Influence on combustion and ash characteristics during co-combustion of municipal solid waste and pelleted sewage sludge

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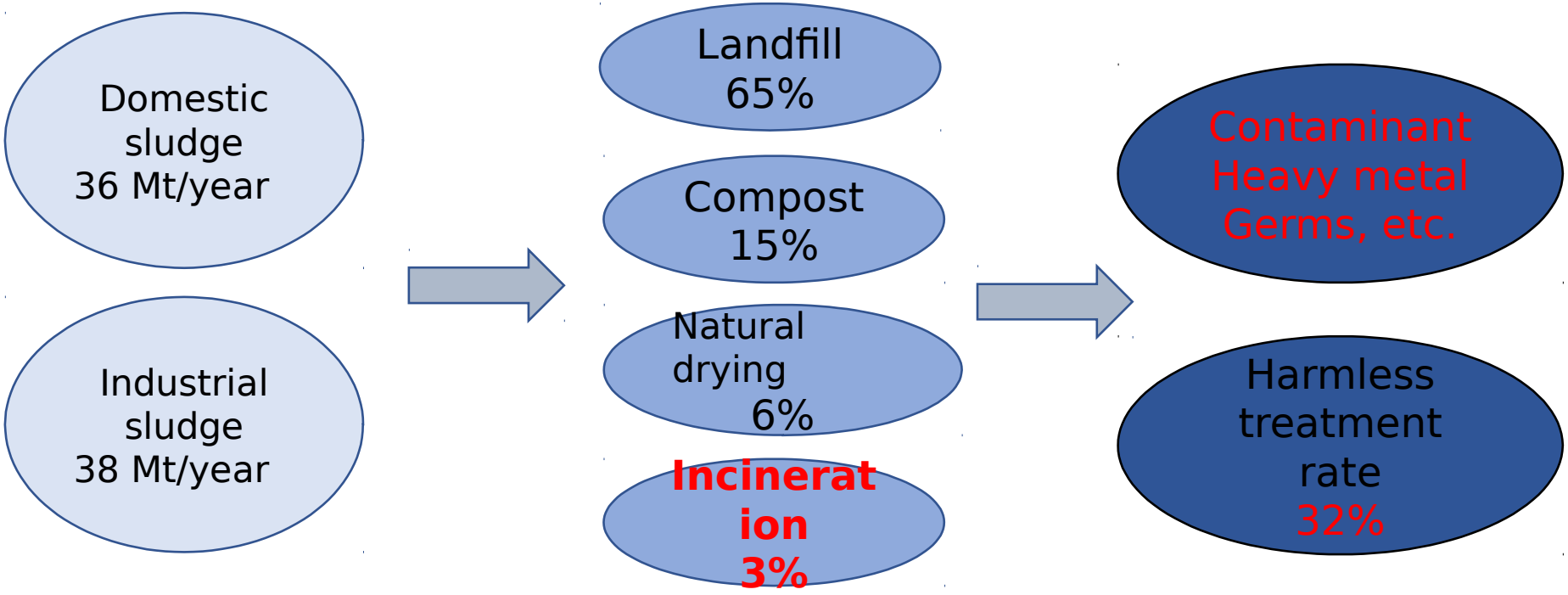
CONTENT

01 Research Background



High Sludge Production

High Concentration Pollutants

Low Harmless treatment rate

01 Research Background

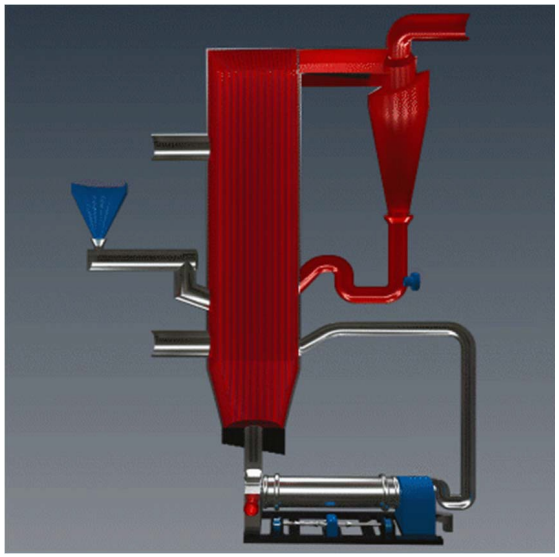
Landfill

- **Require Large area**
- **Hard to kill germs completely**
- **Fetor**
- **Low cost**

