

Introduction - Context

Gasification of biomass in Entrained Flow Reactor (EFR) produces a clean, tar and methane-free syngas thanks to the high temperature reaction. This thermo-chemical conversion is one of the most promising technologies to produce syngas or H_2 .

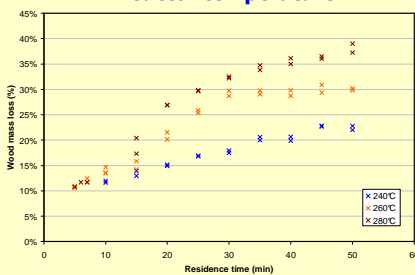
↳ **But** : short residence time (≈ 1 s) requires **a fine grinding of biomass, which is energy costly**

↳ **Interest of our work** : Biomass **torrefaction** = pre-treatment process allowing to **reduce grinding energy** consumption

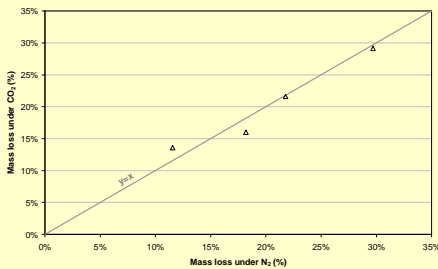
↳ **Objectives of this study** : Characterization of the influence of operating conditions on the products of torrefaction

Experimental results

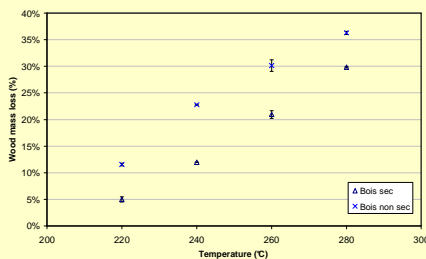
Effect of residence time and reactor temperature



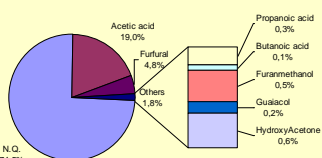
Effect of nature of atmosphere (N_2/CO_2)



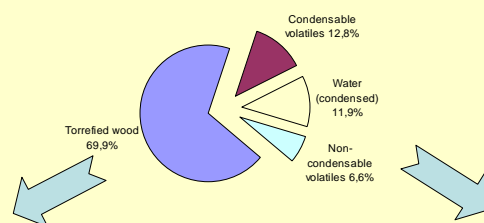
Effect of natural moisture



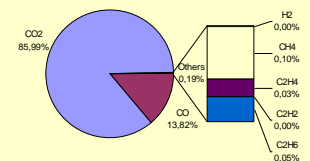
Condensable volatiles



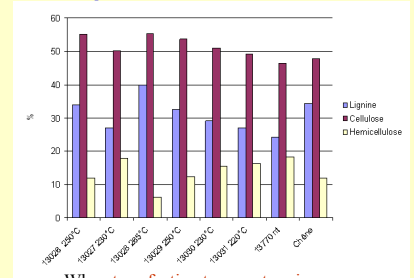
Mass balance (260°C)



Non-condensable volatiles



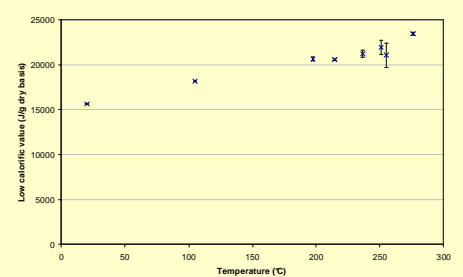
Composition of torrefied wood



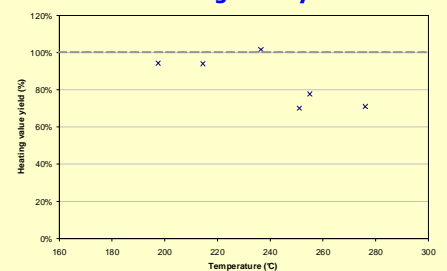
When **torrefaction temperature increases** :

→ Hemicellulose content ↘
→ Lignin and Cellulose contents ↗

Lower calorific value of torrefied wood



Heating value yield



Conclusions

- No influence of nature of the atmosphere and of natural moisture of wood (on dry basis) on wood mass loss
- When torrefaction temperature ↑ : Hemicellulose content ↓ ; Lignin and Cellulose contents ↑
- Heating value yield is $\approx 100\%$ until $240^\circ C$, then decreases at higher temperature
- Wood mass loss is mainly due to the release of condensable volatiles ; water, acids and furfural are major species
- Gas amounts are small ; gases are mainly constituted of CO_2 and CO