

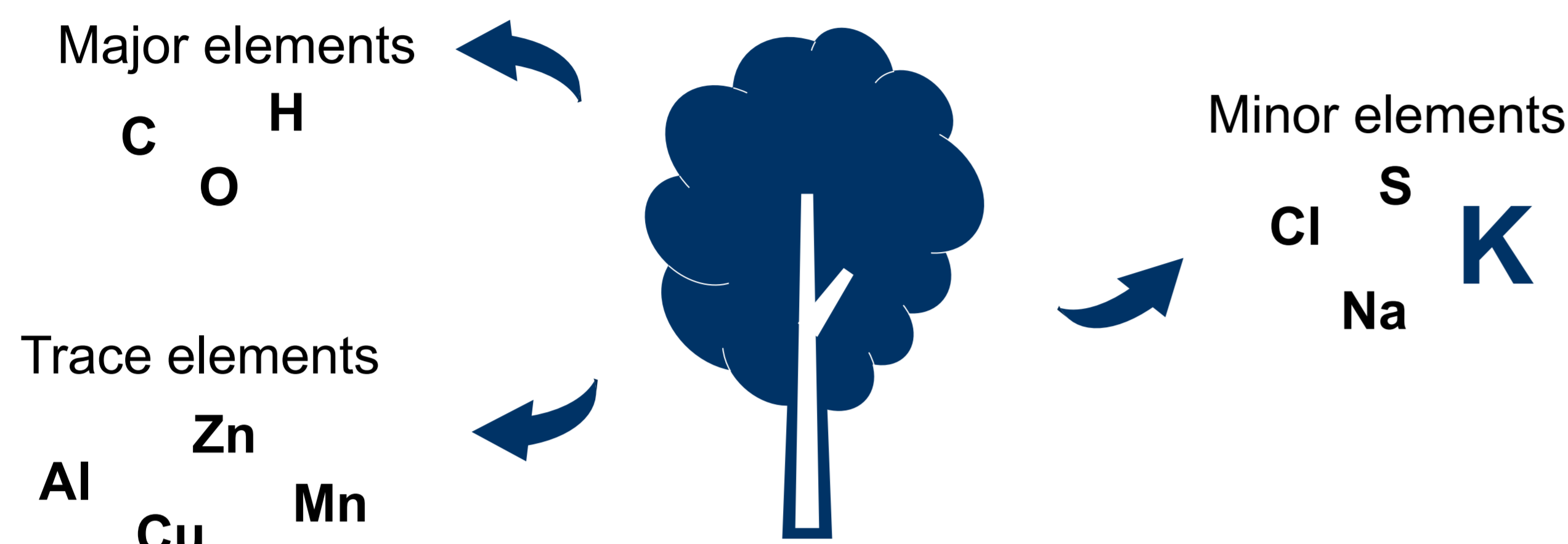
Additives as fuel-oriented particulate matter (PM) mitigation measure for small-scale wood chip combustion

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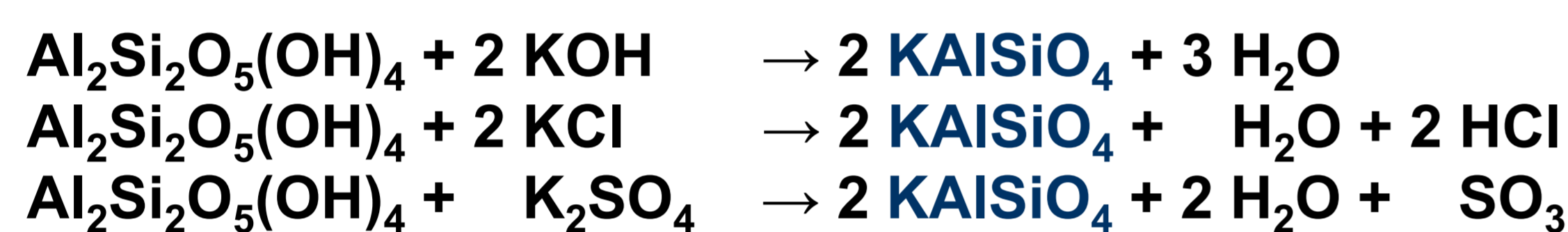
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Motivation

The complete thermo-chemical conversion of solid biogenic fuels (e.g., wood chips, wood pellets) is associated with unavoidable release of (inorganic) particulate matter (PM) emissions; especially in small- and middle-scale combustion appliances.



