

# Combustion of single Wood Particles – Fuel-N Conversion

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## Experiments

Combustion experiments of single wood particles in an electrically heated quartz glass fluidised bed reactor give concentration vs time profiles (Figure 1.)

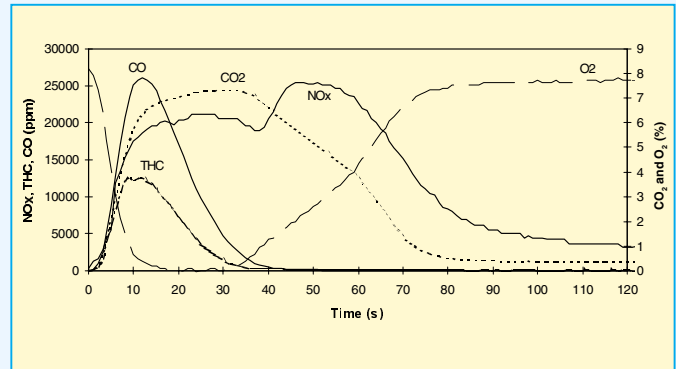
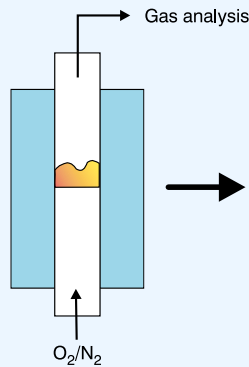


Figure 1. Concentration vs time profiles for the initial 120 s during combustion of a single pellet (type a1) in a fluidised bed at 1073 K and with 8% O<sub>2</sub>.

Pellet	Diameter (mm)	Moisture (w-%)	Ash* (w-%)	Carbon* (w-%)	Hydrogen* (w-%)	Oxygen* (w-%)	Nitrogen* (w-%)	Eff. HV* (MJ/kg)
a1	10	6.8	0.4	51.0	6.3	42.2	0.053	19.00
b1	10	8.3	0.8	51.3	6.3	41.6	0.11	19.06
c1	8	7.1	0.5	50.9	6.3	42.4	0.21	18.88
d1	6	6.6	0.4	50.8	6.4	42.4	0.048	19.00
e1	6	9.0	0.4	51.0	6.4	42.3	0.079	19.14
f1	8	9.4	0.4	50.6	6.3	42.7	0.052	18.99
g1	8	7.1	0.4	51.0	6.4	42.2	0.058	19.00
h1	8	6.9	0.6	50.8	6.4	42.1	0.061	18.75

\* Dry matter

Table 1. Fuel characteristics

## Results

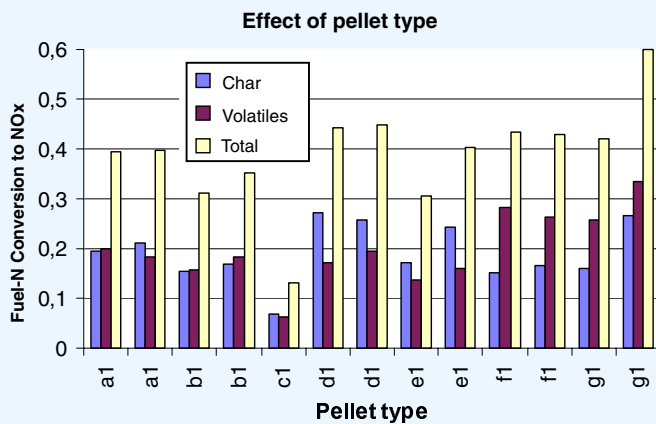


Figure 2. Fuel nitrogen conversion to NO<sub>x</sub> for different pellets (cf. Table 1)

