

# VOLCANIC ASH, WASTE PEN SHELLS AND RED CLAY TO SYNTHESIZE GEOPOLY- MERS

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# Where I am workin



- Scimago Institution Ranking 714
- THE World Ranking 801+
- Assessed at institutional level by **AUN QA**
- 3000+ Scopus-indexed publications
- QS World Ranking 801+
- QS Asian Ranking 155

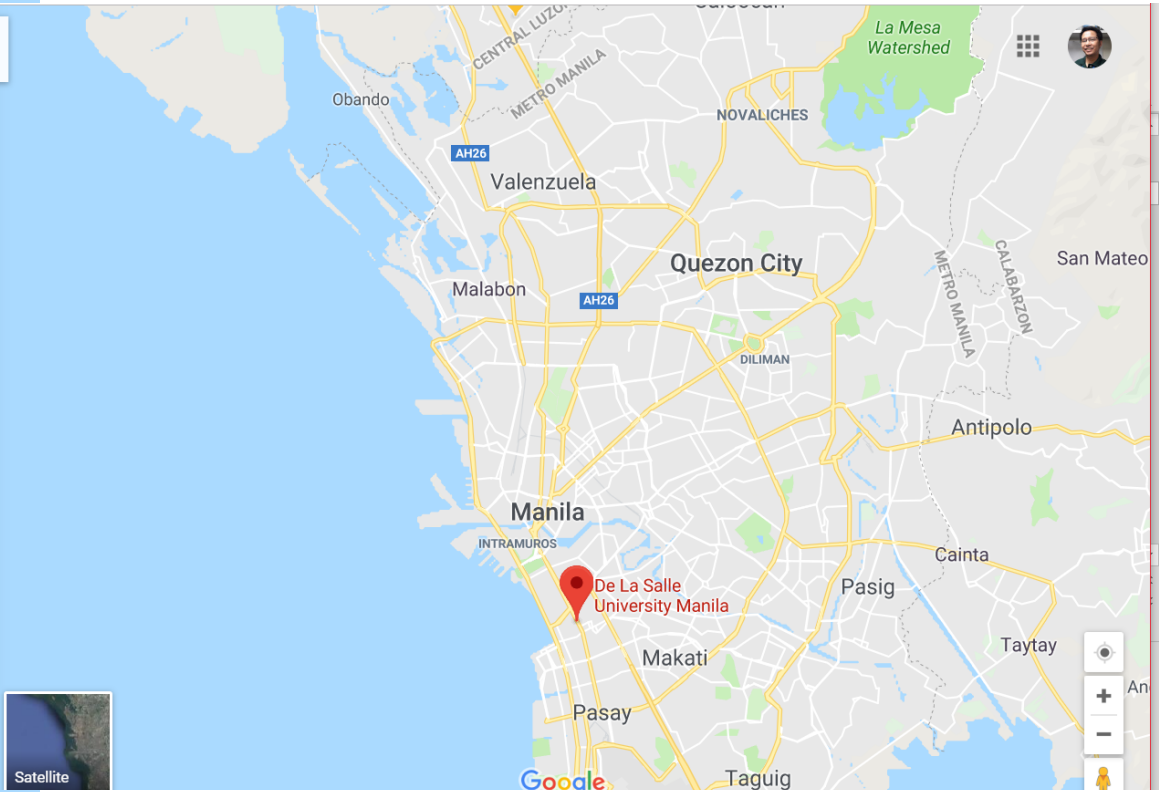
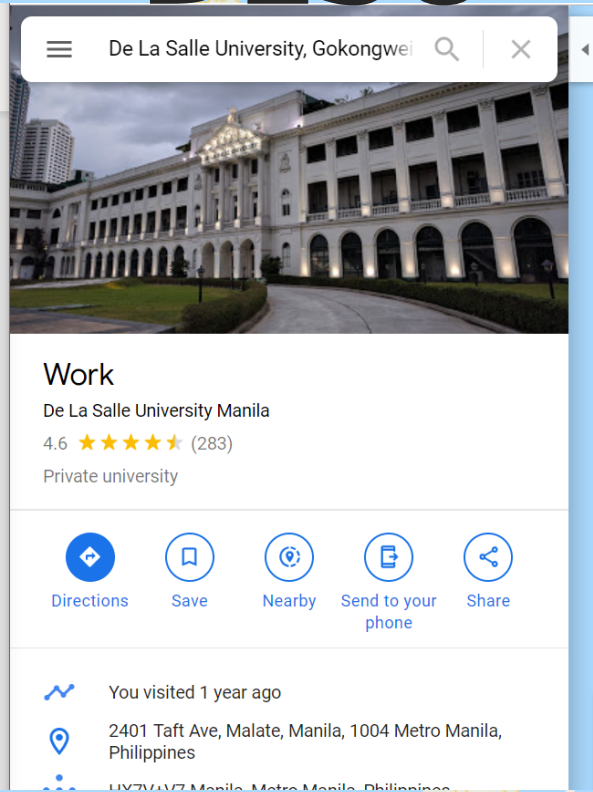
- 1,100 academic staff (40% full time)
- 14,000 undergraduate students
- 4,500 graduate students
- 11 research centers, 4 research support offices, 1 technology business incubator
- 8 colleges, 36 academic departments
  - ✓ Br. Andrew Gonzalez College of Education (BAGCED)
  - ✓ College of Computer Studies (CCS)
  - ✓ College of Law (COL)
  - ✓ College of Liberal Arts (CLA)
  - ✓ College of Science (COS)
  - ✓ Ramon V. Del Rosario College of Business (RVRCOB)
  - ✓ School of Economics
  - ✓ **Gokongwei College of Engineering (GCOE)**



