</td>
</tr>
</tbody>
</table>
Note: Horizontal subsurface flow constructed wetland (HFCW); Wastewater type (WT); Domestic (D); Piggery (P); Synthetic (S); Steroidal hormones (SHs); Hydraulic loading rate (HLR); Operational mode (OM); Organic loading rate (OLR); Chemical oxygen demand (COD); Hydraulic retention time (HRT); System age (SA); Experiment duration (ED); Dissolved oxygen (DO); Oxidation-reduction potential (ORP); Not available (NA); Not removed (NR); Liquid swine manure diluted 1:80 with farm pond water (*).
Supplementary materials 2: The estimated statistics (mean and standard deviation of concentration and removal) of 18 selected EOCs in HFCW.

Table S4. The estimated statistics of 18 selected EOCs in HFCW.

<table>
<thead>
<tr>
<th>EOCs</th>
<th>No. of observation based on removal (%)</th>
<th>Influent conc. (µg L(^{-1})) Mean ± Stdev</th>
<th>Effluent conc. (µg L(^{-1})) Mean ± Stdev</th>
<th>Removal rate (mg m(^{-2}) d(^{-1})) Mean ± Stdev</th>
<th>Removal efficiency (%) Mean ± Stdev</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhCs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetaminophen</td>
<td>12</td>
<td>2.9 ± 4.3</td>
<td>0.1 ± 0.1</td>
<td>0.3 ± 0.2</td>
<td>70 ± 24</td>
</tr>
<tr>
<td>Clarithromycin</td>
<td>10</td>
<td>0.4 ± 0.2</td>
<td>0.2 ± 0.1</td>
<td>0.5 ± 0.6</td>
<td>45 ± 20</td>
</tr>
<tr>
<td>Diclofenac</td>
<td>45</td>
<td>24 ± 35</td>
<td>12 ± 18</td>
<td>1.2 ± 2.0</td>
<td>39 ± 24</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>13</td>
<td>9.6 ± 4.9</td>
<td>3.7 ± 3.3</td>
<td>1.1 ± 0.7</td>
<td>61 ± 25</td>
</tr>
<tr>
<td>Gemfibrozil</td>
<td>8</td>
<td>50 ± 53</td>
<td>23 ± 26</td>
<td>4.9 ± 4.0</td>
<td>58 ± 23</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>61</td>
<td>33 ± 36</td>
<td>14 ± 19</td>
<td>2.2 ± 3.9</td>
<td>53 ± 27</td>
</tr>
<tr>
<td>Naproxen</td>
<td>42</td>
<td>27 ± 37</td>
<td>7 ± 13</td>
<td>1.6 ± 2.8</td>
<td>63 ± 26</td>
</tr>
<tr>
<td>Ofloxacin</td>
<td>13</td>
<td>0.04 ± 0.11</td>
<td>0.005 ± 0.017</td>
<td>0.01 ± 0.03</td>
<td>98 ± 4</td>
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<tr>
<td>Salicylic acid</td>
<td>20</td>
<td>16 ± 9</td>
<td>2.3 ± 1.2</td>
<td>0.5 ± 0.3</td>
<td>79 ± 21</td>
</tr>
<tr>
<td>Sulfadiazine</td>
<td>6</td>
<td>0.07 ± 0.03</td>
<td>0.04 ± 0.01</td>
<td>0.01 ± 0.01</td>
<td>46 ± 30</td>
</tr>
<tr>
<td>Sulfamethazine</td>
<td>20</td>
<td>1.5 ± 6.7</td>
<td>0.7 ± 2.9</td>
<td>0.02 ± 0.07</td>
<td>45 ± 27</td>
</tr>
<tr>
<td>Sulfamethoxazole</td>
<td>10</td>
<td>0.5 ± 0.8</td>
<td>0.2 ± 0.2</td>
<td>0.02 ± 0.02</td>
<td>43 ± 24</td>
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<td>PCPs</td>
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<tr>
<td>Triclosan</td>
<td>19</td>
<td>10 ± 22</td>
<td>1.4 ± 3.1</td>
<td>3.5 ± 6.6</td>
<td>56 ± 33</td>