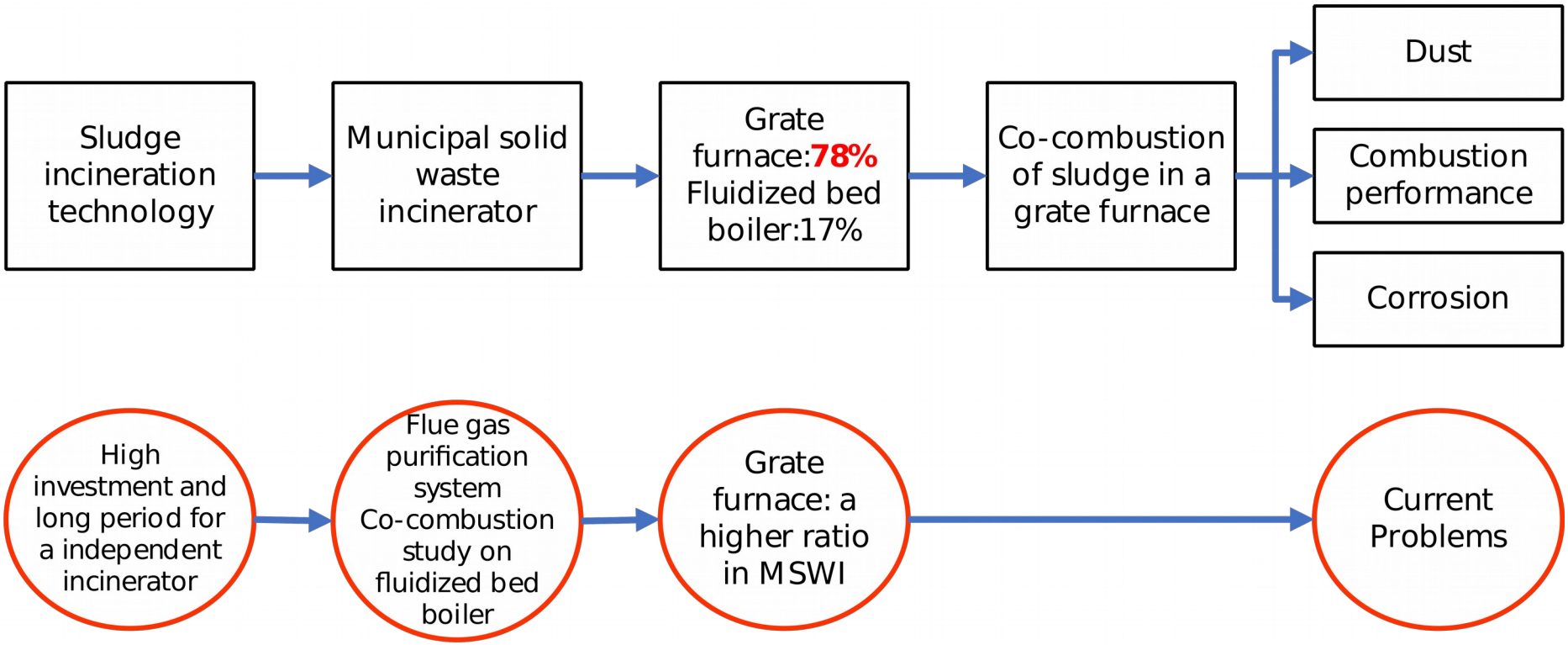
Incineration

- **High rate of volume reduction**
- **Harmless treatment**
- **Recovery energy**
- **High cost**

Better Option



01 Research Background



Study target

Combustion and ash characteristics during co-combustion of MSW and pelleted sludge in a grate furnace

02 Experiment System

Experiment Conditions in the Tube Furnace*

Parameter	Drying section	Combustion section	Burn-out section
Flow velocity (m/s)	1.15	4.48	1.22
Residence time (min)	18	25	50
Temperature Condition a(℃)	250	600	450
Temperature Condition b(℃)	300	1050	700

