

EcoBLAC: Sustainable Masonry from Boiler Ash

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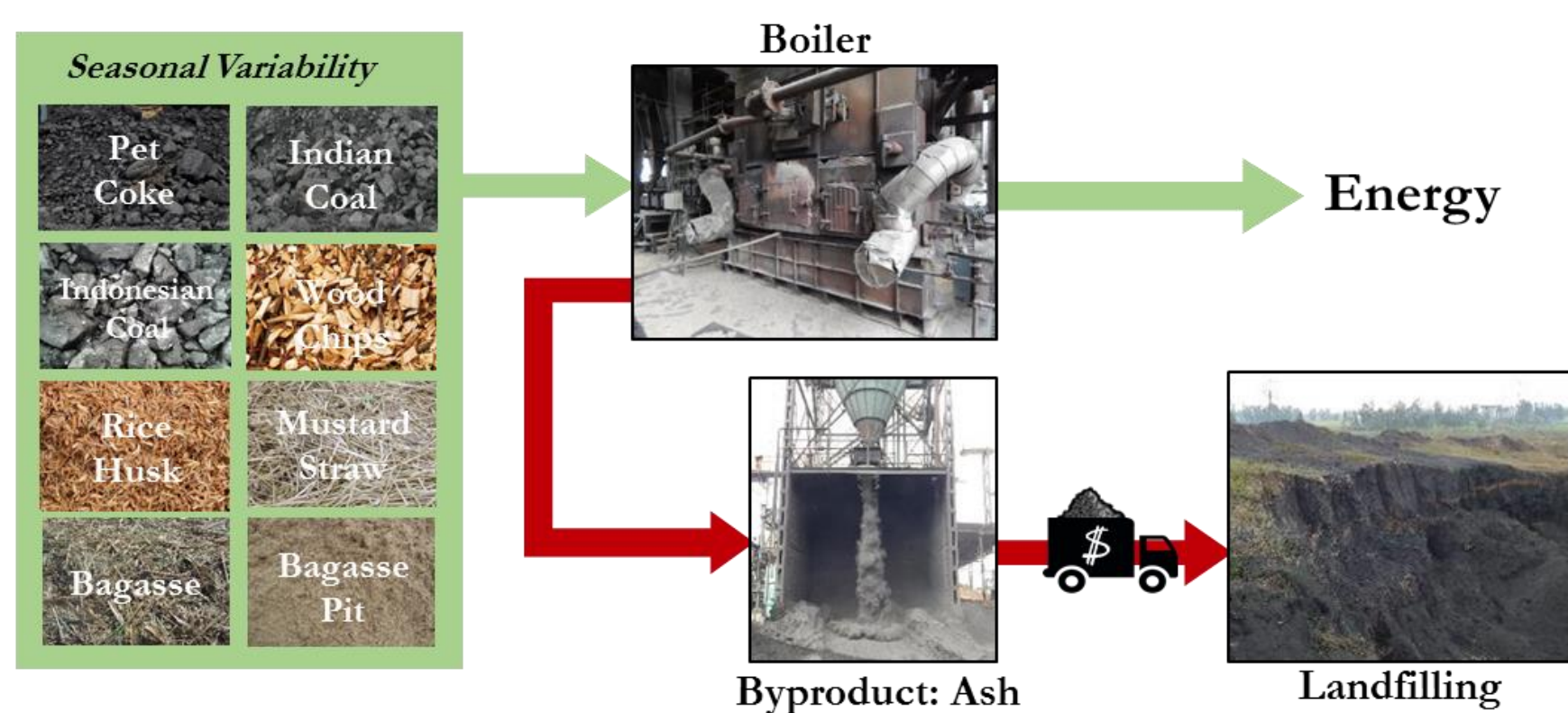
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Context and Opportunity

Boiler Ash Production



Fired Clay Brick Production

#1 Building Material in India due to low cost, local availability, and simple manufacturing

