BIOMASS BLENDING AS A WAY TO REDUCE NO\textsubscript{X} EMISSIONS DURING THE COMBUSTION OF BIOMASS RESIDUES

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Doctoral School
Energy & Environment
Concerns regarding greenhouse gas emissions

→ Bioenergy

Growing pressure on wood

Valorization of agricultural residues

Slagging, fouling, corrosion

PM, SO$_2$, NO$_x$
Approach

- Which compounds contained in biomass can influence NO$_x$ emissions?
- Can synergies be implemented by biomass blending to reduce NO emissions?

Procedure

Selection of biomass residues
Lab scale pelletization
Combustion experiments
NO emissions: blending strategy

Influence of N

Combustion of « pure » samples

Blend: extremal N-content samples

Pine Bark & Grape Marc

Influence of Ca

Ca

CST

N

CST

Ca/N

CST

Rice Husk & Rape Straw

Rice Husk & Olive Pomace
Combustion setup

Cold zone
T = 30 °C
(3)

Heated zone
T = 800 °C
(4)

(6) T_{R2} = 650 °C

Gas Analyser

N₂: 79%  O₂: 21%
Total flow rate: 3,8 Nl.min⁻¹

m_{pellet} = 500mg

To exhaust

(10)
Typical emission profiles: CO and CO$_2$

- **Low CO concentration:**
  - $< 1000$ ppm (0.1%vol)

- **Efficient combustion:**
  - $\frac{CO+CO_2}{Fuel-C} > 90\%$
  - $\frac{CO}{CO+CO_2} < 1.5\%$
Typical emission profile: NO
Blending strategy

Influence of N

Combustion of « pure » samples
NO emissions and N-content for the fuels selected in this study

![Graph showing NO emissions vs. %N (w/w, db)]
Blending strategy

Influence of N

Combustion of « pure » samples

Blend: extremal N-content samples

Pine Bark & Grape Marc
NO emissions: Pine Bark & Grape Marc blends
NO emissions: Pine Bark & Grape Marc
0,9%N
NO emissions: Pine Bark & Grape Marc

Gap between theoretical and experimental results

[Graph showing NO emissions over time]

NO (ppm) vs. Time (s)
### Blending strategy

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<tr>
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<th>Ca</th>
<th>CST</th>
<th>Ca/N</th>
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Influence of Ca

Rice Husk & Rape Straw
NO emissions: Rice Husk & Rape Straw

Gap between theoretical and experimental results: fixed %N
### Blending strategy

Influence of Ca

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Rice Husk & Olive Pomace
NO emissions: Rice Husk & Olive Pomace

Gap between theoretical and experimental results: fixed Ca/N
Conclusions on NO emissions

Influence of N

Correlation on « pure » samples

Non linearity for blends

Influence of Ca

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Low nonlin. | No effect | Low nonlin. | Nonlin | No effect | Reduction
Thank you for your attention

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