# The World is

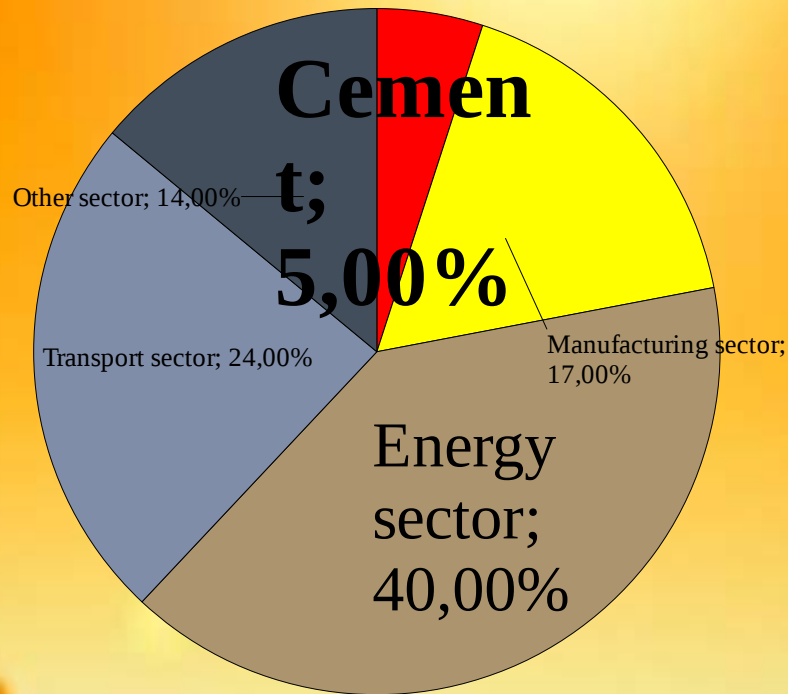


# About Manila and DLSU



HERAKLION 2019 7<sup>th</sup> International Conference on Sustainable Solid Waste Management  
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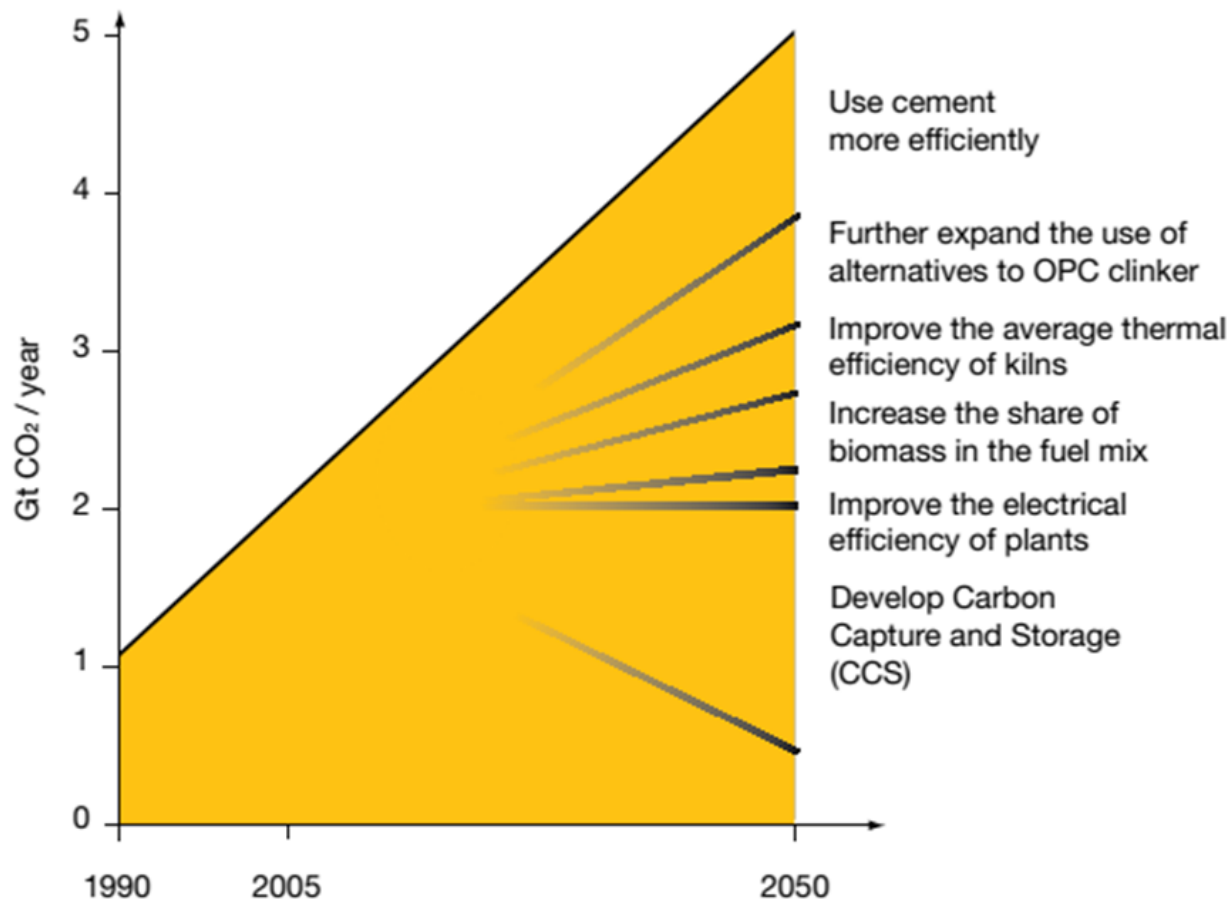
# Our Research Motivation