DRAWBACKS

Topsoil Depletion | **Energy** | **Air Pollution** | **Working Conditions**



- Reduces farmland
- Future threat to food security

- Consume 25 million tons of coal per year
- Fire kiln at over 1000°C

- Carbon dioxide and other pollutants
- Health problems

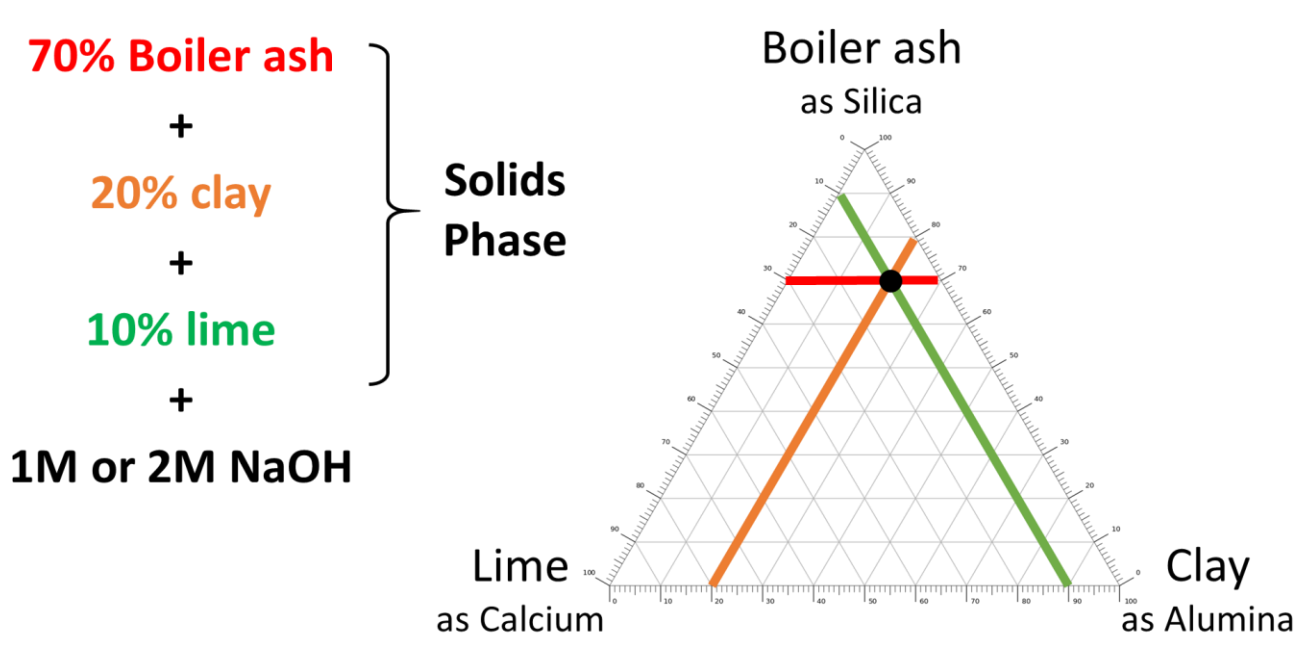
- 10 million migrant workers
- Lack of shelter, sanitation, drinking water

Objective

Develop a brick which achieves the following characteristics:

