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INERIS
maîtriser le risque pour un développement durable

REAL-LIFE EMISSIONS PROJECT – ACTION A4

Test of the new extended EN PME method and OGC measurement: Intercomparison campaign

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Life

Real-LIFE Emissions

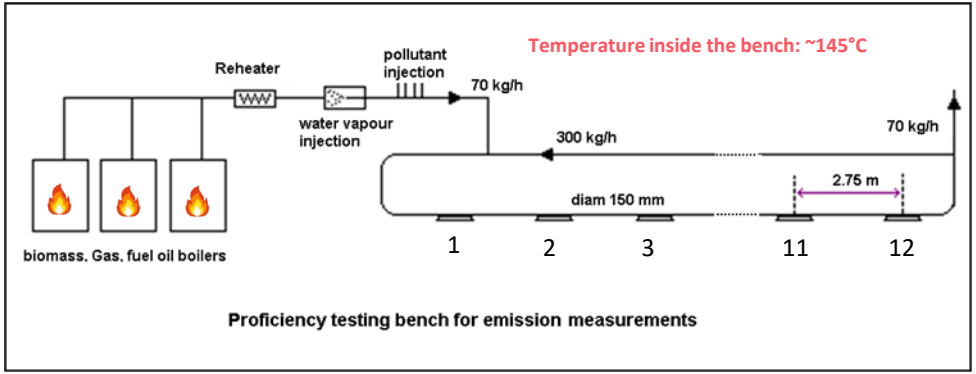
Presentation plan

- Principle and objective of the intercomparison + Design of the test bench
- Feasability study: Emission levels and homogeneity of solid Particles and OGCs generated using dry and fresh wood chips (previously demontrated with pellets in 2014 and 2017)
- Intercomparison Campaign performed in september 2023: Description + Results and Discussion

Principle and objectives of the intercomparison

- **Principle:**
  - One homogeneous sample provided to several laboratories and results obtained are compared.
  - To be statistically exploitable, at least 8 participants are required

- **Real life emissions project:**
  - Test of the new extended EN PME method (4 prototype sampling lines) and OGC measurement
  - The objective is not to perform a statistical analysis but to evaluate the implementation of the new method on a small scale, a first stage of evaluation



Proficiency testing bench for emission measurements

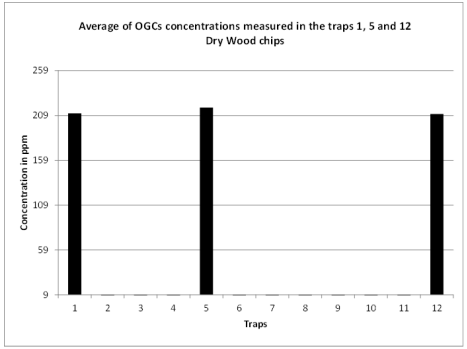
- Titanium loop (to minimize reactions, transformations and losses of the generated compounds)
- Designed to generate gaseous effluents of identical composition
- 12 sampling ports

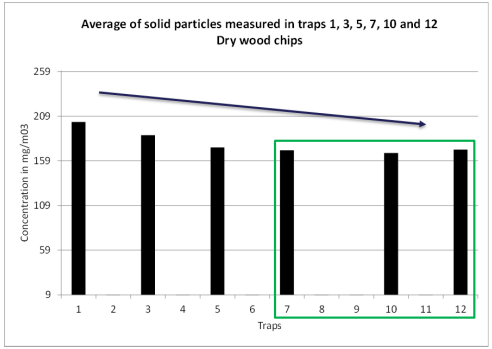
Homogeneous Distribution Over the Bench: Feasibility Tests for OGC and solid particles

OGCs homogeneity

Fuel types tested:
Dry wood chips
Fresh wood chips

Solid particles homogeneity





Concentrations of OGC considered as homogeneous along the full bench

Concentrations of solid PM considered as homogeneous from sampling ports 7 to 12

Intercomparison campaign: Overview

18/09/2023:

- Partners arrival, Visit and Briefing.
- Equipment Installation

19th to 21st :

(Pellets, Dry and Fresh wood chips): 1 day/fuel

- Minimum 4 Combustion Tests/day/fuel type between the sampling ports 7, 8, 9, 10 and 11;
- OGCs measured continuously (TPM measured during 30-45 min);
- Other combustion gases measured by Ineris (O_2, CO_2, CO and NOx);