**Global Carbon Dioxide Emissions**



# Wedges to reduce cement-related CO<sub>2</sub> emissions



Source: Muller and Harnisch, 2008



# Greening of Future Concrete

- Emission sequestration
- Waste utilization in cement production
- Pozzolan blended cements in producing concrete
- Supplementary cementitious material
- ...
- **Geopolymer /Alkali activation technology:  
an alternative binder or cementitious material**

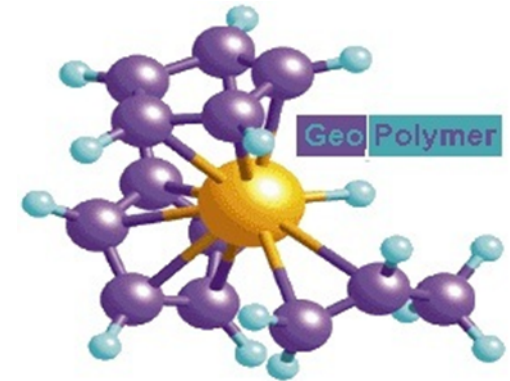


Designed by Eda Sy

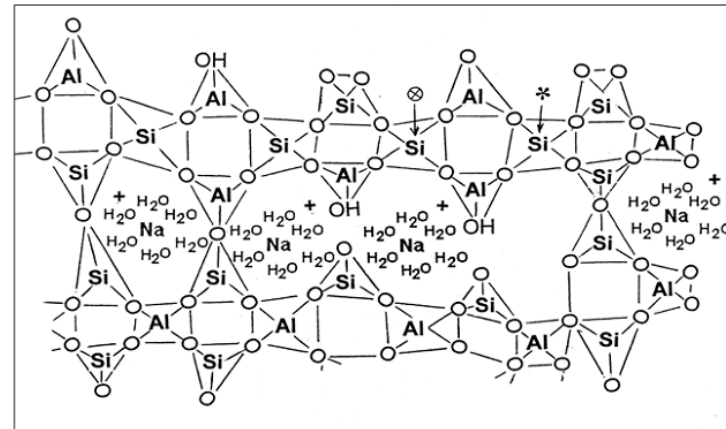
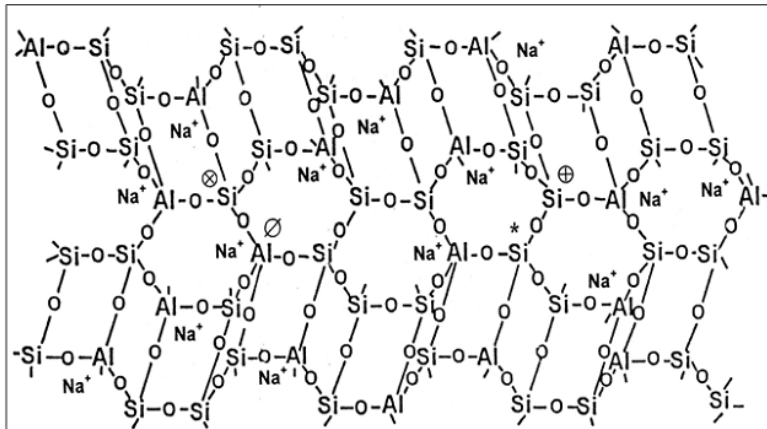


# What is a Geopolymer?

- Inorganic polymer-formation of polysialate and polysialate-siloxo networks (Davidovits, 1979)**



[www.geopolymer.org](http://www.geopolymer.org)