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<tr>
<td>SHs</td>
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</tr>
<tr>
<td>17α-ethinylestradiol</td>
<td>19</td>
<td>50 ± 46</td>
<td>21 ± 23</td>
<td>1.7 ± 1.7</td>
<td>52 ± 25</td>
</tr>
<tr>
<td>17β-estradiol</td>
<td>4</td>
<td>0.008 ± 0.008</td>
<td>0.001 ± 0.0</td>
<td>0.0002 ± 0.0001</td>
<td>79 ± 14</td>
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<tr>
<td>Estriol</td>
<td>3</td>
<td>0.01 ± 0.01</td>
<td>0.007 ± 0.005</td>
<td>0.0002 ± 0.0001</td>
<td>44 ± 26</td>
</tr>
<tr>
<td>Estrone</td>
<td>8</td>
<td>17 ± 47</td>
<td>1.9 ± 5.3</td>
<td>7 ± 17</td>
<td>83 ± 21</td>
</tr>
<tr>
<td>Testosterone</td>
<td>3</td>
<td>0.007 ± 0.004</td>
<td>0.0005 ± 0.0</td>
<td>0.0002 ± 0.0001</td>
<td>90 ± 7</td>
</tr>
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</table>
Supplementary materials 3: The estimated statistics (mean and standard deviation of removal efficiency) of 18 selected EOCs in primary, secondary, and tertiary treatment by HFCW.

Table S5. Statistics (mean and standard deviation) of 18 selected EOCs in primary, secondary, and tertiary treatment by HFCW.

<table>
<thead>
<tr>
<th>EOCs</th>
<th>Influent conc. (μg L⁻¹) Mean ± Stdev</th>
<th>Effluent conc. (μg L⁻¹) Mean ± Stdev</th>
<th>Removal efficiency (%) Mean ± Stdev</th>
<th>Influent conc. (μg L⁻¹) Mean ± Stdev</th>
<th>Effluent conc. (μg L⁻¹) Mean ± Stdev</th>
<th>Removal efficiency (%) Mean ± Stdev</th>
<th>Influent conc. (μg L⁻¹) Mean ± Stdev</th>
<th>Effluent conc. (μg L⁻¹) Mean ± Stdev</th>
<th>Removal efficiency (%) Mean ± Stdev</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PhCs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Acetaminophen</td>
<td>0.6 ± 0.3</td>
<td>0.3 ± 0.2</td>
<td>53 ± 17 (4)</td>
<td>10 ± 0</td>
<td>0 ± 0</td>
<td>100 ± 0 (3)</td>
<td>0.6 ± 0.9</td>
<td>0.1 ± 0.1</td>
<td>65 ± 20 (5)</td>
</tr>
<tr>
<td>Clarithromycin</td>
<td>0.3 ± 0.2</td>
<td>0.1 ± 0.1</td>
<td>54 ± 16 (4)</td>
<td>0.3 ± 0.0</td>
<td>0.2 ± 0.0</td>
<td>32 ± 0 (2)</td>
<td>0.5 ± 0.2</td>
<td>0.3 ± 0.05</td>
<td>43 ± 27 (4)</td>
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<tr>
<td>Diclofenac</td>
<td>35 ± 34</td>
<td>19 ± 18</td>
<td>44 ± 12 (20)</td>
<td>2.2 ± 2.7</td>
<td>1.8 ± 2.4</td>
<td>30 ± 26 (14)</td>
<td>37 ± 50</td>
<td>14 ± 24</td>
<td>41 ± 34 (11)</td>
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<td>Erythromycin</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>10 ± 4</td>
<td>4.0 ± 3.2</td>
<td>61 ± 25 (13)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>Gemfibrozil</td>
<td>100 ± 0</td>
<td>47 ± 14</td>
<td>53 ± 14 (4)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>0.04 ± 0.04</td>
<td>0.03 ± 0.04</td>
<td>63 ± 32 (4)</td>
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<tr>
<td>Ibuprofen</td>
<td>43 ± 36</td>