In this context, the utilization of so-called additives is a promising, fuel-oriented PM mitigation measure. The selection of suitable additives leads to a temperature-stable integration of the main PM-forming elements (e.g., **K**) from the biomass in the ash.

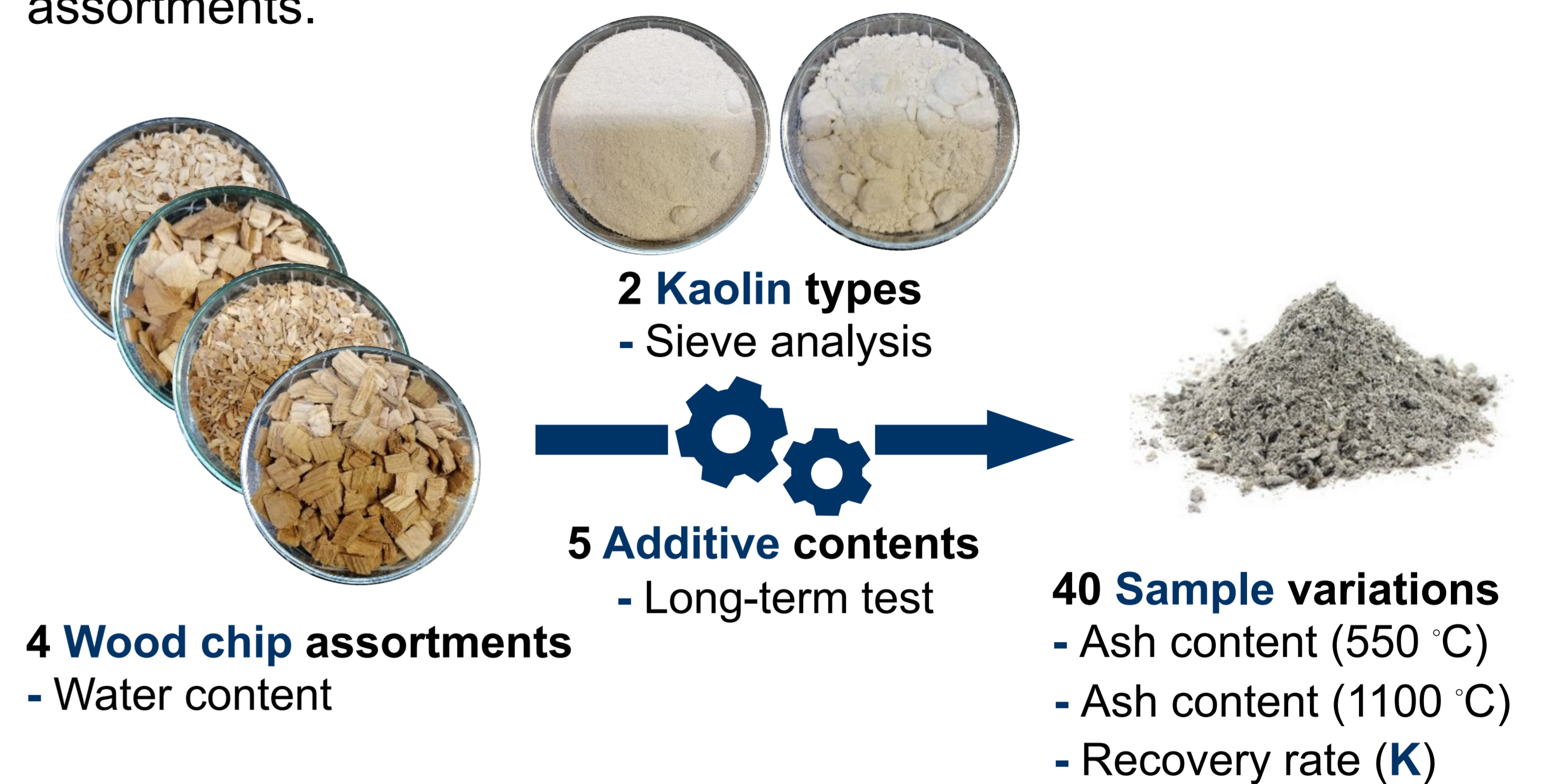


Kaolinite ($\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$) reacts with volatile potassium compounds to form temperature-stable products