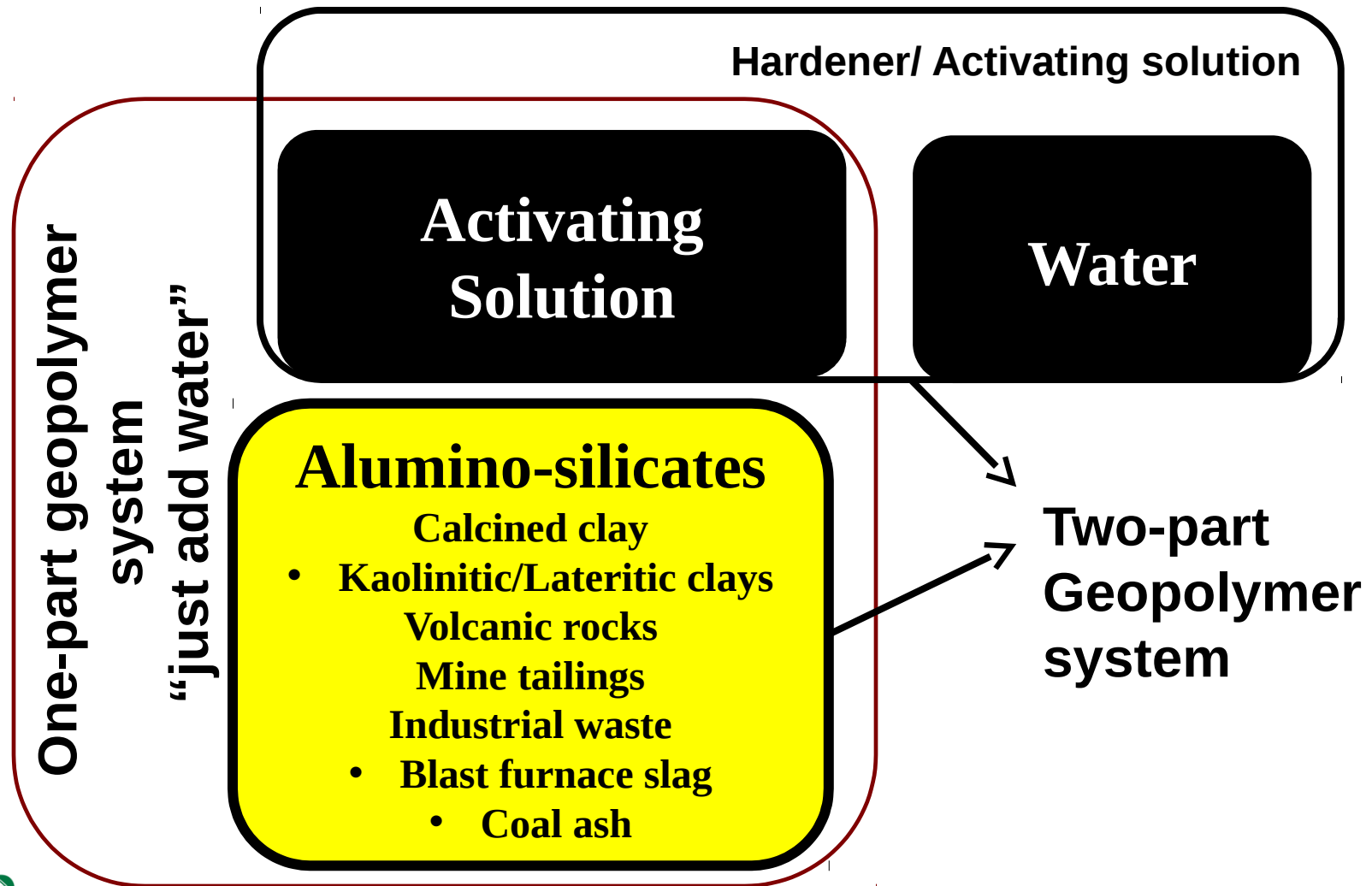
(Barbosal et al., 2000)