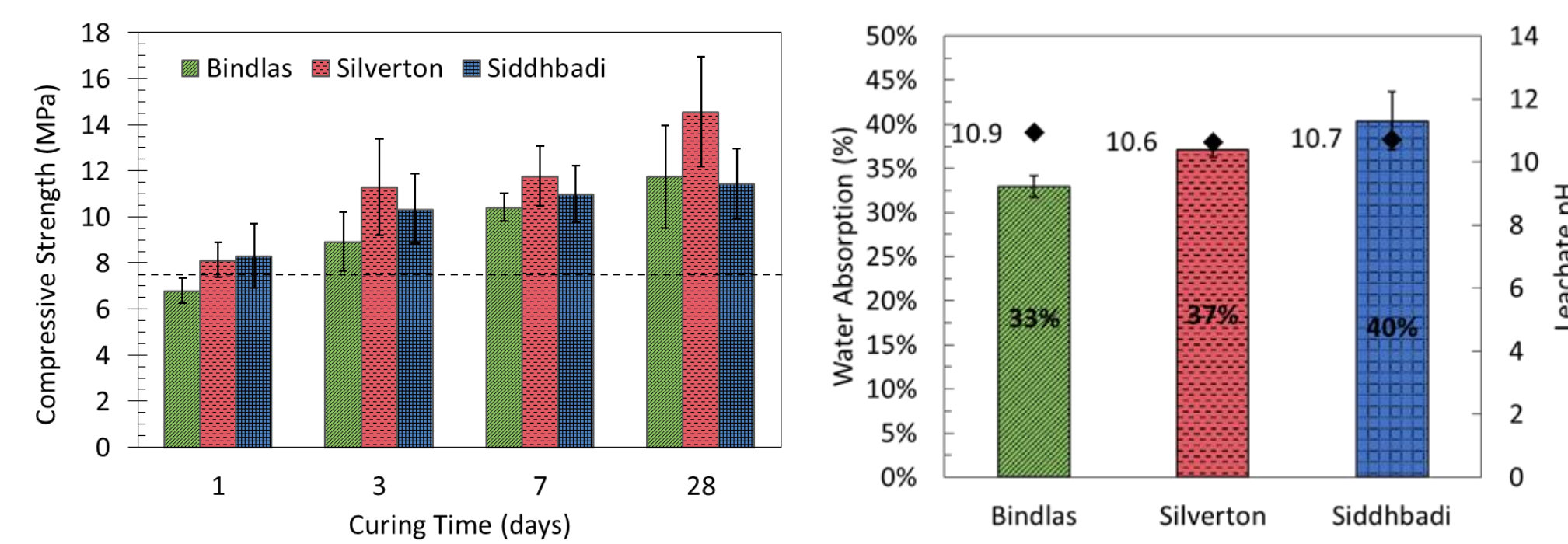
- ❖ Maximum use of boiler ash
- ❖ Low natural resource consumption
- ❖ Low energy processes
- ❖ Low cost

