BioC Ltd - Theoretical calculation of Pmax

Fuel analysis:

	as received	Dry base	Dry ash free	
C:	47.46	47.93	48.34	%
N:	0.24	0.24	0.24	%
H:	6.30	6.36	6.42	%
S:	0.04	0.04	0.04	%
Cl:	0.01	0.01	0.01	%
O:	44.13	44.56	44.94	%
H_2O:	1.00	0.00	0.00	%
Ash:	0.84	0.85	0.00	%
Total:	100.02	100.00	100.00	%

NCV: 18.11 [MJ/kg]

RESULTS:

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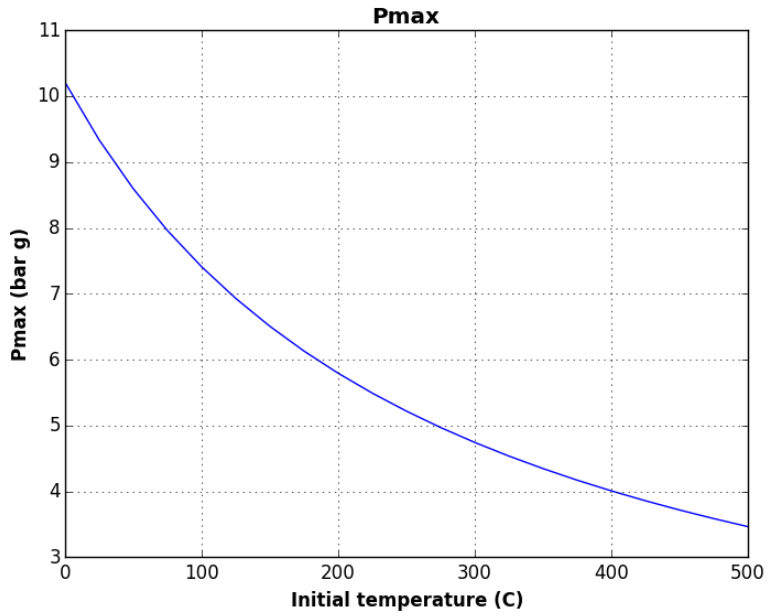
For fuel with as tested moisture content.
At stoichiometric conditions.
A start temperature of 15.00 °C
A fuel moisture content of 1.00 %
A measured fuel Net CV of 18.11 MJ/kg
A calculated fuel Net CV (for comparison) of 19.40 MJ/kg

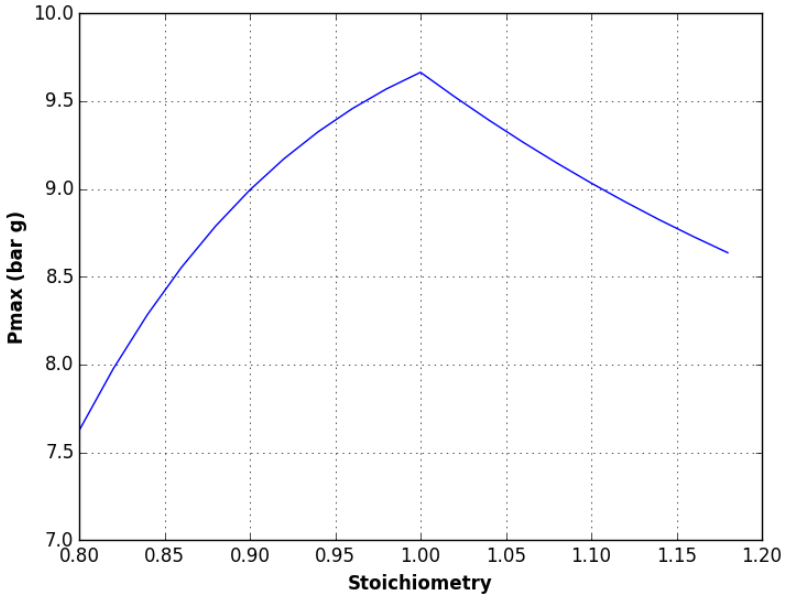
Explosion temperature: 2361.75 °C
Calculated Pmax: 9.66 bar g
Concentration: 0.21 kg fuel/Nm^3

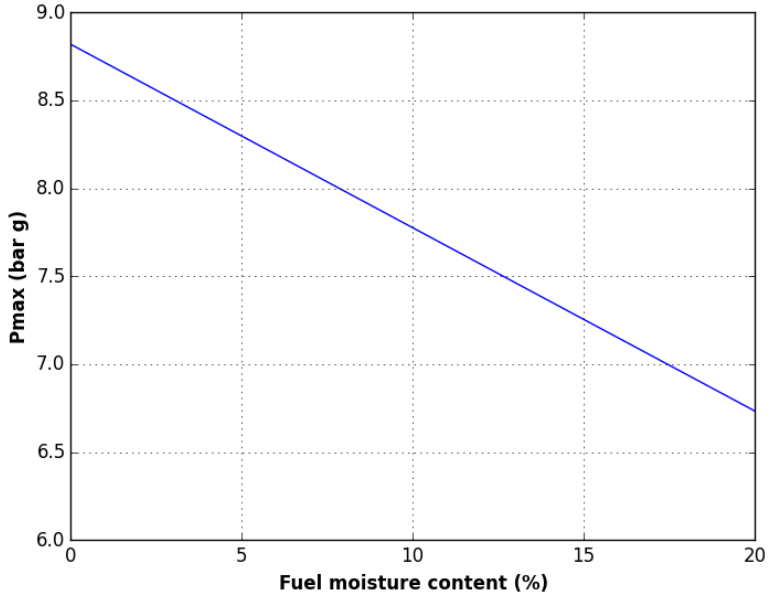
For completely dry fuel.
At stoichiometric conditions.
A start temperature of 15.00 °C
A fuel moisture content of 0.00 %

Explosion temperature: 2135.00 °C
Calculated Pmax: 8.82 bar g
Concentration: 0.21 kg fuel/Nm^3

The 3 plots show the dependence of Pmax (bar g) from initial temperature, stoichiometry and fuel moisture content. The initial temperature affects the volume of the stoichiometric amount of air required to release the calorific content of the fuel, and thus the maximum pressure. Under-stoichiometric conditions don’t allow all heat in the fuel to be released and over-stoichiometric conditions means that more gas needs to be heated by the same amount of heat, both result in a lower Pmax. The fuel moisture, finally, replaces fuel which reduces the amount of available heat in 1 kg of fuel and also adds water that needs to be heated and evaporated.


Pmax
Pmax (bar g)
Initial temperature (C)
11
10
9
8
7
6
5
4
3
0
100
200
300
400
500


Pmax (bar g)
Stoichiometry
10.0
9.5
9.0
8.5
8.0
7.5
7.0
0.80
0.85
0.90
0.95
1.00
1.05
1.10
1.15
1.20


Pmax (bar g)
Fuel moisture content (%)
9.0
8.5
8.0
7.5
7.0
6.5
6.0
0
5
10
15
20