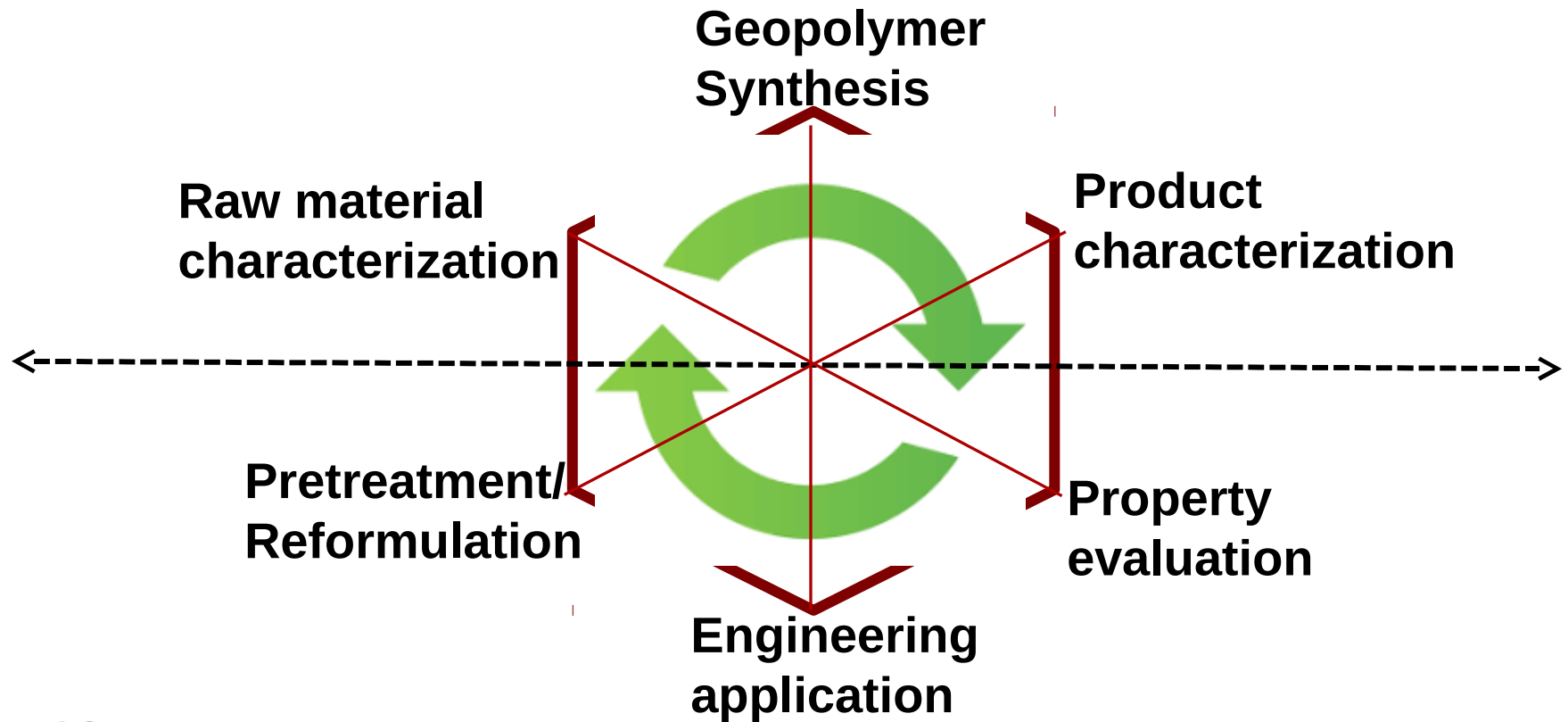


# How to make Geopolymer cement ?

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# OUR Research and Innovation framework

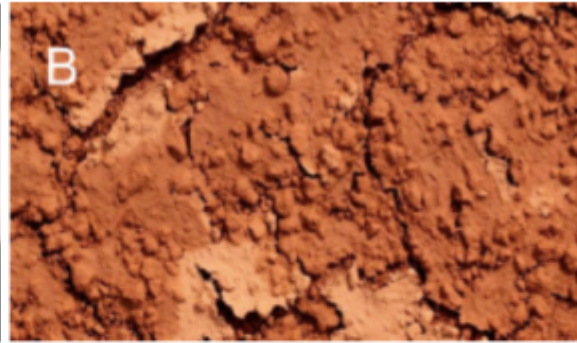


# Raw Materials

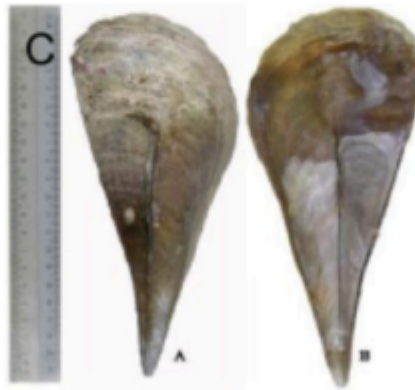
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Volcanic Ash