Brick Formulation

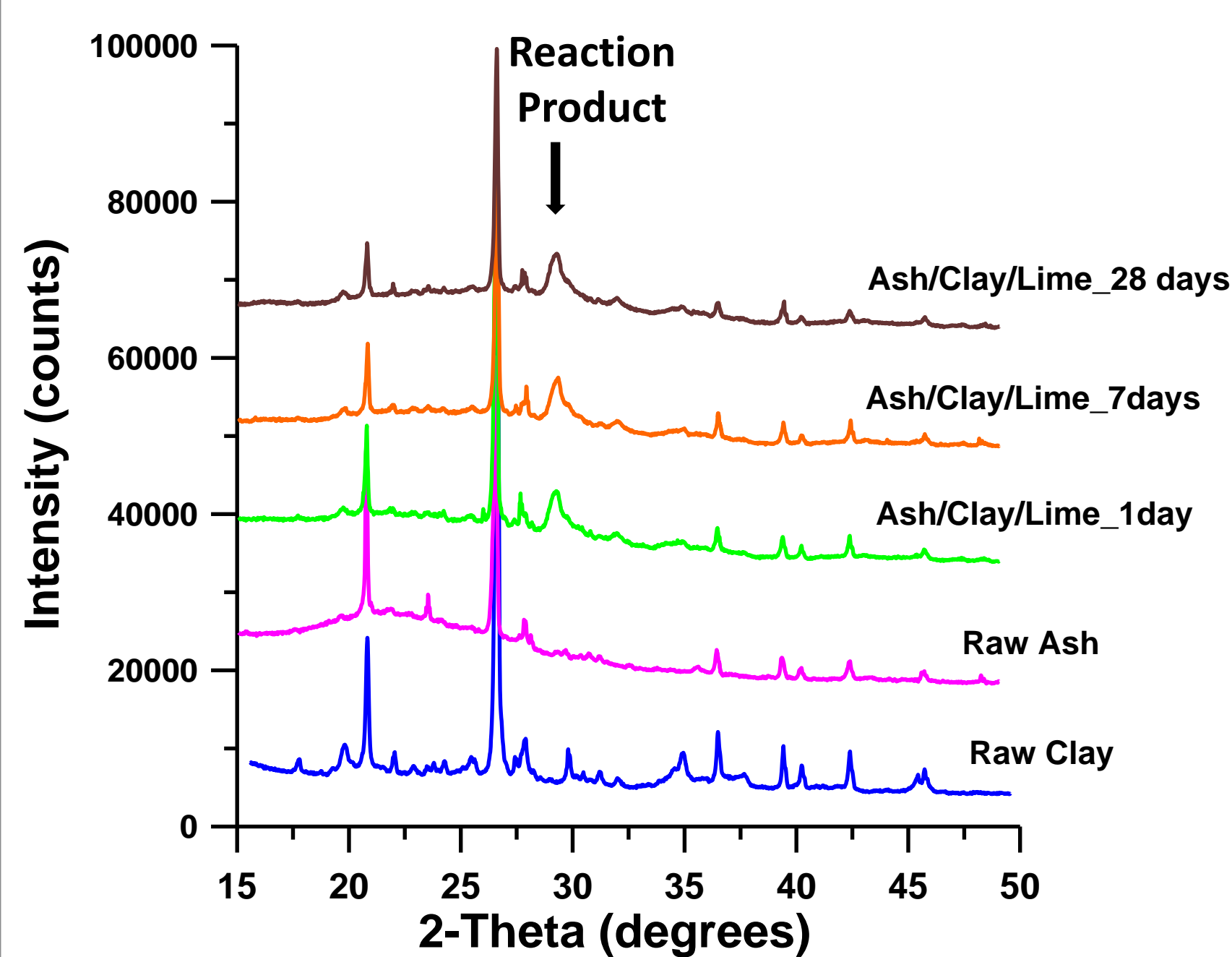


Results

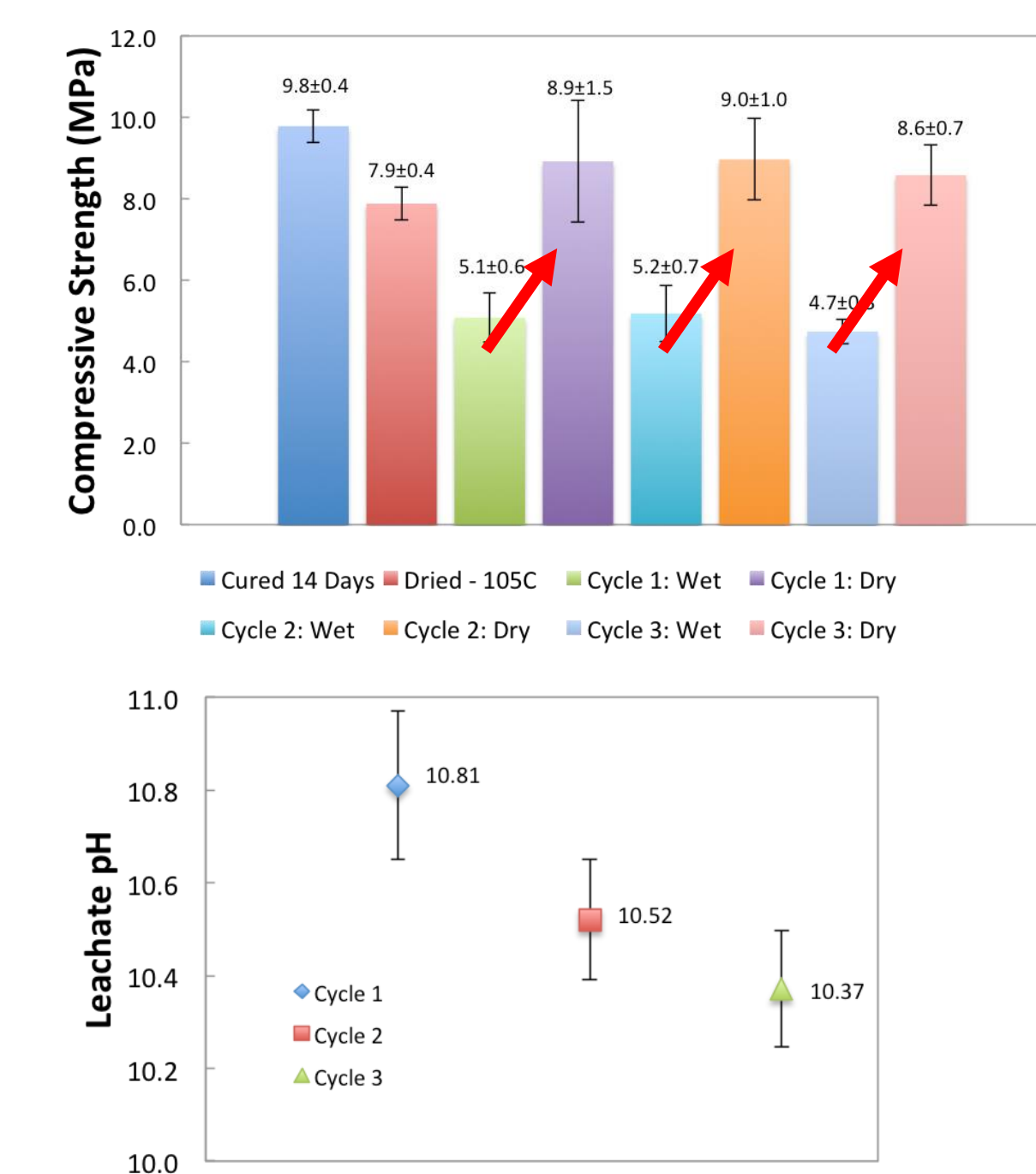
Compressive Strength & Water Absorption



Monitoring the Reaction Progress



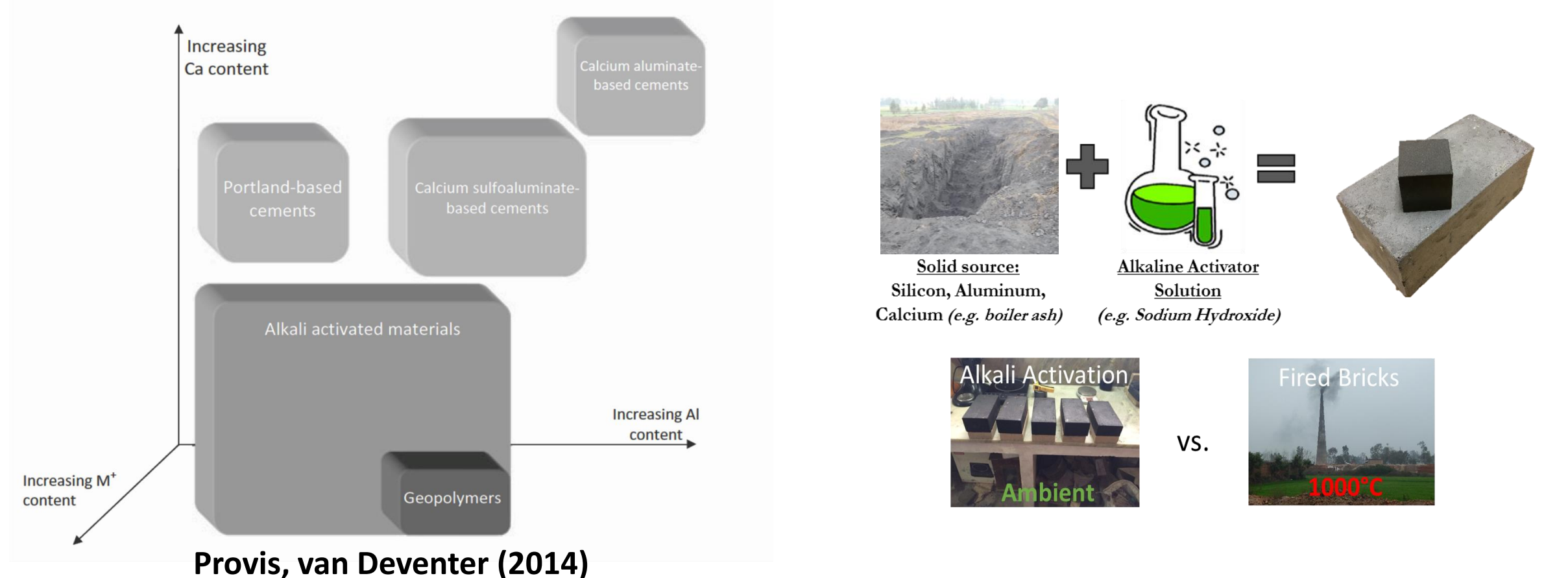
Drying/Wetting Test (Bindlas Ash)



