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Solid recovered fuel gasification in sliding bed reactor

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Motivation for WtE

- Waste minimalisation
- Economic feasibility
- Energy demand
  - Heat
  - Electricity

Gasification technology

Sliding bed over circular grate

Cross/Updraft

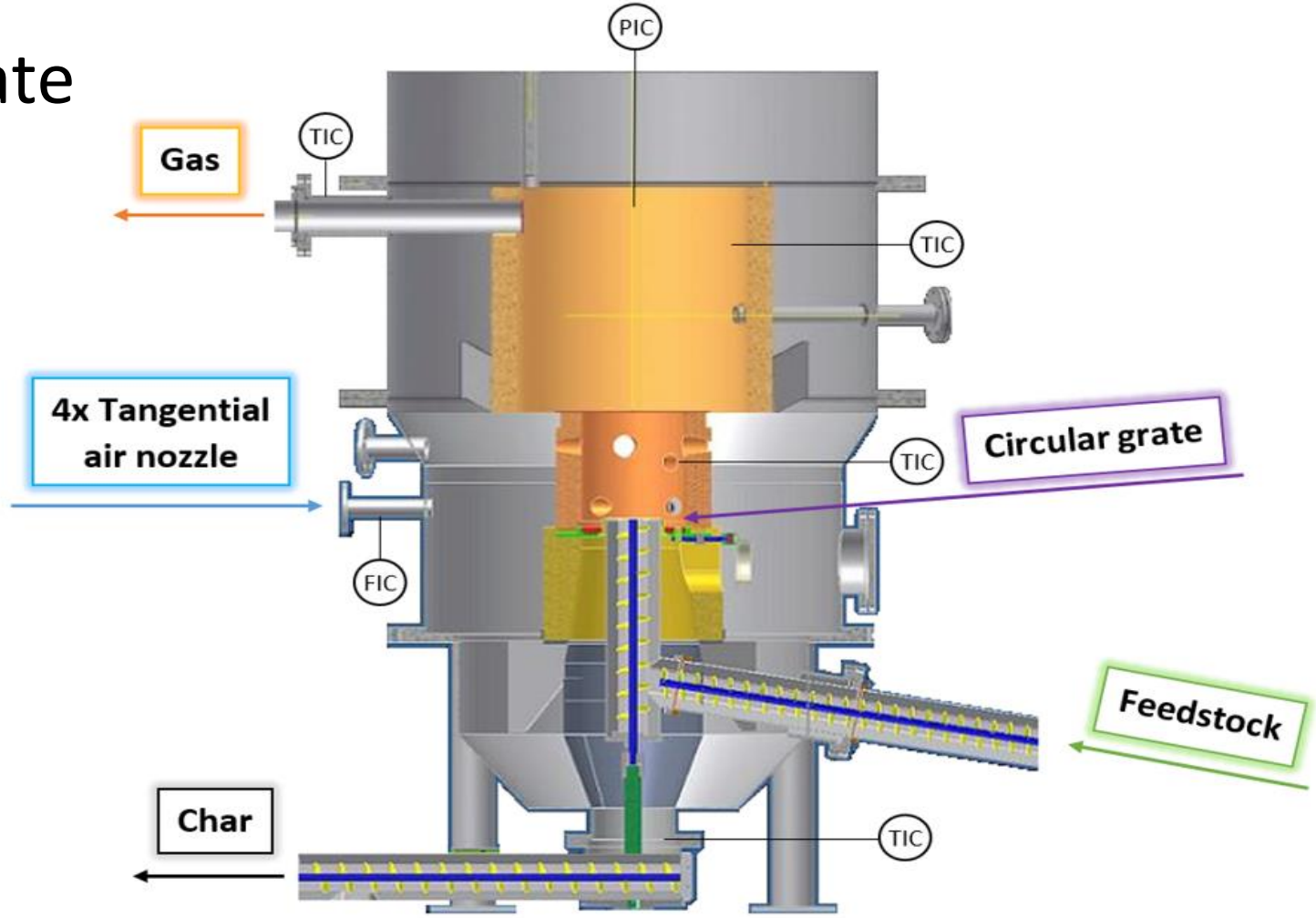
Atmospheric air

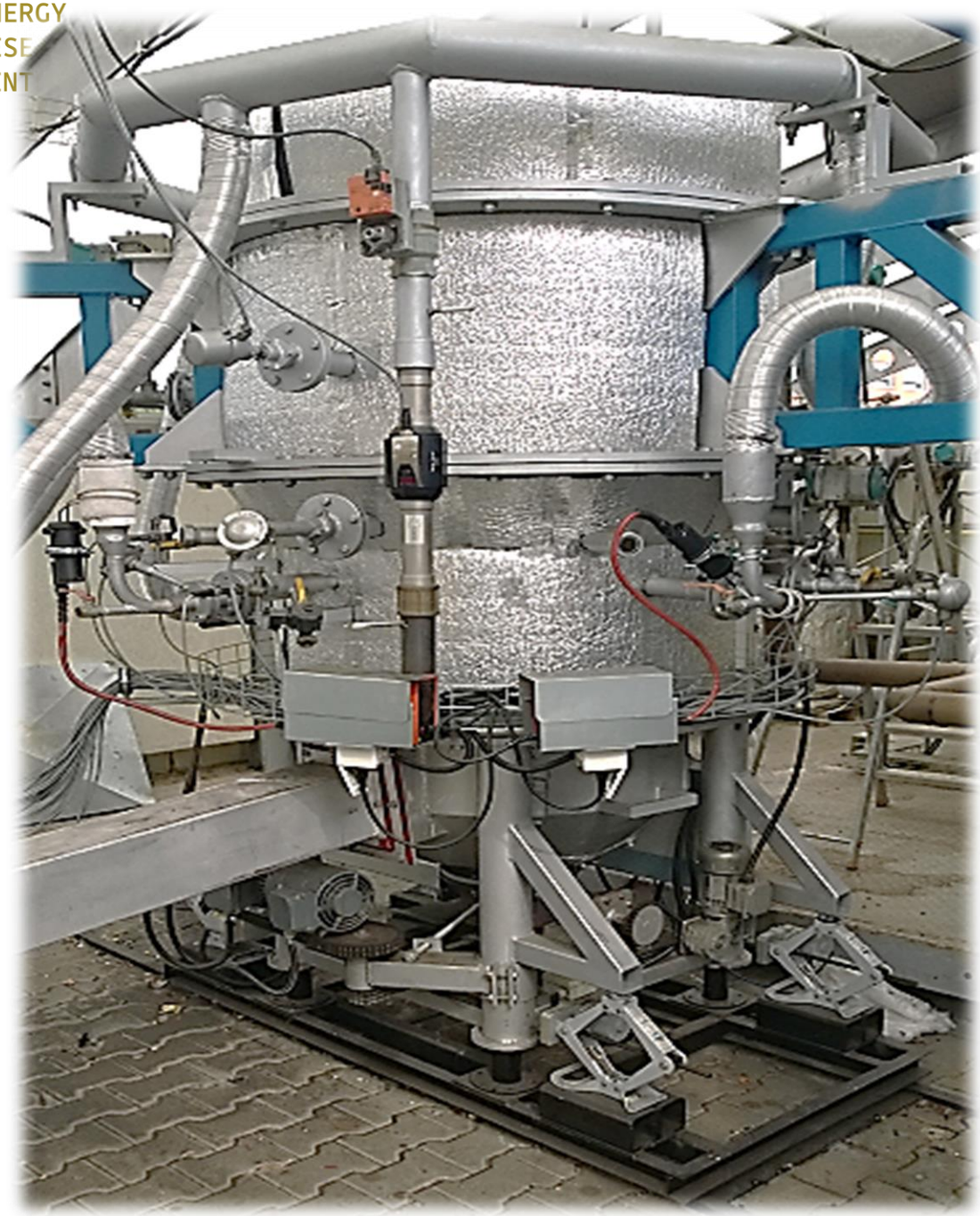
10-60 kg/h

200 kW power input

650-950 °C

Autothermal





Fuel

60 % - Unrecyclable **plastics**, **wood**, **paper** and **textiles** from municipal and industrial waste