*Based on the measured data of a grate furnace in Zhejiang Province

Variables

- Temperature conditions
- Diameter of pelleted sludge (powder, 3mm and 8mm)
- Addition of desulfurizer (CaO, mass ratio: 1%)

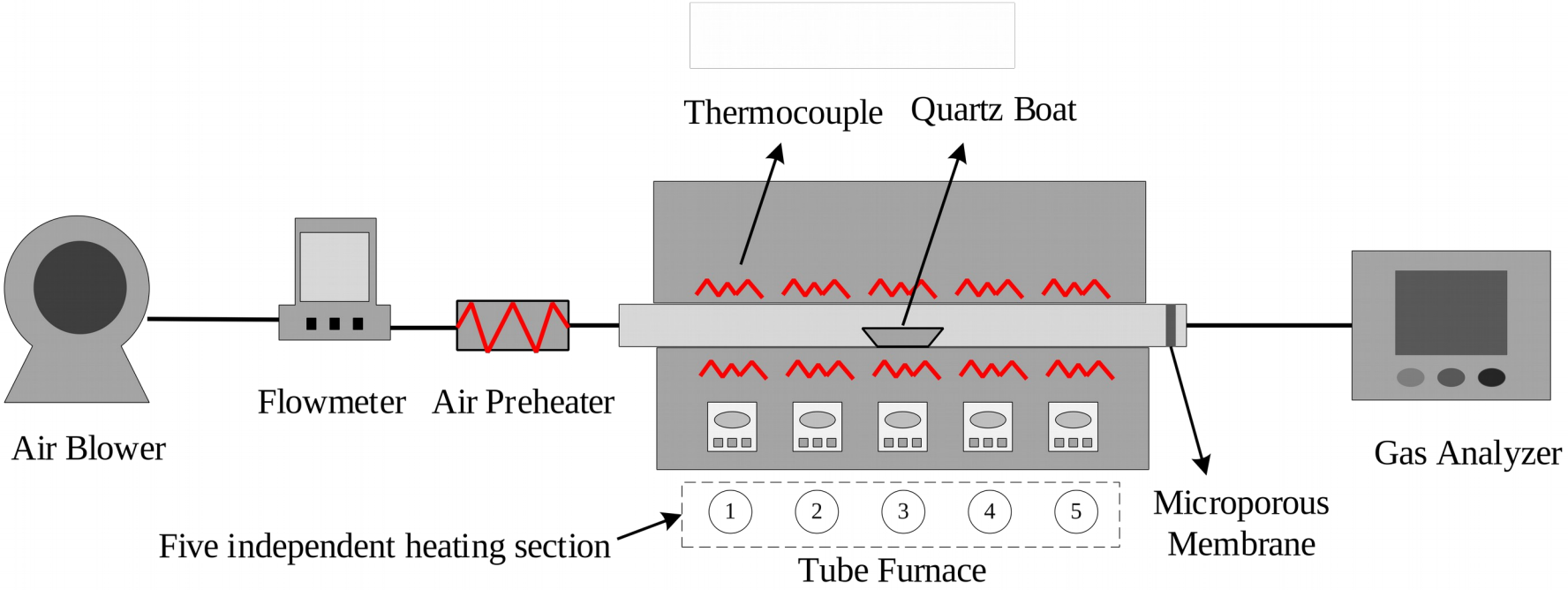
02 Experiment System

Sludge powder

Sludge pellet—3mm

Sludge pellet—8mm

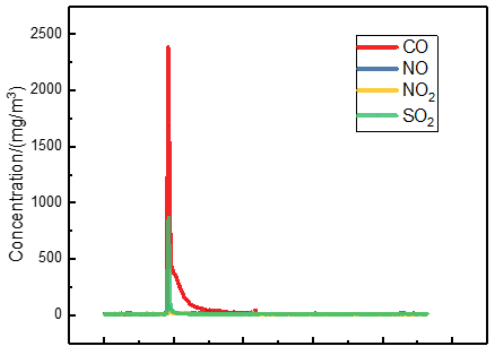
02 Experiment System



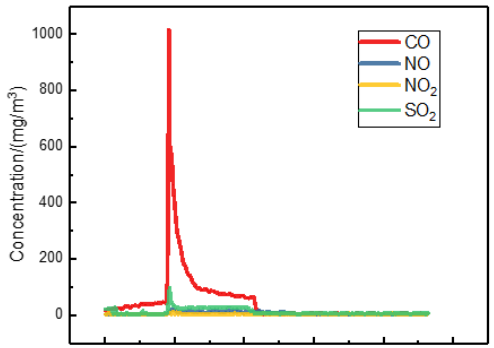
- 10g sample (drying sludge , moisture: 28%)
- Section 1, 3 and 5 are used to simulate different combustion conditions (drying, combustion and burn-out)
- Bottom ash and fly ash are collected to get the ratio.
- Concentration of flue gas pollutants is measured online.