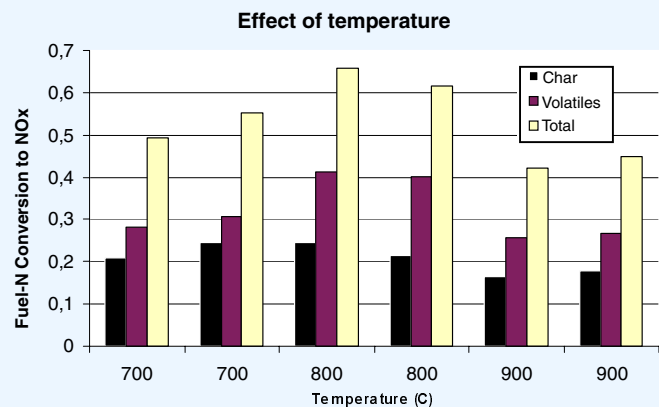


Figure 3. Effect of bed temperature on fuel nitrogen conversion to NO<sub>x</sub> (14% O<sub>2</sub>)



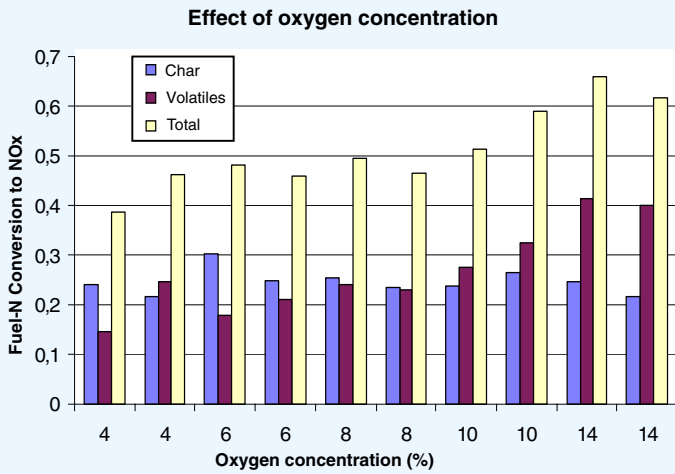


Figure 4. Effect of oxygen concentration on fuel nitrogen conversion to NO<sub>x</sub> (14% O<sub>2</sub>)

#### Fuel nitrogen conversion as a function of carbon conversion

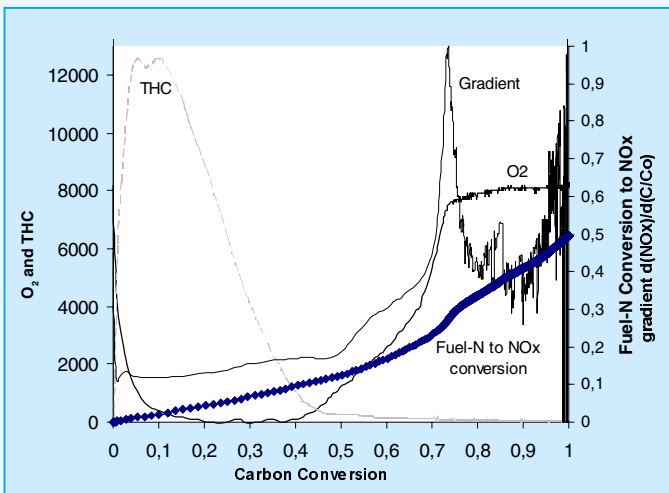


Figure 5. Fuel nitrogen conversion to NO<sub>x</sub> as a function of carbon conversion (pellet type a1, 1073 K, 8% O<sub>2</sub>, cf. Fig.1)

## Discussion & Conclusions

The NO<sub>x</sub> emission is a result of mechanisms of formation as well as destruction of NO<sub>x</sub> and NO<sub>x</sub> precursors.

Both the combustion of the volatiles and the residual char are important for the NO<sub>x</sub> emissions.

The NO<sub>x</sub> net formation:

- is suppressed during the first part of the devolatilisation ( $C/C_0 < 0,5$  in Fig. 5) due to reducing conditions
- increases slightly as the THC and CO concentrations decrease and O<sub>2</sub> increases ( $0,5 > C/C_0 < 0,7$  in Fig. 5)
- increases sharply at the transition between devolatilisation and char ignition ( $C/C_0 \approx 0,7$  in Fig. 5)
- increases as the O<sub>2</sub> concentration is raised due to less severe reducing conditions during devolatilisation (Fig. 4)
- decreases with increasing temperature in the temperature range investigated.

### Acknowledgement

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