22/09:

- Debriefing, equipment storage, partners departure

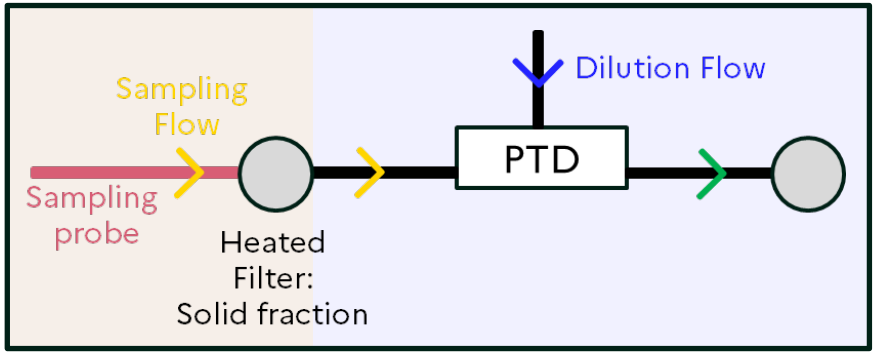
Intercomparison campaign: Overview

- **4 participants: TFZ, UEF, VSB and Ineris**
- **Methods tested:**
  - Particulate Matter (solid+condensable): 4 prototype sampling lines of the new extended EN PME method
  - Probe cleaned using blowing and rinsing
  - OGC: 3 FID and 1 FTIR
- **16 trials performed within the 3 days of measurement**
- **Levels of concentrations generated:**
  - OGC:
    - 5 trials between 0 and 50 mg Ceq/Nm^3
    - 11 trials between 50 and 650 mg Ceq/Nm^3
  - Total particles (Solid + Condensables):
    - 5 trials between 0 and 50 mg//Nm^3
    - 11 trials between 50 and 300 mg/Nm^3

New extended EN PME method

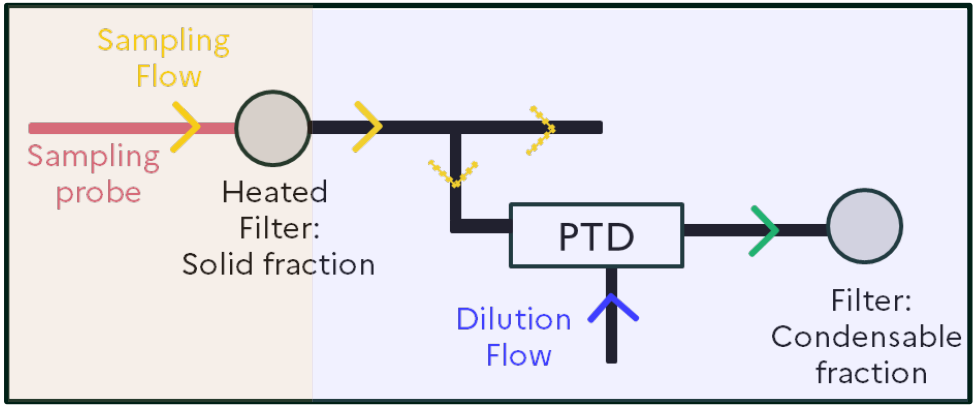
Two sampling configurations for condensables have been tested:

Full Flow: Lab 1 & Lab 2



EN PME Extended EN PME

Partial Flow: Lab 3 & Lab 4

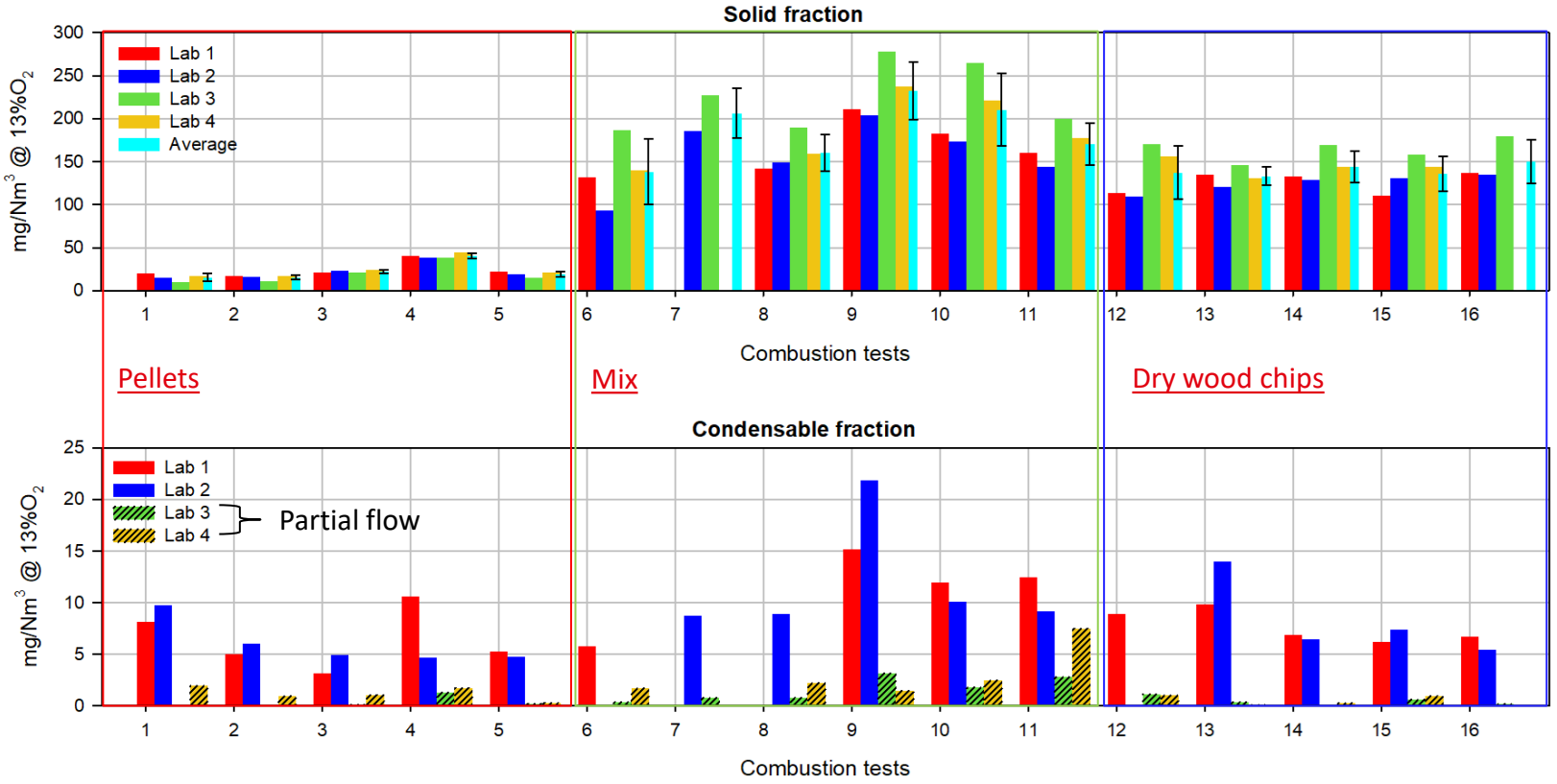


EN PME Extended EN PME

New extended EN PME method: sampling conditions

	Sampling Flow rate NL/min	ENPME probe	Filter 1	Connection Filter 1-PTD	Fitlter 1 Pre-conditionning	Fitlter 1 Post-conditionning	Dilution ratio	Filter 2	Partial Flow rate NL/min
Lab 1	7-10	180°C	Quartz 180°C	Not heated	200°C, >1h, desiccator overnight, Weighed	180°C, >1h, desiccator overnight, weighed	8-11	Quartz 25-32°C	-
Lab 2	10		Stuff cartridges (days 2 and 3) +Quartz 180°C	Not heated			8	Quartz 25-34°C	-
Lab 3	10		Glass fiber 180°C	180°C insulated			8	1,2,3,6: quartz Rest: Teflon 42°C	5
Lab 4	8-10		Quartz 180 °C	180°C			8-12	Teflon 32-40°C	5