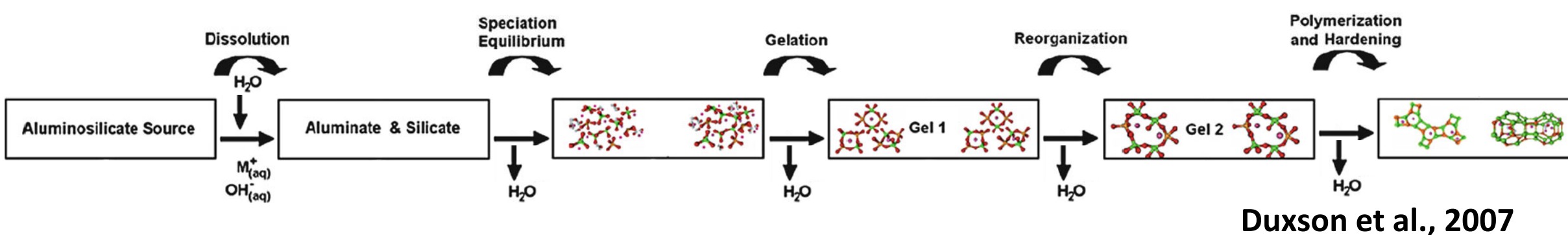
Notes

- ❖ Early strength development (over 50% of 28 day strength after 1 day curing)
- ❖ Robust formulation for ashes from three different sources
- ❖ High water absorption (> 30%) and associated strength loss
- ❖ Strength regained after drying the wet samples at 105°C
- ❖ pH of the curing water in the range of 10.5-11
- ❖ Formation of the reaction product evident from X-ray diffraction