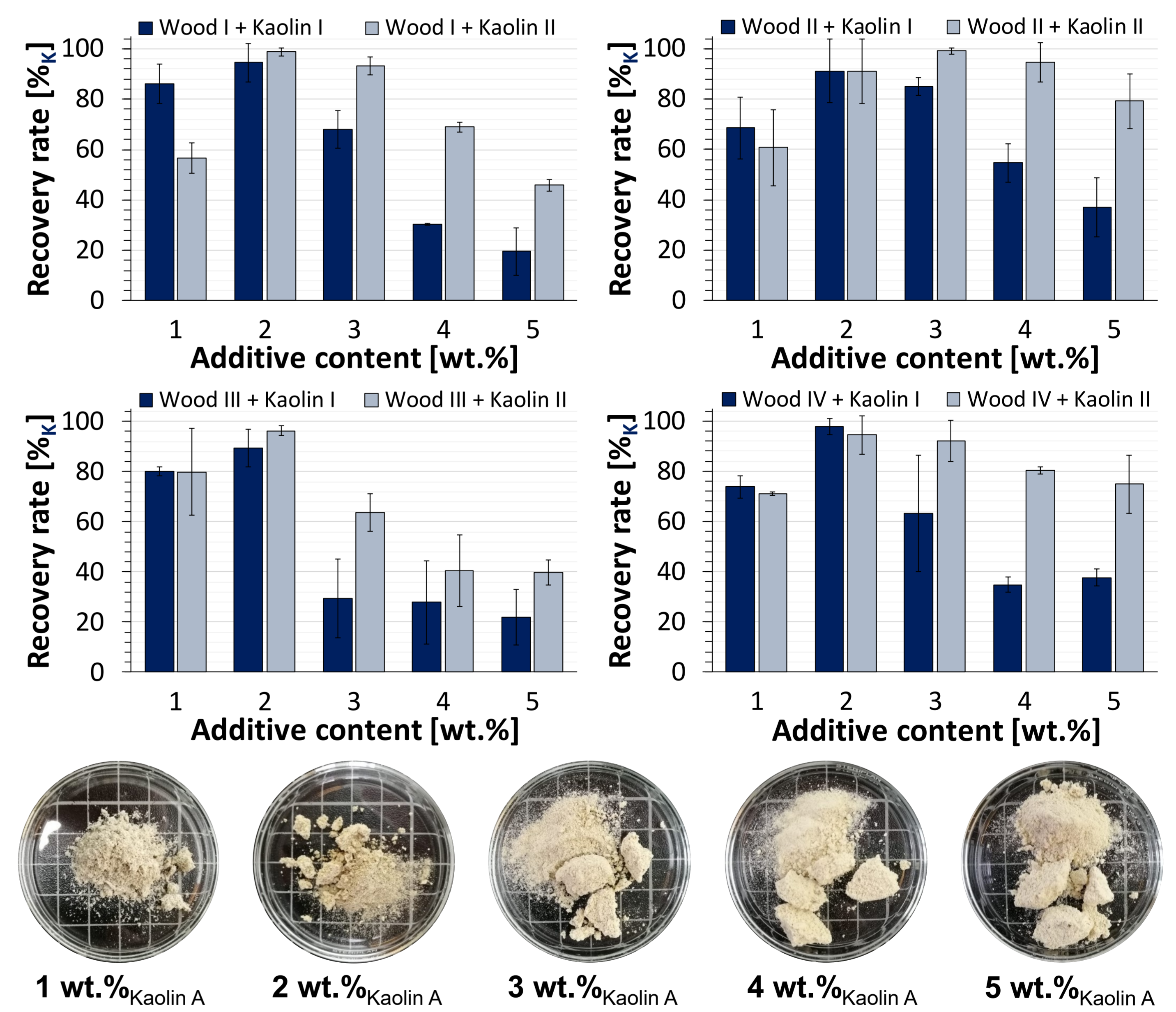
Experimental design

In order to reduce the release of inorganic PM emissions during small-scale wood chip combustion, the present study aims to analyze the influence