

Potential ecotoxicity of biomass combustion-derived fine and ultrafine particles

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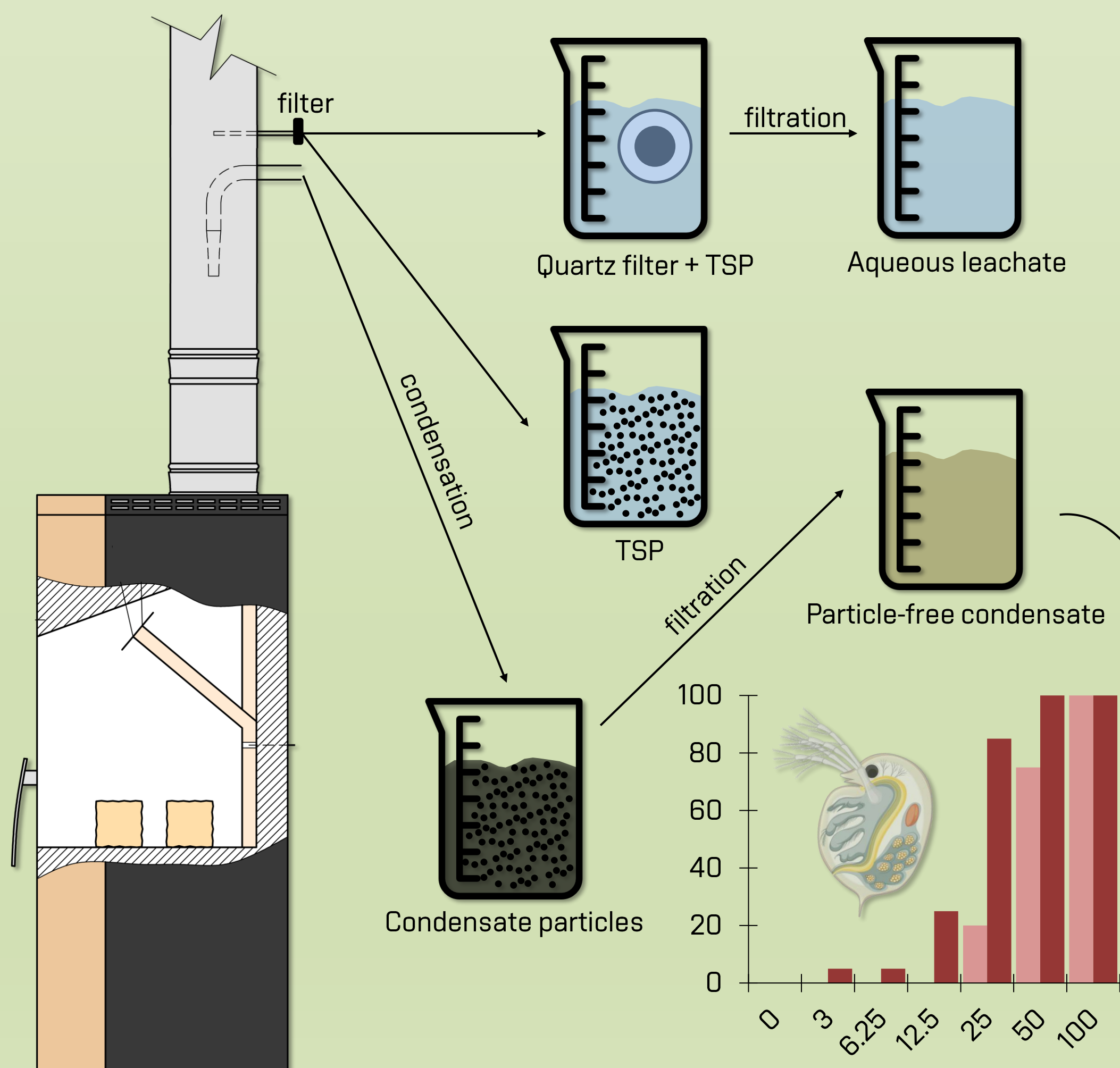
Introduction

Air pollution is the greatest environmental health risk in the 21st century. One of the significant sources of indoor and outdoor air pollution worldwide is biomass burning. One of the significant pollutants during combustion process is particulate matter (PM). They are very damaging to the environment and the human health due to their long residence time, long distance transport and high toxic adsorption capacity.

For the reasons given above, the authors of this study focused on the possible ecotoxicity of PM produced during domestic combustion process. Ecotoxicity was assessed using zooplanktonic *Daphnia magna* acute toxicity immobility assay.