03 Result and discussion

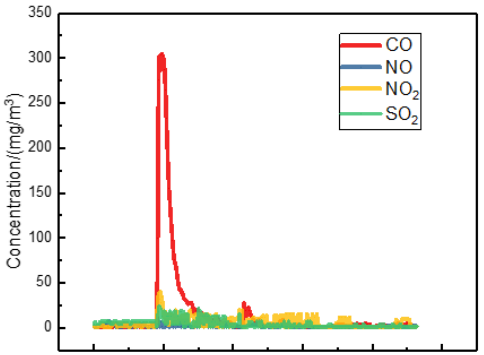
Condition a



a-1: Sludge powder under condition a

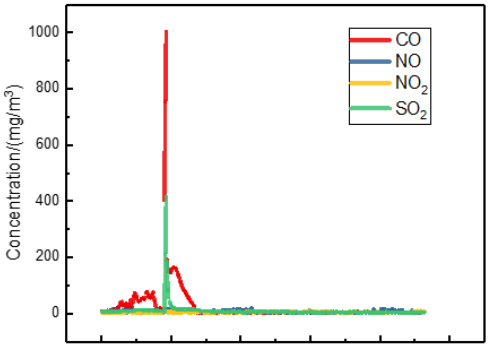


a-2: Sludge pellets(3mm) under condition a

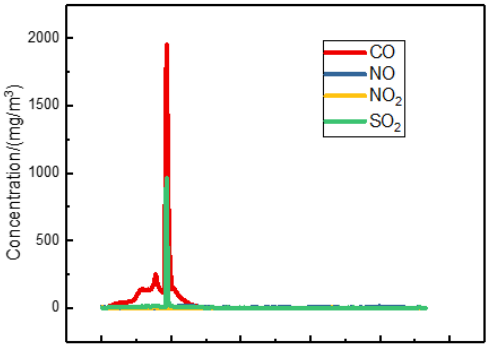


a-3: Sludge pellets(8mm) under condition a

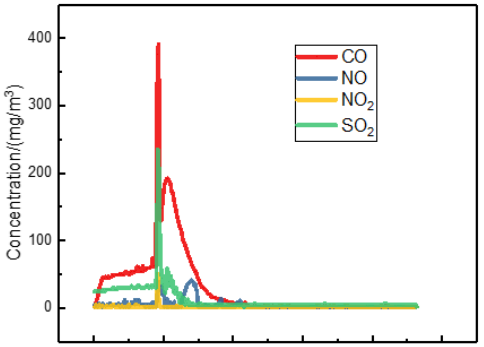