of two kaolin types on the high-temperature ash retention of potassium for four different wood chip assortments.



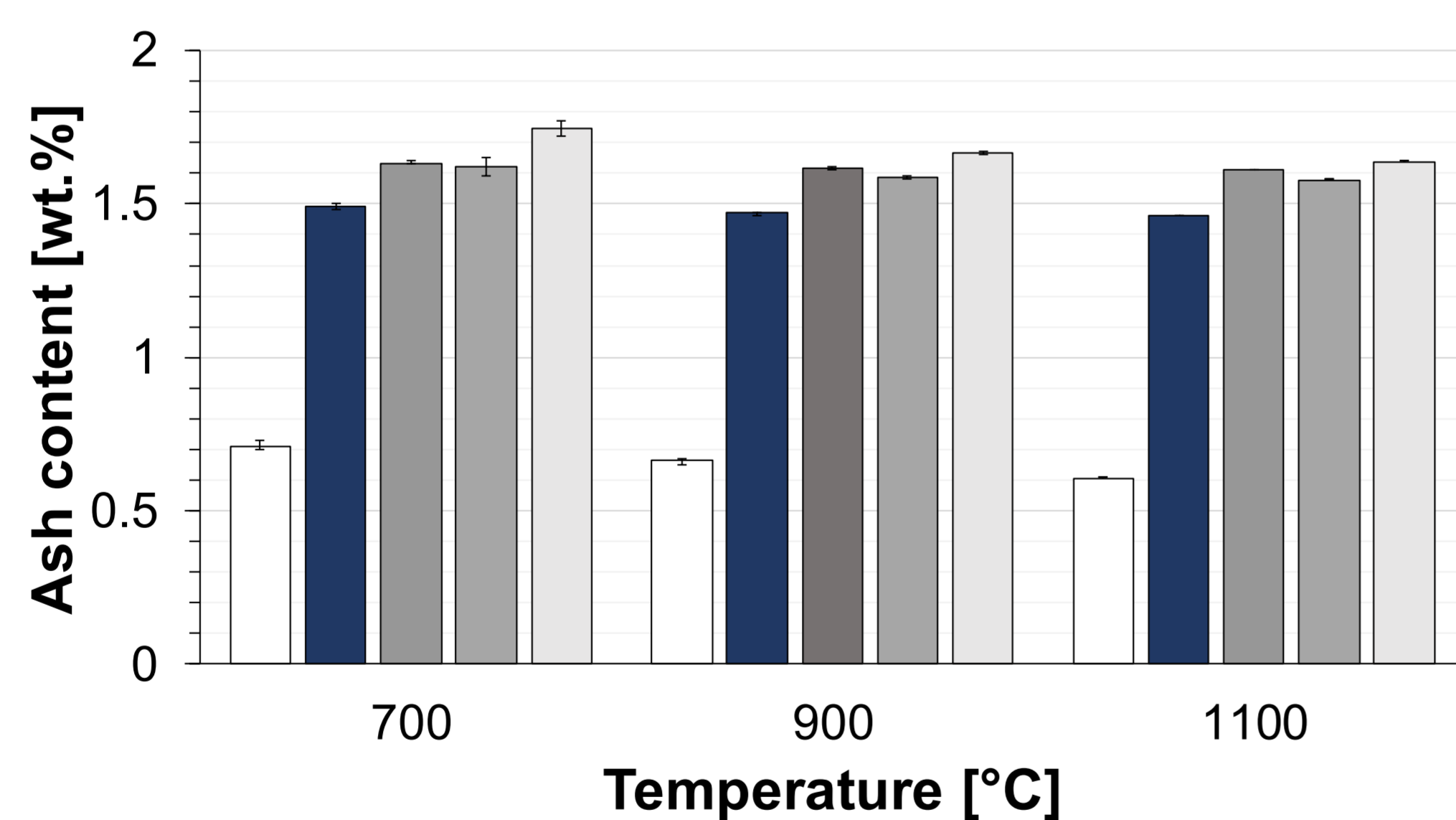
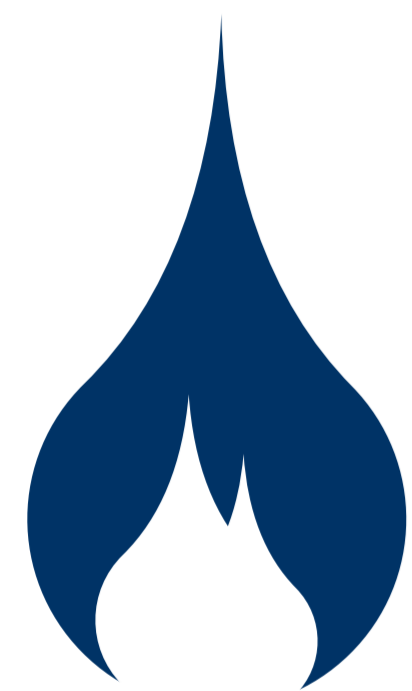
Results