Materials and methods

- Manual log feed stove ABX 6 kW
- Barkless beech wood beams (80×80×250 mm)
- Total suspended particle (TSP) according to ČSN EN 13284-1
- Liquid condensate of particle → cooling below dew point
- Daphnia magna* acute toxicity immobility assay
- Elemental analysis by ICP-MS (ARCOS, Spectro)
- Organic composition GC/MS (GCMS-QP2010 Ultra, Shimadzu)



Conclusion

- Liquid condensate and TSP samples were found to be ecotoxic
- Heavy metals and bounded PAHs play key role in toxic mechanism
- The suggested toxicity mechanism is oxidative stress
- Further plans:
 - Toxicological test in higher organism
 - ROS detection assay

Results and discussion

Ecotoxicity test

- Condensate particles (tars and soot) 100% mortality after few minutes
- Particle-free condensate (tars and soot) EC₅₀ after 24 h 37%, after 48 h 16%
- TSP samples:
 - Aqueous leachate: 0% mortality after 48 h
 - Quartz filter + TSP and TSP : 60% mortality after 48 h

Tab. 1: Effect of different samples from biomass combustion on the *Daphnia magna* mortality

Concentration	24 h	48 h
	Mortality [%]	Mortality [%]
0%	0	0
3%	0	5
6.25%	0	5
12.5%	0	25
25%	20	85
50%	75	100
100%	100	100
EC ₅₀	37	16

Sample	24 h	48 h
	Mortality [%]	Mortality [%]
Aqueous leachate	0	0
Quartz filter + TSP	20	60
TSP	27	60

Elemental analysis

- Mainly C, O, H and N
- Soluble elements (e.g., K, Ca, Na)
- Heavy metals (Fe, Mn, Pb, Cr, Cu)

Organic composition

- All 16 priority PAHs according to US EPA were detected
- Liquid condensate contains more benzene-based hydrocarbons

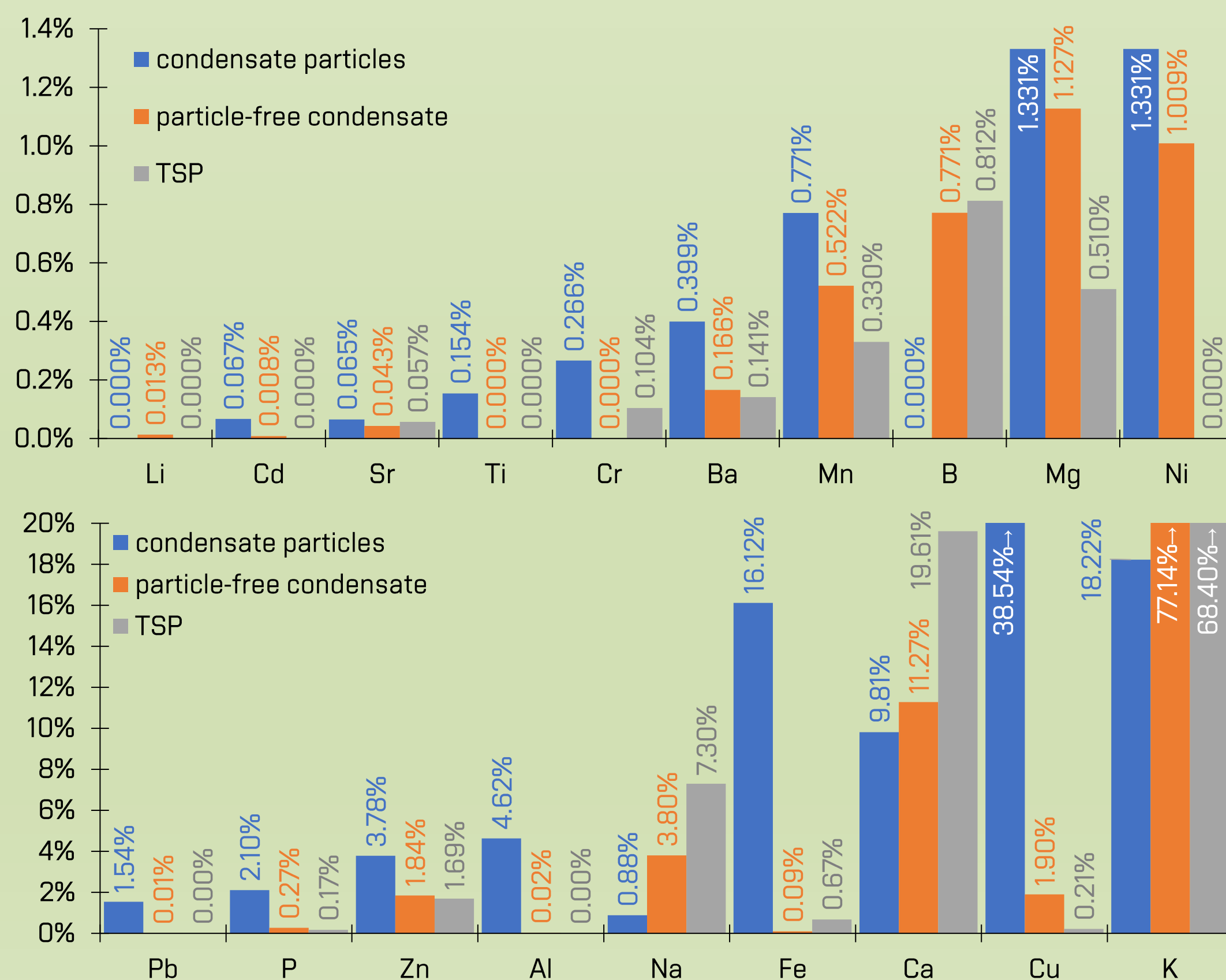


Fig. 1: Semi-quantitative elemental composition from biomass combustion by ICP-OES

Acknowledgements

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