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Evaluation of the antifungal activity of cattle manure bio-oil

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EVALUATION OF THE ANTIFUNGAL ACTIVITY OF CATTLE MANURE BIO-OIL

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Cork, Ireland
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Sample preparation room

Rotary Kiln Reactor 1 kg h\(^{-1}\)

Fluidized bed Reactor - 0.3 kg h\(^{-1}\)

Microreactor – 50-200 mg

Activated charcoal trapped between glass wool

8 Ω Ni-Cr wire

50 mg of sample

N\(_2\) at 2 mL min\(^{-1}\)

Borosilicate glass tube 100 mm X 4 mm

127 V AC
Introduction

• One third of world food is wasted
• Fungi causes severe crop losses
• Fusarium solani and Lasiodiplodia theobromae
• Pyrolysis at 400 °C, 500 °C and 600 °C
- A cattle produces about 30 kg of manure per day
- Brazil has around 230 million cattle
- Manure causes soil and groundwater pollution

6.9 Mt / day
Materials and Methods

Potato Dextrose Agar (PDA)

Bio-oil + DMSO

20 mL

Solidification

10 mm mycelium

Bio-oil concentrations

1000 µg mL⁻¹, 2000 µg mL⁻¹, 3000 µg mL⁻¹, 4000 µg mL⁻¹, 5000 µg mL⁻¹

PGI (%)) = \frac{dc - dt}{dc} \times 100%

PGI: fungistatic potential
dc: control diameter
dt: treatment diameter
**Results and Discussion**

**Yields of the Cattle Manure pyrolysis**

<table>
<thead>
<tr>
<th></th>
<th>400 °C</th>
<th>500 °C</th>
<th>600 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochar (%)</td>
<td>44,25</td>
<td>41,58</td>
<td>46,02</td>
</tr>
<tr>
<td>Aqueous Fraction (%)</td>
<td>24,76</td>
<td>24,75</td>
<td>17,73</td>
</tr>
<tr>
<td>Bio-oil (%)</td>
<td>7,60</td>
<td>8,32</td>
<td>6,57</td>
</tr>
<tr>
<td>Biogas (%)</td>
<td>23,39</td>
<td>25,35</td>
<td>28,68</td>
</tr>
</tbody>
</table>
Analysis using FT-MS

EASI (-) for the oxygenated compounds

Petroleum and Energy from Biomass Research Group - PEB
Analysis by GC/MS

- Chromatogram shows that phenolic compounds are majority in the bio-oil sample
- Phenol, Guaiacol, 2-methoxi-4-vinylphenol, pyrocatechol, Cresol, 4-ethylphenol
Microbiological Analyzes with *Lasiodiplodia theobromae*  

**Graphic 1.** Percentage o Growth Inhibition of the bi-oil produced at 400 °C, 500 °C and 600 °C against the fungus *Lasiodiplodia theobromae* after 72 h.

- Bio-oil produced at 600 °C in a concentration of 5000 μg mL-1 had the best results since caused a lower growth of the fungus *Lasiodiplodia theobromae*, a fungistatic potential of 95.26%.
- No bio-oil had a fungicide potential against the fungus of the gender *Lasiodiplodia*. 
Microbiological Analyzes with *Fusarium solani*

**Graphic 2.** Percentage of Groth inhibition of the bio-oil produced at 400 °C, 500 °C and 600 °C against the fungus Fusarium solani after 96 h.

- Bio-oil produced at 600 °C had the best result in the maximum concentration, achieving a fungistatic potential of 100%.
- No bio-oil had fungicide potential.
Summary

• Great new way to produce fungicide due to the abundance of the biomass and its low cost
• Phenolic compounds are majority in the bio-oils
• Antifungal potential is related to phenolic compounds
• Fungal cytoplasmic membrane penetration, causing a loss of essentials nutrients
• Aqueous fraction had also a good percentage of growth inhibition and fungicide potential.
Acknowledgements
THANKS FOR YOUR ATTENTION!
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PETROLEUM AND ENERGY FROM BIOMASS
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https://pt.wikipedia.org