40 % - Soft-wood pellets

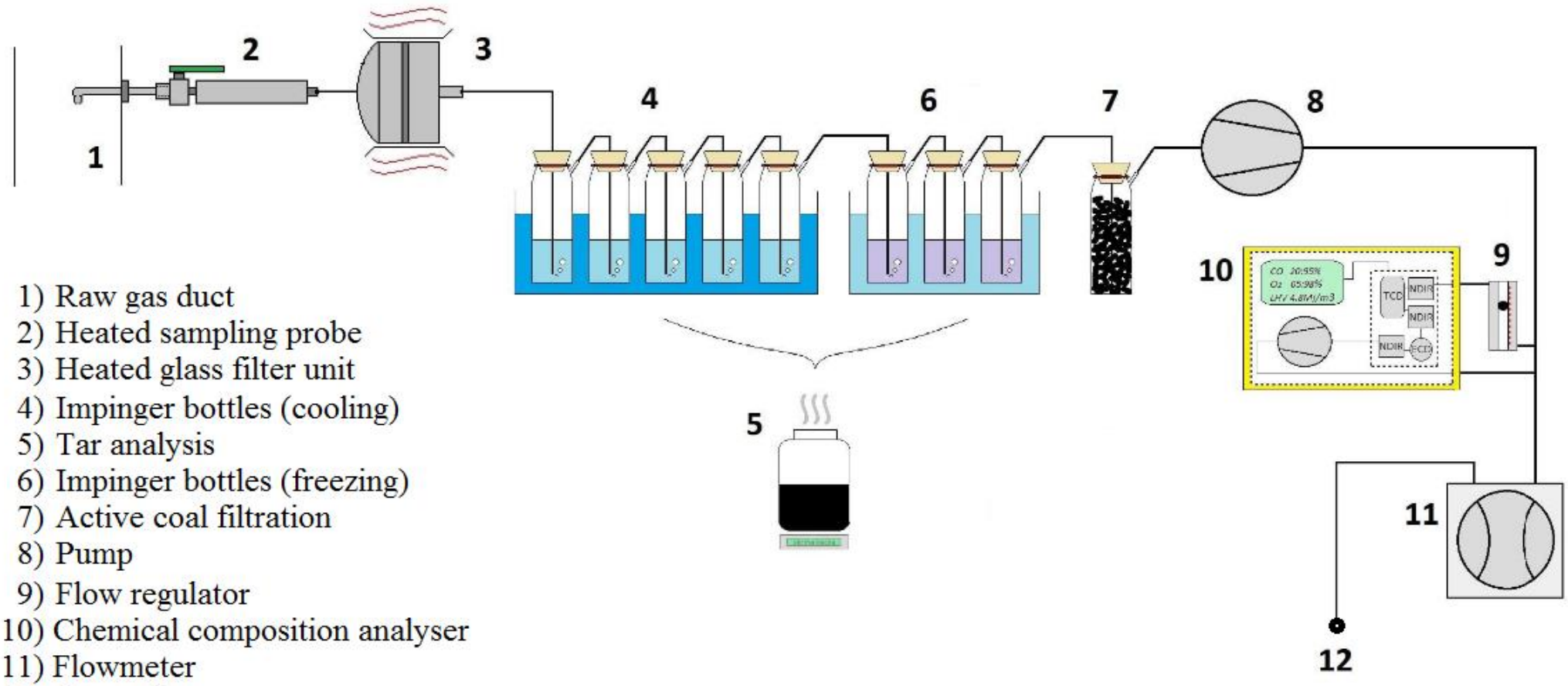
SRF

Parameter	Plastics	Wood	Paper	Textiles	Other
Value	45 %	30 %	20 %	4 %	1%

SRF/wood mixture

Parameter	Volatile	Water	Ash	Carbon	Oxygen	Hydrogen	Nitrogen	Sulphur	LHV
Value	77.3 %	7.1 %	3.9 %	48.2 %	33.6 %	6.2 %	1.0 %	0.1 %	18.2 MJ/kg