<td>20 ± 22</td>
<td>57 ± 17 (31)</td>
<td>15 ± 7</td>
<td>11 ± 7</td>
<td>38 ± 35 (15)</td>
<td>34 ± 49</td>
<td>7 ± 17</td>
<td>58 ± 33 (15)</td>
</tr>
<tr>
<td>Naproxen</td>
<td>44 ± 34</td>
<td>13 ± 16</td>
<td>74 ± 17 (17)</td>
<td>2.0 ± 1.2</td>
<td>1.4 ± 1.1</td>
<td>53 ± 28 (15)</td>
<td>41 ± 51</td>
<td>6 ± 15</td>
<td>59 ± 31 (10)</td>
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<tr>
<td>Ofloxacine</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>0.01 ± 0.0</td>
<td>0.0001 ± 0.0</td>
<td>99 ± 0 (12)</td>
<td>0.4</td>
<td>0.06</td>
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<tr>
<td>Salicylic acid</td>
<td>25 ± 0</td>
<td>2.6 ± 0.7</td>
<td>90 ± 3 (8)</td>
<td>12 ± 3</td>
<td>2.4 ± 1.2</td>
<td>77 ± 15 (10)</td>
<td>0.3 ± 0.2</td>
<td>0.1 ± 0.01</td>
<td>45 ± 54 (2)</td>
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<td>NA</td>
<td>NA</td>
<td>0.08 ± 0.02</td>
<td>0.04 ± 0.01</td>
<td>46 ± 30 (6)</td>
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<tr>
<td>Sulfamethazine</td>
<td>30</td>
<td>13</td>
<td>56 (1)</td>
<td>0.008 ± 0.003</td>
<td>0.004 ± 0.001</td>
<td>38 ± 21 (17)</td>
<td>0.2 ± 0.2</td>
<td>0.0 ± 0.0</td>
<td>100 ± 1 (2)</td>
</tr>
<tr>
<td>Sulfamethoxazole</td>
<td>2.0 ± 0.5</td>
<td>0.5 ± 0.1</td>
<td>76 ± 17 (2)</td>
<td>0.2 ± 0.1</td>
<td>0.07 ± 0.04</td>
<td>46 ± 20 (4)</td>
<td>0.09 ± 0.08</td>
<td>0.07 ± 0.07</td>
<td>24 ± 7 (4)</td>
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</tr>
<tr>
<td>Triclosan</td>
<td>26 ± 32</td>
<td>3.5 ± 4.6</td>
<td>74 ± 17 (7)</td>
<td>0.5 ± 0.5</td>
<td>0.4 ± 0.5</td>
<td>57 ± 47 (5)</td>
<td>0.3 ± 0.3</td>
<td>0.1 ± 0.1</td>
<td>38 ± 28 (7)</td>
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<tr>
<td>17α-ethinylestradiol</td>
<td>53 ± 46</td>
<td>22 ± 23</td>
<td>54 ± 23 (18)</td>
<td>0.013</td>
<td>0.011</td>
<td>9.0 (1)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>17β-estradiol</td>
<td>0.01 ± 0.009</td>
<td>0.001 ± 0.00</td>
<td>85 ± 9 (3)</td>
<td>0.003</td>
<td>0.001</td>
<td>60 (1)</td>
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<td>NA</td>
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<tr>
<td>Estriol</td>
<td>0.02 ± 0.0</td>
<td>0.01 ± 0.0</td>
<td>30 ± 11 (2)</td>
<td>0.01</td>
<td>0.002</td>
<td>73 (1)</td>
<td>NA</td>
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<td>Estrone</td>
<td>34 ± 67</td>
<td>3.8 ± 7.5</td>
<td>92 ± 6 (4)</td>
<td>0.02</td>
<td>0.005</td>
<td>69 (1)</td>
<td>0.03 ± 0.0</td>
<td>0.01 ± 0.01</td>
<td>77 ± 33 (3)</td>
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<tr>
<td>Testosterone</td>
<td>0.007 ± 0.004</td>
<td>0.0005 ± 0.00</td>
<td>90 ± 7 (3)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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Note: Not available (NA); Number of data points (n).