In the following, selected analysis results of the wood chip samples containing varying amounts of additive are shown:

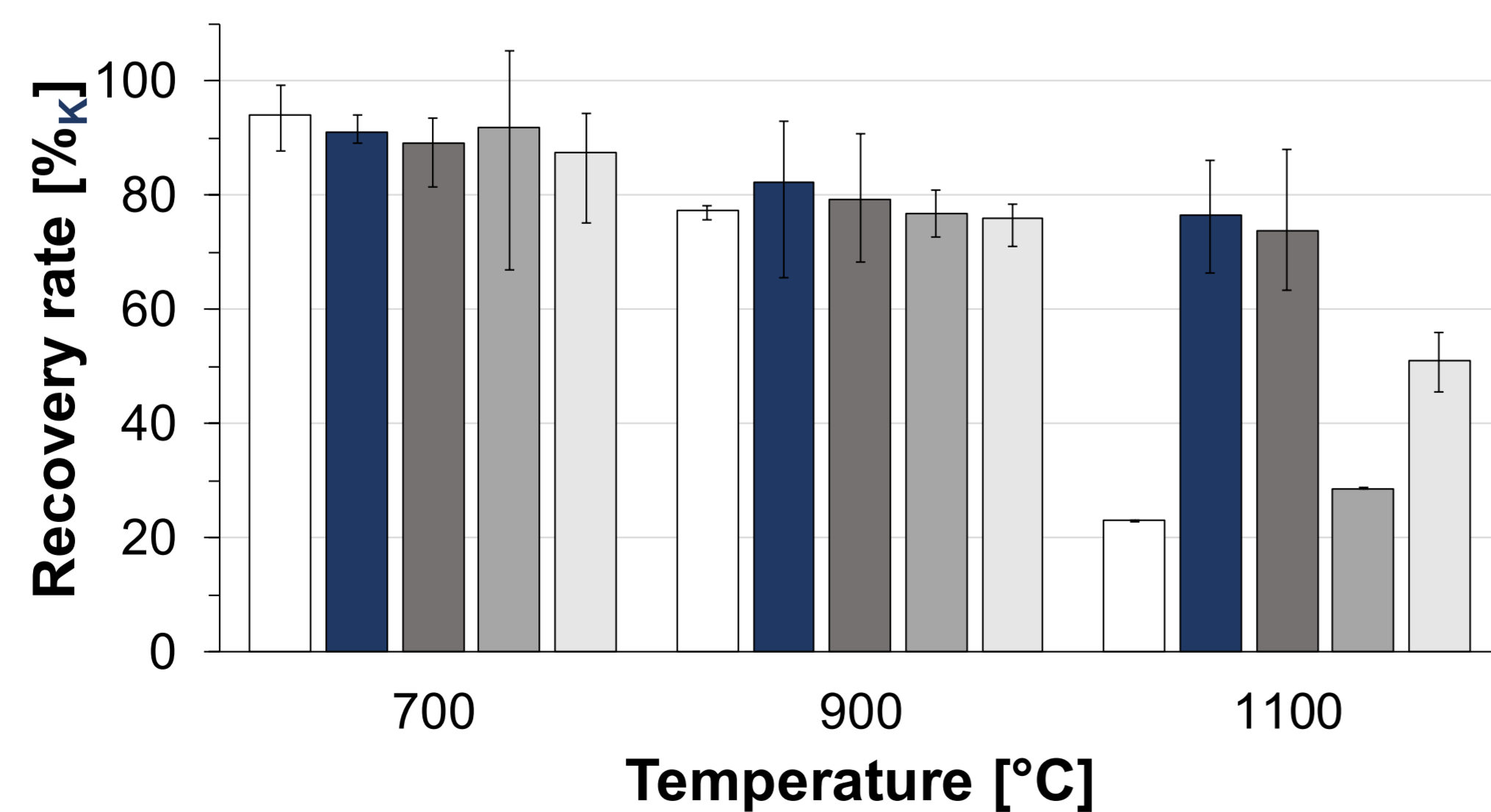
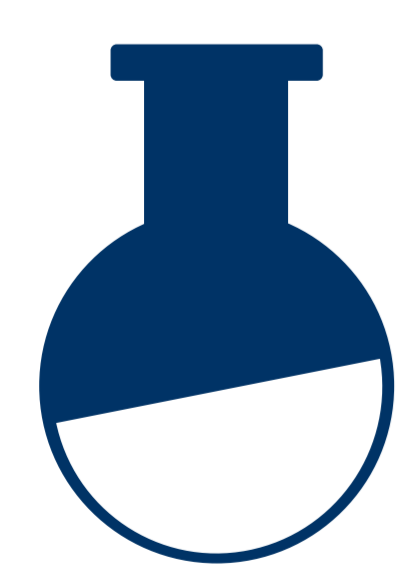


Additive pre-testing

Based on chemical equilibrium calculations (FactSage), additives can be pre-selected for laboratory analyses with respect to their influence on ash composition and behavior as well as to the potential formation of inorganic PM emissions.



□ No Additive ■ Kaolinite ■ Anorthite ■ Titanium dioxide □ Calcium silicate



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Laboratory-scale pre-testing provides valuable information in terms of further analyses and experimental design.

Outlook

- Initial laboratory experiments indicated positive results for the utilization of additives in the context of wood chip combustion.
- Increased ash contents due to the addition of additive might be easily countered by the proper selection of suitable combustion systems.
- The laboratory-proven potassium retention of the additives should be confirmed by additional test measurements on a modified small-scale combustion appliance in a next step.