Red Clay



Waste Pen Shells

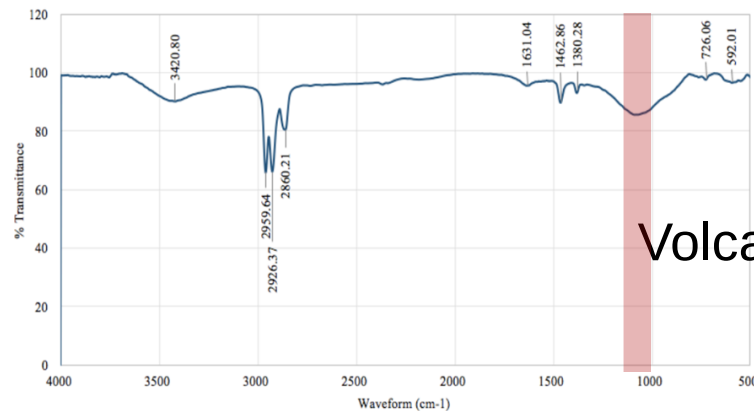
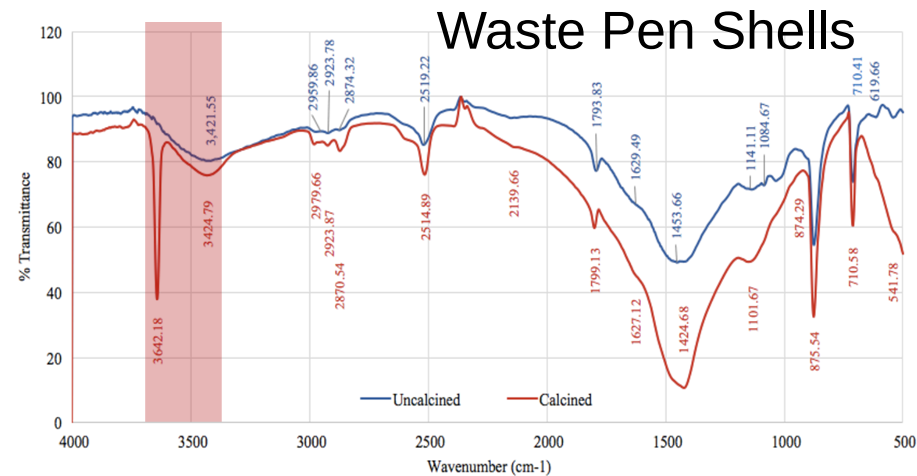
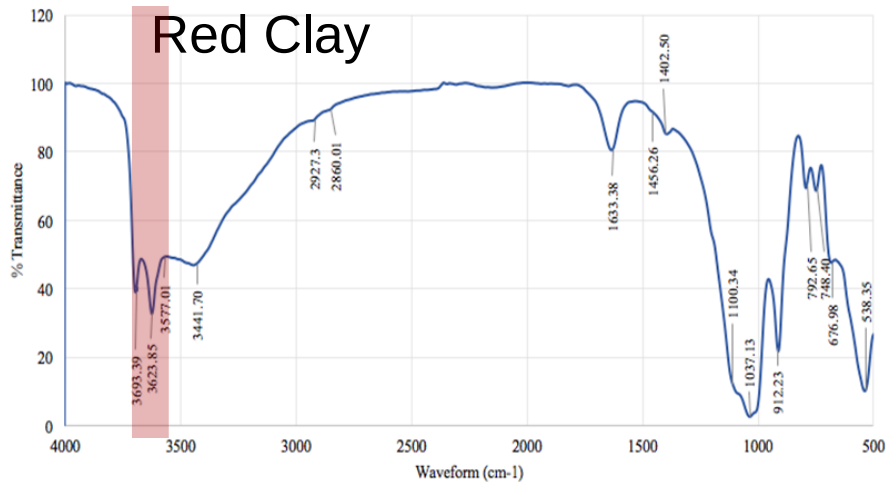


# Mix Design

Mixture Code	Volcanic Ash, VA (%)	Red Clay, RC (%)	Waste pen (Baluko) Seashell, BS (%)
UCL008	75	25	0
UCL009	50	50	0
UCL010	45	45	10
UCL011	66.67	16.67	16.67
UCL012	16.67	66.67	16.67
UCL013	75	0	25
UCL14	25	75	0
UCL015	0	75	25