Experiment



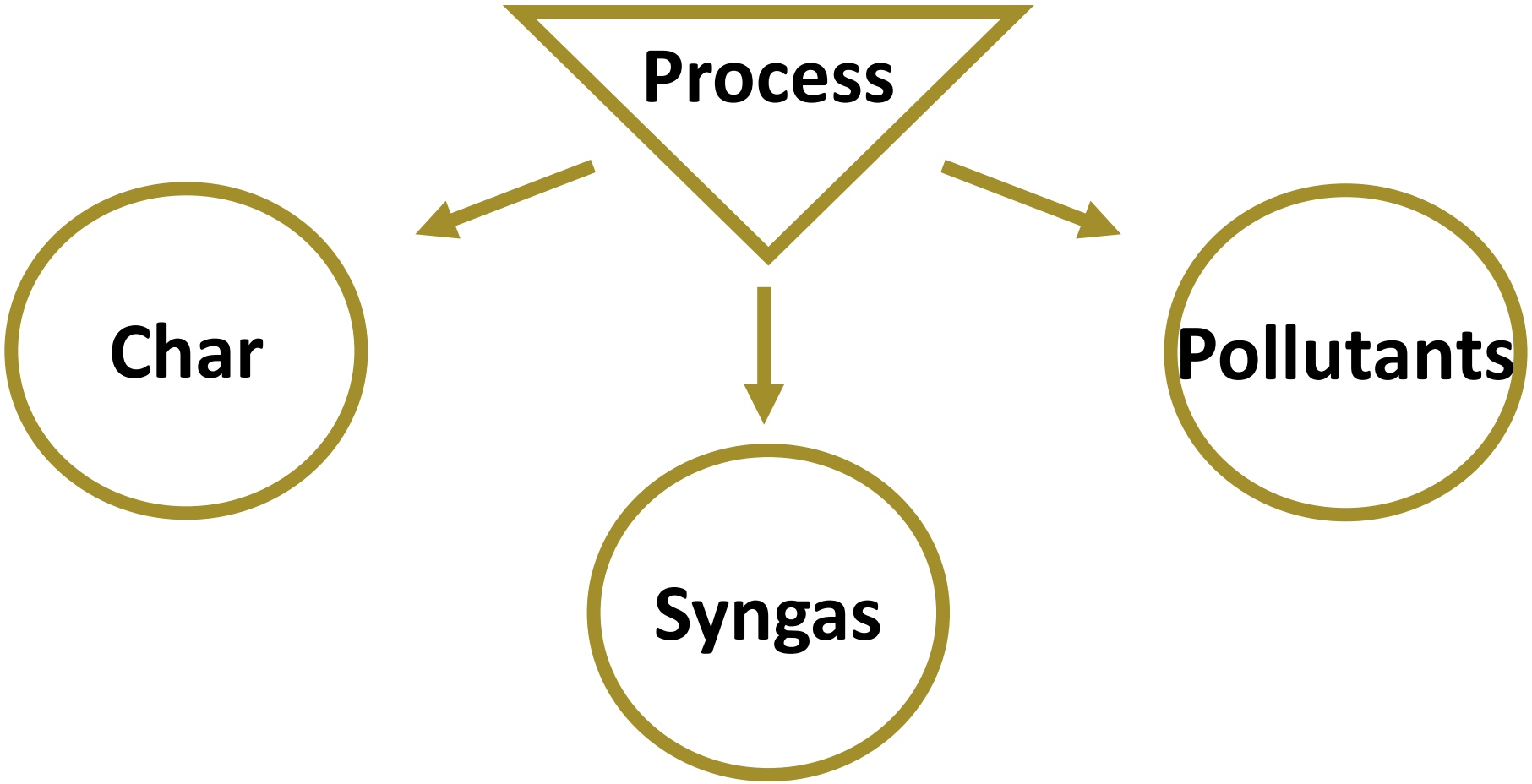
1) Raw gas duct
2) Heated sampling probe
3) Heated glass filter unit
4) Impinger bottles (cooling)
5) Tar analysis
6) Impinger bottles (freezing)
7) Active coal filtration
8) Pump
9) Flow regulator
10) Chemical composition analyser
11) Flowmeter
12) Gas outlet

Experiment

The experimental conditions in four different rounds

Experiment	1	2	3	4	
Equivalence ratio	0.04	0.06	0.08	0.12	[-]
Temperature	938.8	941.9	1005.4	935.8	[K]
Relative pressure	-0.1	-0.2	-0.3	-0.1	[kPa]
Fuel flow	48.5	48.6	50.3	14.2	[kg/h]
Air flow	9.0	14.8	18.3	9.8	[m^3/h]

Results



Results - Syngas

Experiment	1	2	3	4	
Gas flow	41	50	48	41	[m^3/h]
CO	15.7	9.3	9.3	5.8	[% vol.]
H_2	0	2.9	3.3	1.8	[% vol.]
CH_4	8.8	3.6	3.5	4.3	[% vol.]
LHV	5.0	2.7	2.7	2.4	[MJ/m^3]

T = 293 K and p = 101325 Pa

Results - Char

Char yield = 10-20% (of the initial material weight)

C^d = 75.5 ± 6.2% wt.