Condition b



b-1: Sludge powder under condition b



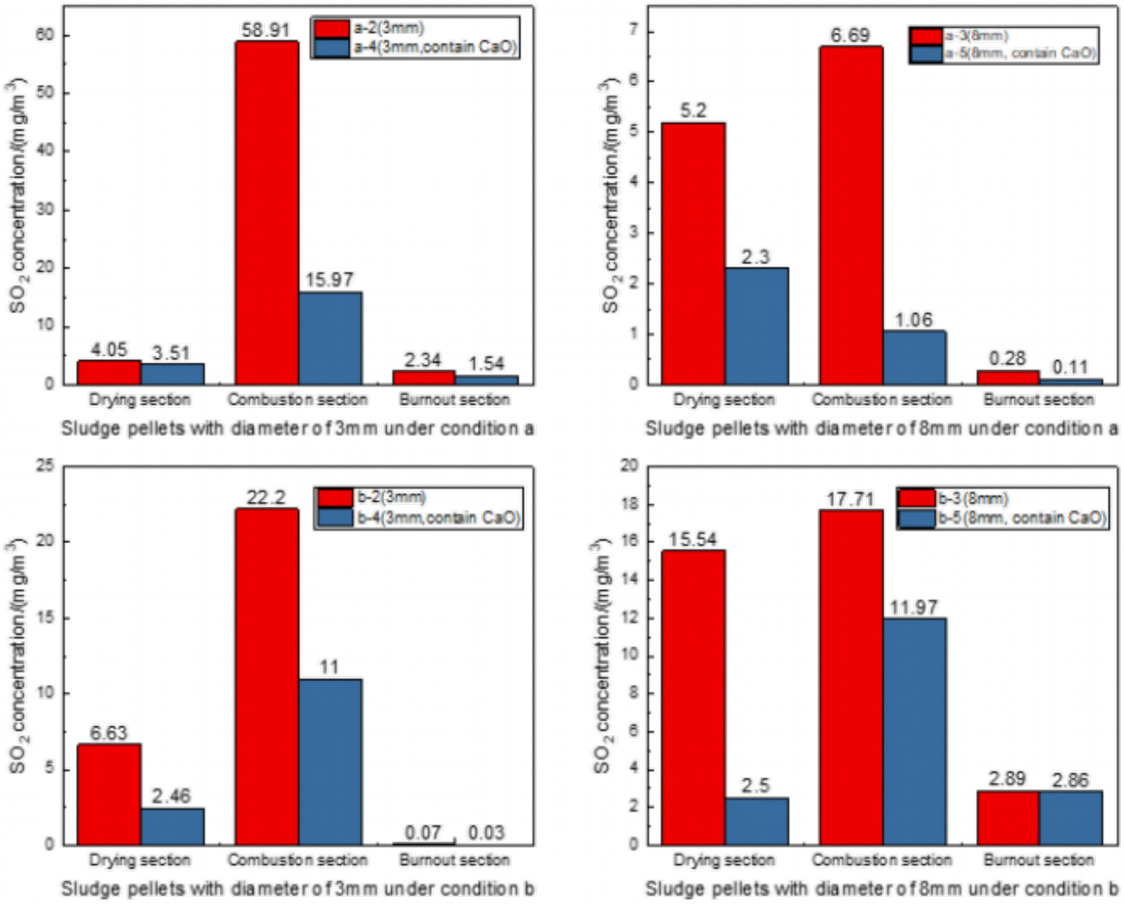
b-2: Sludge pellets(3mm) under condition b



b-3: Sludge pellets(8mm) under condition b

- CO、 NO_x、 SO_2 reaches maximum at combustion section under all conditions
- Low concentration of CO and SO_2 appear at drying section under **condition b**.