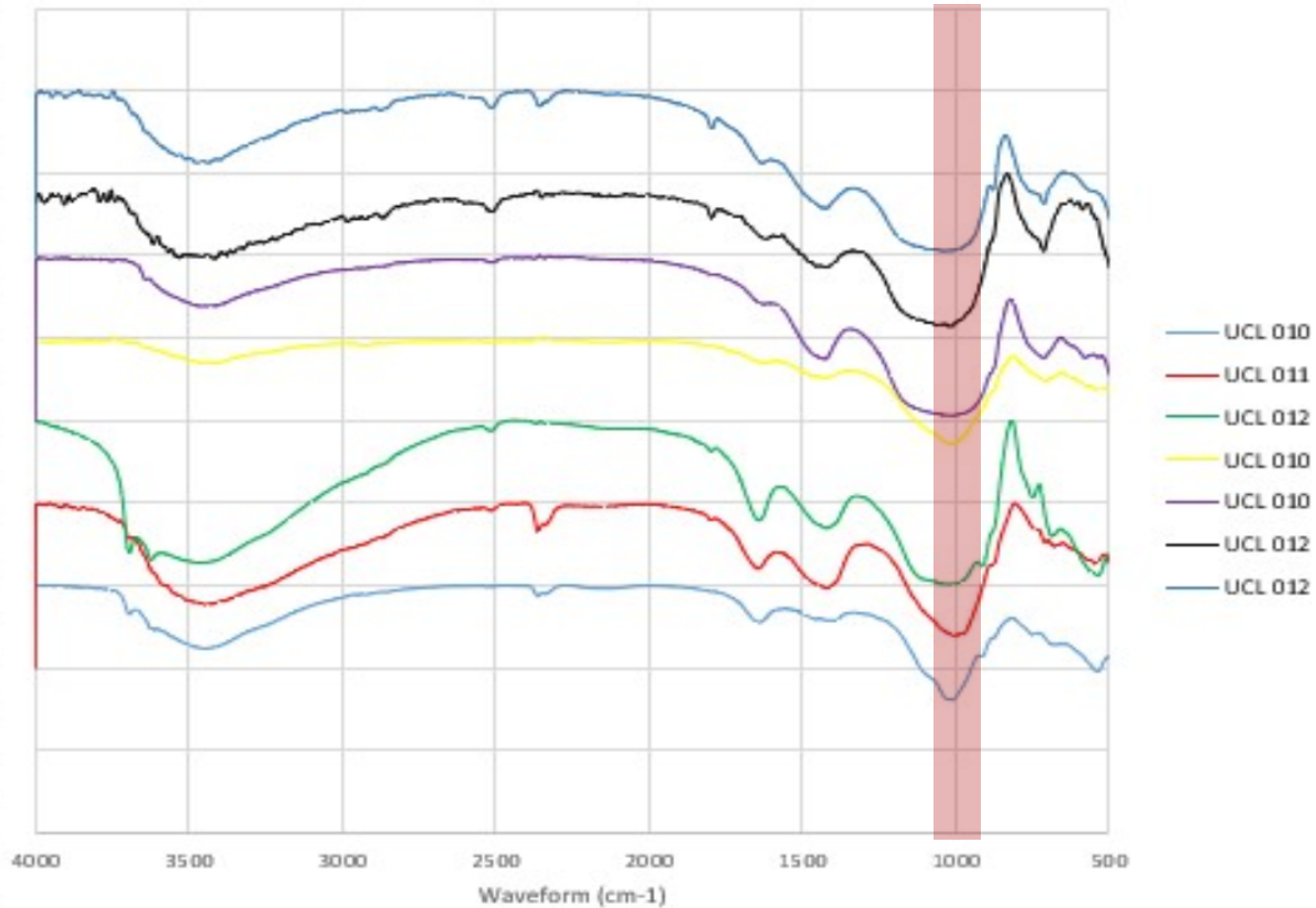
# FTIR of Raw Materials <sup>13</sup>



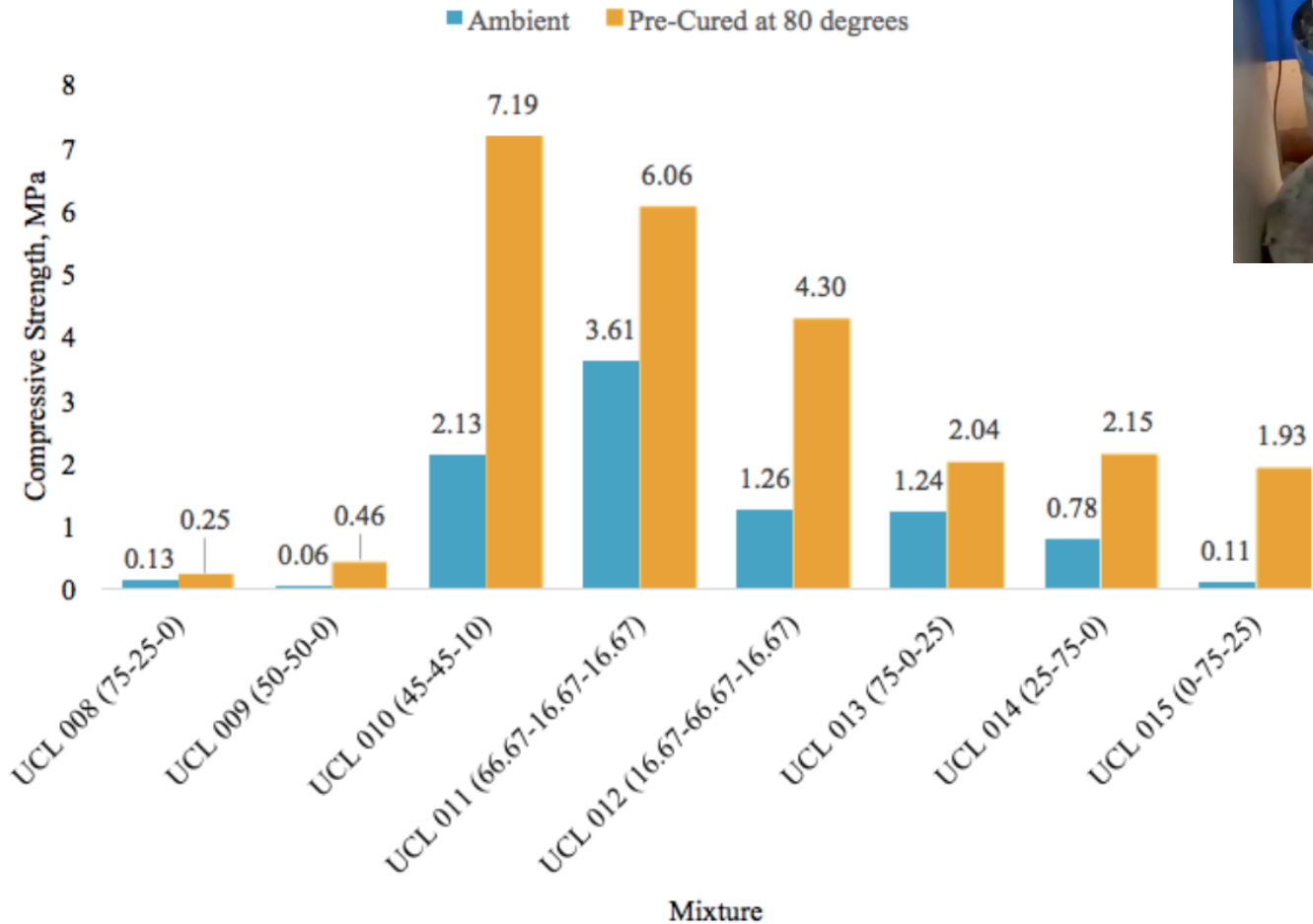


# FTIR of Geopolymer specimens

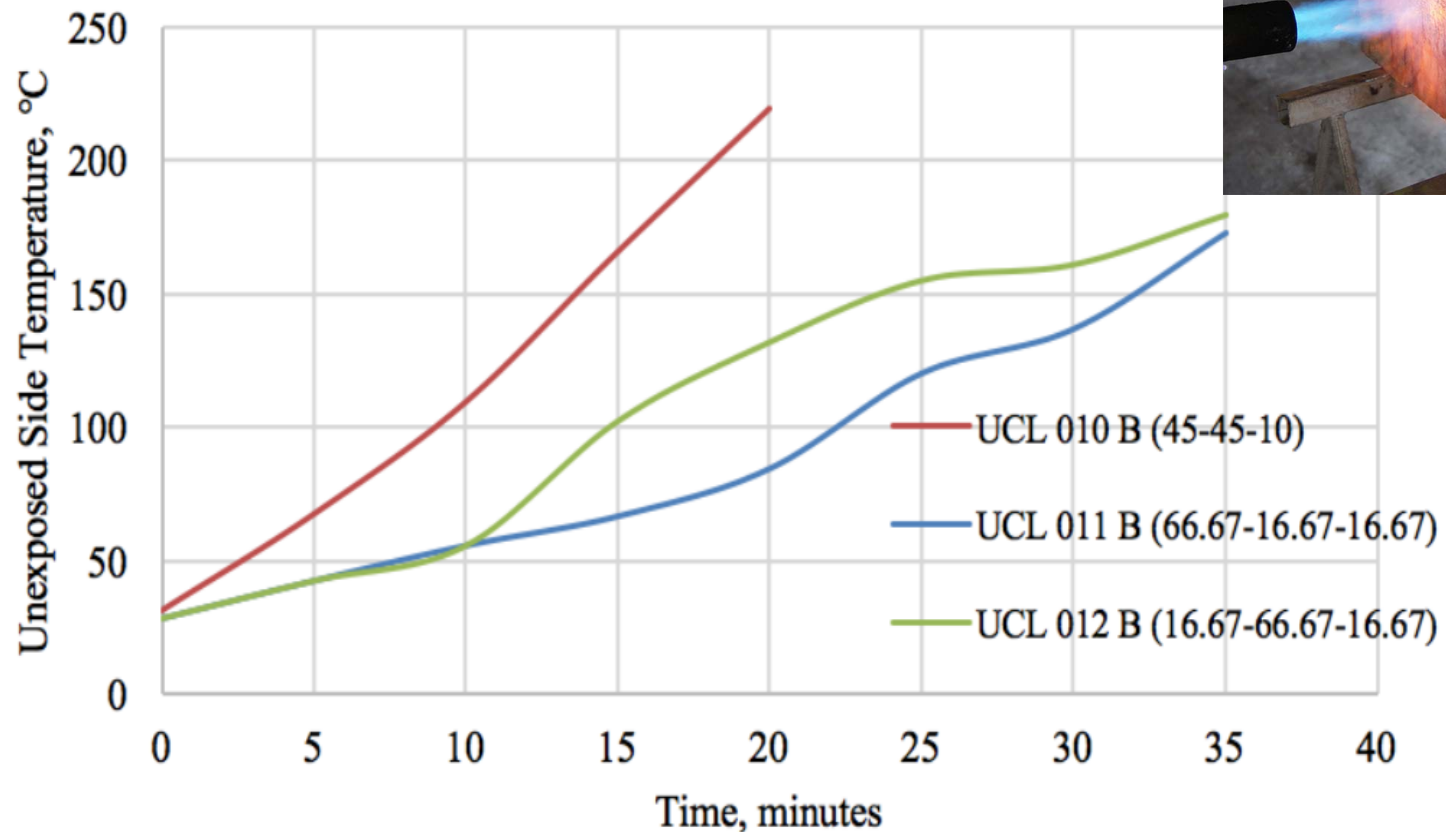
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# Compressive strength



# Fire Resistance test



# Work in Progress

**“Innovation work doesn’t happen in isolation, it requires a network of ideas, individuals, and institutions to come together to be more than a sum of their parts.”**

\*Dr. Mahmoud Mohieldin, World Bank’s Senior Vice President for the 2030 Development Agenda, United Nations Relations, and Partnerships.



# Conclusions

- Volcanic ash, red clay and waste “*Baluko*” shell were valorized to produce geopolymer-based materials.
- A mix proportioning which contains 45% Volcanic Ash-45% Red Clay-10% calcined waste shell was observed to have the highest compressive strength out of all the samples.
- The fire resistance of the geopolymers formed from a ternary mixture of 16% Volcanic Ash-66.67% Red Clay-16% calcined waste shell powder was observed to be comparable to that of OPC.





# Let's build NOW a GREENER Future...

## Thank you for listening!



Questions and Comments are Welcome

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