New EN PME-PT method: Solid and condensable fractions



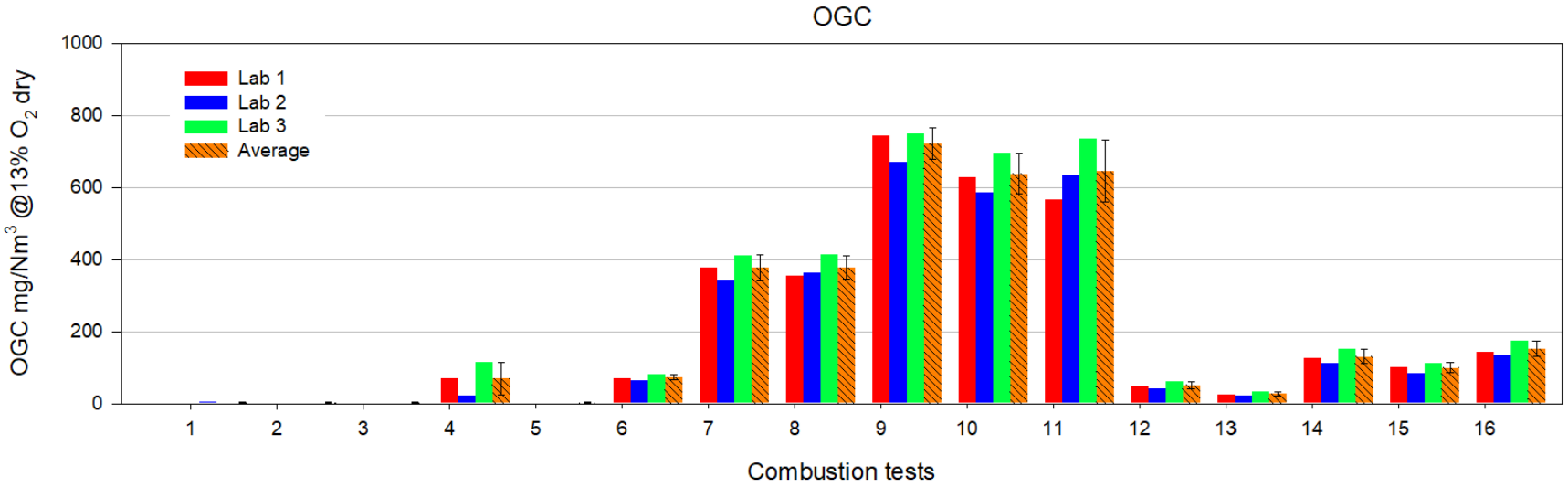
New extended EN PME method: Probe blowing and rinsing

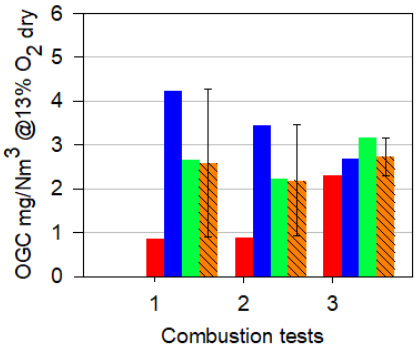
	% Blowing (Avg)	% Rinsing (Avg)
Lab 1	3	13
Lab 2	2	7
Lab 3	2	No data
Lab 4	2	4

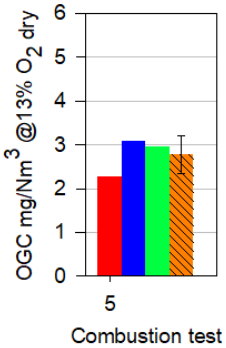
- Blowing represents < 3% of the collected fraction on the first filter
- Rinsing can represent up to 13% of the collected fraction on the first filter

➢ Remaining deposits after blowing, rinsing procedure as described in EN 16510 for each testing day is crucial

OGCs measurements (FID)







Good agreement over the different tests

Conclusions & Perspectives

Conclusions:

- We were able to carry out comparisons on the INERIS bench with different concentrations of particles (Solid + condensable)
- Rinsing shows that after blowing, there is still particle deposition → Rinsing procedure as described in EN 16510 for each testing day is crucial
- Two configurations were tested for the new extended EN PME method
- The two configurations gave coherent results of solid fraction
- The two configurations gave different levels of results of condensation, the full-flow configuration gave higher results than the partial flow configuration
- The two labs using the full flow configuration presented concentrations of condensables of the same order of magnitude.
- OGC → good agreement between the 3 labs using the FID technique.

Conclusions & Perspectives

Perspectives:

- Being able to generate higher concentrations of condensables.
- Testing the new extended EN PME method: more investigation needed to evaluate its performance at different concentrations (testing on stoves).
- Comparisons with other methods necessary.

Inter-comparison campaign

Thank you for your attention!