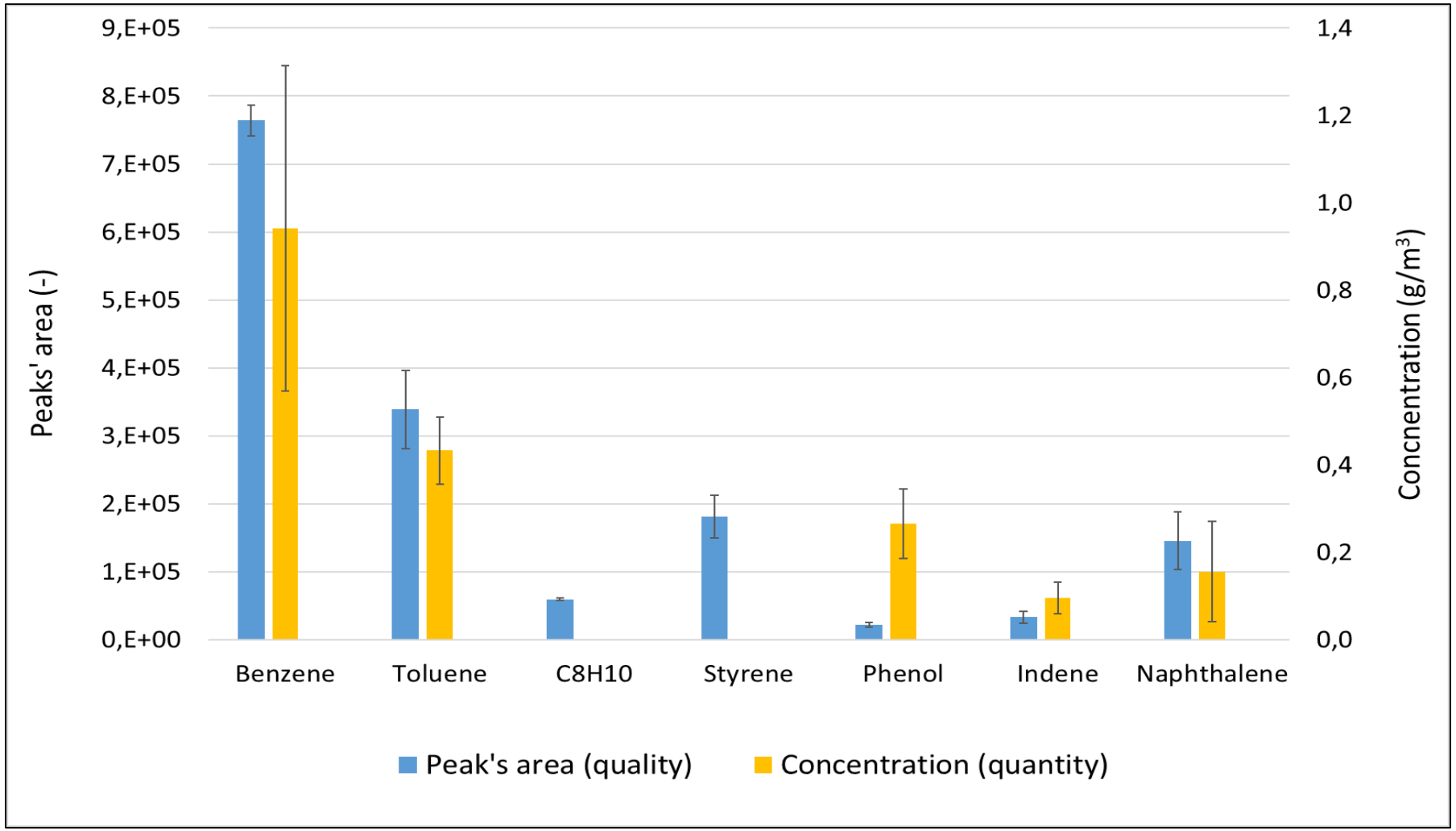
A^d = 10.3 ± 4.8% wt.

