Comparison of Biochar and Conventional Solid Waste Treatment

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Traditional Cycle of Municipal Solid Waste & Management Scenarios

The traditional process of the municipal solid waste (MSW) management leads to negative environmental impacts (Figure 1). These environmental impacts are mostly due to the organics that make up 62% of MSW composition. Two management scenarios are depicted in Figure 2, where municipal solid waste was evaluated to quantify environmental impacts of different waste management strategies, which may provide opportunities for pollution reduction.

The Pyrolysis Process

Figure 3 and Table 1 show the multistep pyrolysis process and the high dose wood biochar pyrolysis values that have been calculated respectively.

Composition of Municipal Solid Waste

Figure 4 and Figure 5 show the most common and relative breakdown of the organic fraction of MSW compositions. The composition of the waste can be predictive of leachate and methane pollution emissions.

Leachate Characterization Using Literature and Experimental Data

Properties of the most common landfill waste (decay rates, methane yield, moisture content, and carbon storage factor) were calculated (Table 2).

Life-Cycle Assessment

LCA methodologies following the ISO 14040 framework will assess the two management scenarios (Figure 6), biochar and conventional solid waste treatment, to compare their respective environmental impacts. Also, other alternatives will be considered in the future.

Table 1: Calculated municipal solid waste characteristics

<table>
<thead>
<tr>
<th>Decay Rates [yr⁻¹]</th>
<th>Methane Yield [m³CH₄ (dry Mg Refuse)⁻¹]</th>
<th>Moisture Content</th>
<th>Carbon Storage Factor [Kg C dry Kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>99.6</td>
<td>20.0%</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Table 2. Calculated municipal solid waste characteristics

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Goal and Scope definition</th>
<th>Inventory Analysis</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Solid Waste Treatment</td>
<td>VS Biochar Leachate Management</td>
<td>Compost &amp; Anerobic Digestion</td>
<td></td>
</tr>
</tbody>
</table>

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Recreated using Thompson et. al (2016)