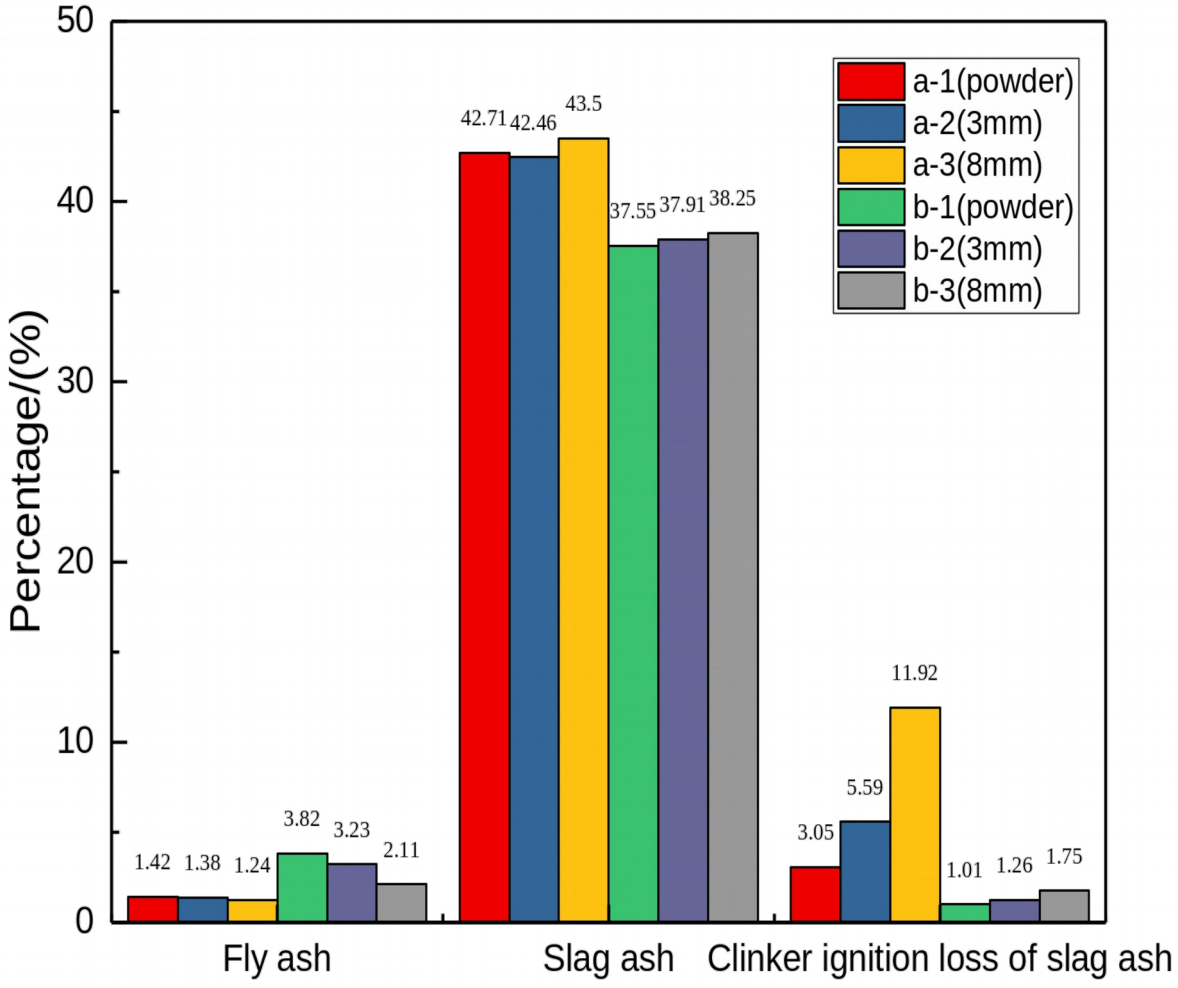
03 Result and discussion



SO_2 concentration at three sections with/without CaO

- Addition of CaO （1%） in sludge pellets can reduce the average SO_2 concentration in each section.
- During the combustion section with the highest SO_2 concentration, the maximum SO_2 removal rate can reach 80%.

03 Result and discussion



Ash characteristics at different experimental conditions

- With the increase of diameter and compressive strength, the ratio of slag ash and its clinker ignition loss increase, while the ratio of fly ash decreases.
- Under condition a, the clinker ignition loss of slag ash may reach as high as 11.9%.

03 Result and discussion

- Addition of desulfurizer (CaO) in sludge pellets can reduce SO_2 emission concentration greatly.
- With the increase of diameter and compressive strength, the combustion specific surface area of sludge pellets decreases and the fly ash inside the pellets is hard to escape from it.
- Under a low combustion temperature condition (600℃), the clinker ignition loss of slag ash exceeds the limit (5%).
- Temperature on combustion section should be higher than 800℃ to avoid incomplete combustion.

04 Prospect

Future work

1. Effect of sludge pellet on ash fusion temperature
2. Co-combustion experiment of sludge and municipal solid waste.
3. Study on crystalline phase and elemental composition of co-combustion of sludge and municipal solid waste by XRD and XRF.

Thanks for your time