Supplementary materials 4: The selected statistics on risk quotient for 18 EOCs based on effluent concentration in HFCW.

Table S6. The statistics on risk quotient of 18 selected EOCs based on effluent concentration in HFCW.

<table>
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<tr>
<th>EOCs</th>
<th>N</th>
<th>Mean</th>
<th>STDEV</th>
<th>Min</th>
<th>Max</th>
<th>P10</th>
<th>P25</th>
<th>P50</th>
<th>P75</th>
<th>P90</th>
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<tr>
<td>Acetaminophen</td>
<td>12</td>
<td>0.141</td>
<td>0.144</td>
<td>0.000</td>
<td>0.400</td>
<td>0.000</td>
<td>0.015</td>
<td>0.100</td>
<td>0.200</td>
<td>0.380</td>
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<td>Clarithromycin</td>
<td>10</td>
<td>2.757</td>
<td>1.205</td>
<td>0.857</td>
<td>4.286</td>
<td>1.371</td>
<td>1.786</td>
<td>2.857</td>
<td>3.607</td>
<td>4.286</td>
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<td>Diclofenac</td>
<td>49</td>
<td>1.201</td>
<td>1.826</td>
<td>0.000</td>
<td>7.526</td>
<td>0.030</td>
<td>0.072</td>
<td>0.206</td>
<td>1.443</td>
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<td>Erythromycin</td>
<td>15</td>
<td>185.500</td>
<td>164.175</td>
<td>1.000</td>
<td>490.000</td>
<td>2.900</td>
<td>22.500</td>
<td>175.000</td>
<td>302.500</td>
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<td>Gemfibrozil</td>
<td>8</td>
<td>25.986</td>
<td>29.437</td>
<td>0.000</td>
<td>66.667</td>
<td>0.008</td>
<td>0.011</td>
<td>16.711</td>
<td>50.278</td>
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<td>Ibuprofen</td>
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<td>8.761</td>
<td>11.308</td>
<td>0.000</td>
<td>52.121</td>
<td>0.158</td>
<td>0.286</td>
<td>0.954</td>
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<td>6.489</td>
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<td>Naproxen</td>
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<td>2.648</td>
<td>5.052</td>
<td>0.000</td>
<td>20.992</td>
<td>0.046</td>
<td>0.286</td>
<td>0.954</td>
<td>1.832</td>
<td>6.489</td>
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<td>Ofloxacin</td>
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<td>0.294</td>
<td>1.038</td>
<td>0.006</td>
<td>3.750</td>
<td>0.006</td>
<td>0.006</td>
<td>0.006</td>
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<td>0.006</td>
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<tr>
<td>Salicylic acid</td>
<td>20</td>
<td>1.762</td>
<td>0.930</td>
<td>0.078</td>
<td>3.906</td>
<td>0.923</td>
<td>1.172</td>
<td>1.758</td>
<td>2.285</td>
<td>2.688</td>
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<td>0.275</td>
<td>0.102</td>
<td>0.148</td>
<td>0.370</td>
<td>0.148</td>
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<td>10.965</td>
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<td>227807</td>
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<td>110000</td>
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<td>0.500</td>
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<td>0.500</td>
<td>0.500</td>
<td>0.500</td>
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</tr>
<tr>
<td>Estriol</td>
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<td>0.122</td>
<td>0.077</td>
<td>0.033</td>
<td>0.167</td>
<td>0.060</td>
<td>0.100</td>
<td>0.167</td>
<td>0.167</td>
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<tr>
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<td>883.589</td>
<td>0.167</td>
<td>2500</td>
<td>0.167</td>
<td>0.167</td>
<td>0.500</td>
<td>1.583</td>
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<tr>
<td>Testosterone</td>
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<td>0.005</td>
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Note: Number of datapoints (N); Standard deviation (STDEV); Minimum (Min); Maximum (Max); Percentile (P); Risk is categorized into four levels: high risk (RQ > 1.0), medium risk (0.1 ≤ RQ ≤ 1.0), low risk (0.01 ≤ RQ ≤ 0.1), and no risk (RQ < 0.01).
References