Results - Pollutants

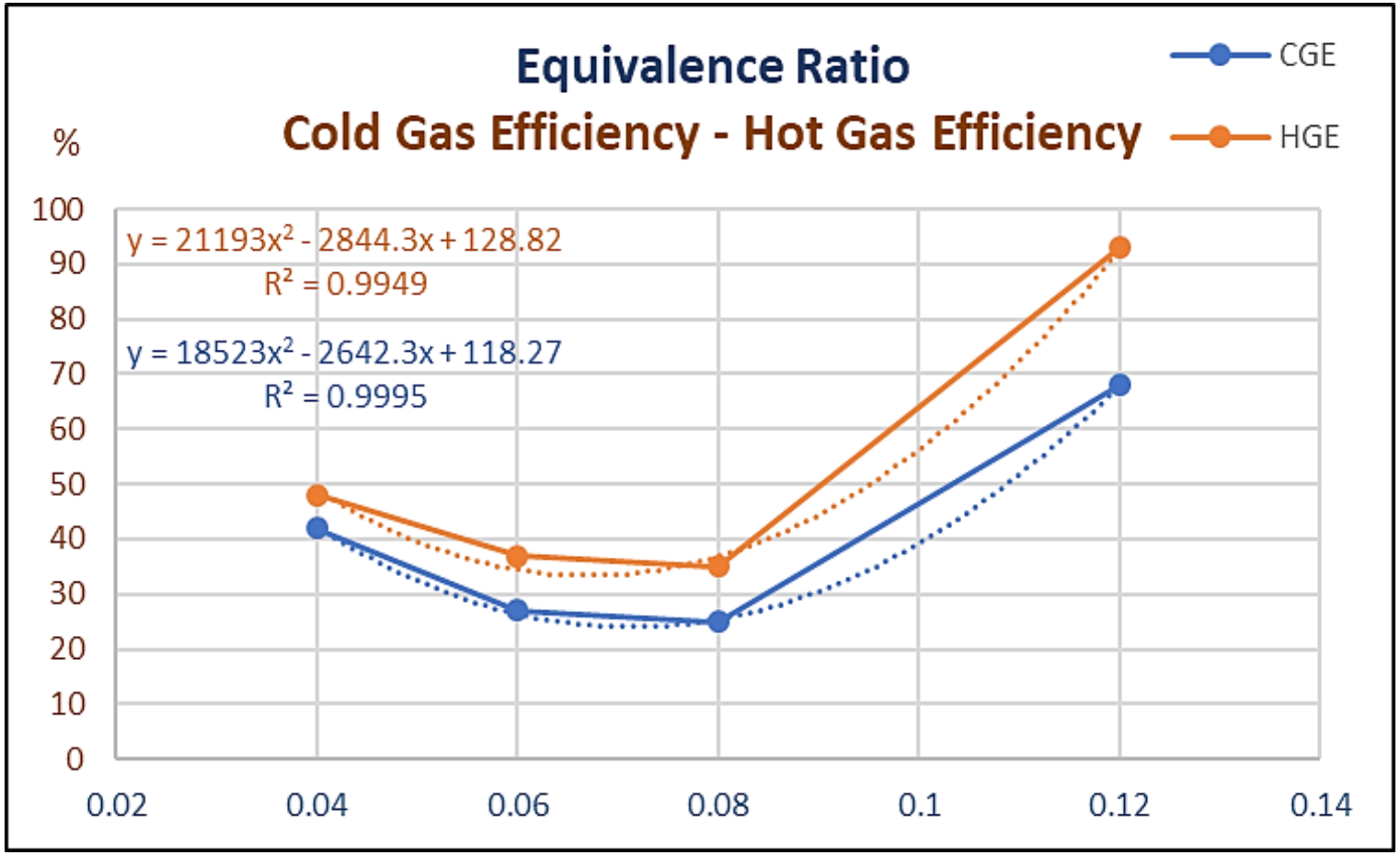
Experiment	1	2	3	4	
Sampling flow rate	1.1	1.1	1.1	1.0	[l/min]
Particulate matter	1.7	1.9	5.0	0.5	[g/m³]
Tar compounds	n.a.	2.2	1.9	0.7	[g/m³]

T = 293 K and p = 101325 Pa

Results - Pollutants



Process efficiency in terms of syngas production



Conclusion

Solid waste gasification can be performed

- In combination with wood
- In very low ER regime – down to 0.04
- With satisfying syngas quality – up to 5 MJ/m^3
- With interesting char production
- With promising production of polluting agents
  - Tars below 2.3 g/m^3

Thank you for your attention

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