Proposed Solution: Alkali-Activation of Boiler Ash



Alkali-Activation Mechanism



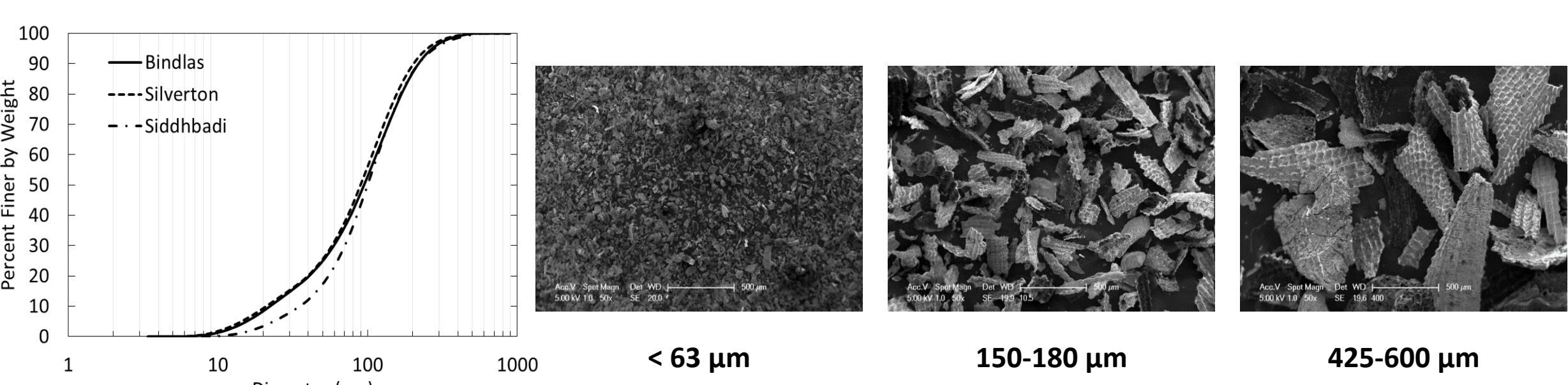
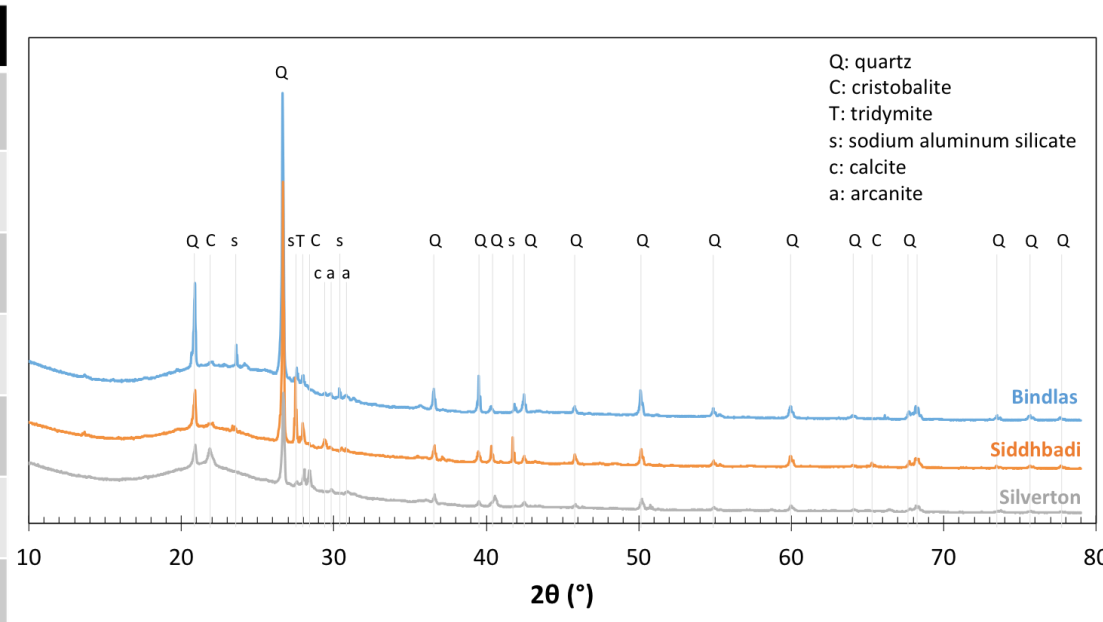
Conclusions and Future Work

- Boiler ash, a by-product of the paper industry, was successfully utilized in making a sustainable masonry material.
- The optimal formulation, consisting of 70% ash, 20% clay and 10% lime, provided the required strength (>7.5 MPa) for the masonry bricks.
- Current work is focused on understanding the relationship between reaction extent, microstructure, and water absorption, as well as their influence on mechanical properties and durability.



Boiler Ash Characterization

Characteristics	Desired	Boiler Ash
Shape	Spherical	Varies
Particle Size < 45 μm	> 75%	< 25%
Loss on Ignition	< 6%	8-35%
Reactive Silica Content	> 40%	> 80% (bulk)
Reactive Alumina Content	> 15%	< 4% (bulk)
Iron Content	< 10%	< 2%
Leaching of Heavy Metals	None	Some



Acknowledgments

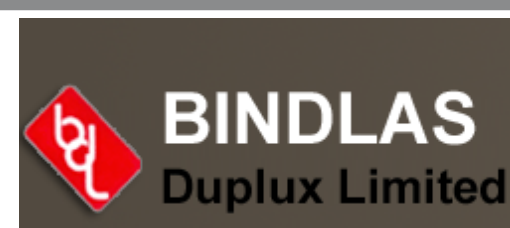
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References

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Collaborations

TECHNICAL



Bindlas Duplex LTD
Muzaffarnagar, UP



CSIR – National Metallurgical Laboratory
Jamshedpur, WB



Development Alternatives
New Delhi, NCT

BUSINESS

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