

Short report on preliminary exhaust gas measurement from Volter 30 small scale CHP at Merikjärvi Research Station

1. General information

Exhaust gas measurement was made in University of Eastern Finland Merikjärvi Research Station Volter 30 small scale CHP exhaust with Gasmeter DX-4000 FTIR as analyzer with attached ZrO₂ oxygen measurement. Measurement was made from hot exhaust gas (above +150 °C) Resulting IR spectra was analyzed with Calcmet Software ver 12.0 using flue gas library revision 2. Measurements were made 19.-20.11.2013 continuous basis on 1 minute interval, resulting 2 measurement sessions with lengths of 20,92h and 12,33h.

2. Results

All concentrations are calculated from FTIR IR spectrum (Figure 1). Major peaks are Carbon dioxide (peaks at wavenumbers 3800-3500 and 2400-2200) and water (peaks 4000-3500 and 2000-1200).

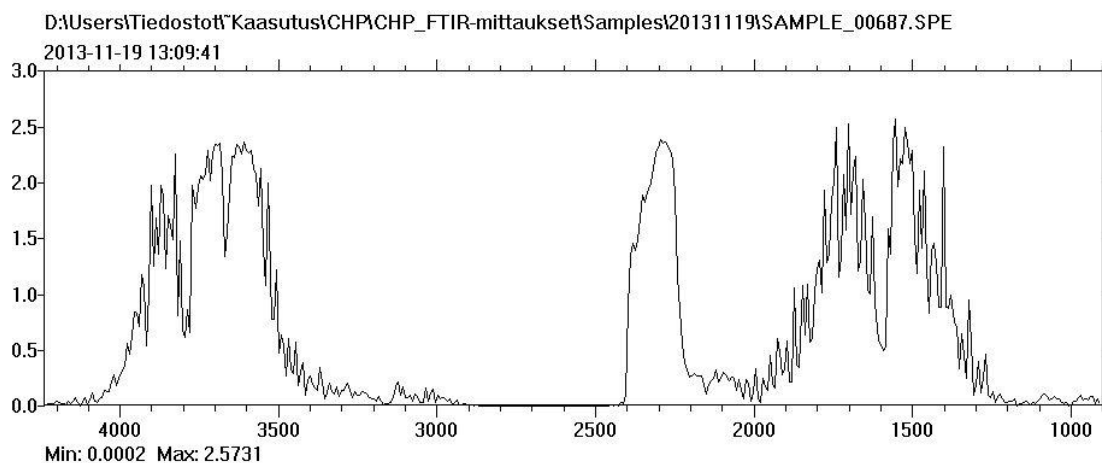


Figure 1: Typical FTIR spectrum

Concentrations of compounds are calculated for each individual spectra from 1 minute spot and concentration (volumetric concentration) results for each compound are averaged for measurement period. From volumetric concentration data other results are calculated using molecular weights and following values: CHP was run on 30% power ie. 10kW_e. Volter reported that on 30% power produces 120kg/h, approximately 150 Nm₃/h, exhaust gas. Measured gas components portions are calculated and residue is assumed to be nitrogen (about 65 vol-%). Exhaust gas is wet, about 15 vol-% water vapor content.



19.11.2013 klo 10.00-20.11.2013 klo 6.55, 20,92h

Emission	g/kWh _e	mg/Nm ³	Vol-%
NO _x	4,6	310	0,024
SO _x	0,12	8	0,0005
CO	40,8	2720	0,35
CO ₂	*	-	17,1
O ₂	16,3	1090	0,22
HC _x	0,31	21	0,004
CHOH	0,006	0,41	0,00005

* When using fully renewable fuel, actual CO₂ emission is 0 g/kWh

20.11.2013 klo 7.40 - 20.11.2013 klo 20.00, 12,33h

Emission	g/kWh _e	mg/Nm ³	Vol-%
NO _x	5,3	353	0,28
SO _x	0,0066	0,44	0,00002
CO	43,0	2870	0,37
CO ₂	*	-	17,0
O ₂	16,1	1075	0,22
HC _x	0,28	18	0,0037
CHOH	0,005	0,32	0,00004

* When using fully renewable fuel, actual CO₂ emission is 0 g/kWh

HC_x is sum of methane, ethane, ethylene and hexane. SO_x is SO₂ and NO_x is sum of NO and NO₂. Results are calculated against electricity output only, values are divided by 3,5 if heat output is also taken into account. For this report actual electricity or heat output measurements were not available.

3. Comments on results

Flue gas library is intended for measurement for direct combustion exhausts where combustion processes in much leaner (oxygen richer) conditions than in combustion engine, typically Carbon monoxide values well below 1000ppm. Results are given as averages of between nitrogen (zero) calibrations. It should also noted that ZrO₂ cell does not tolerate high CO concentrations well, and may result artificially low oxygen result.

Further study will be made regarding emissions and system control.

This report was produced as part of Distributed Biorefineries (Hajautetut biojalostamot) ESF project .

14.2.2014

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