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**CHARACTERIZATION AND COMPRESSIVE
STRENGTH OF GEOPOLYMER PASTE
BASED ON FLY ASH**

By :

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INTRODUCTION

Environmental Sustainability by the United Nations

**Sustainable Development Goals :
Innovation Infrastructure**

Materials Innovation in is also one part of innovation infrastructure

Indonesia Government emphasizes the importance of infrastructure development

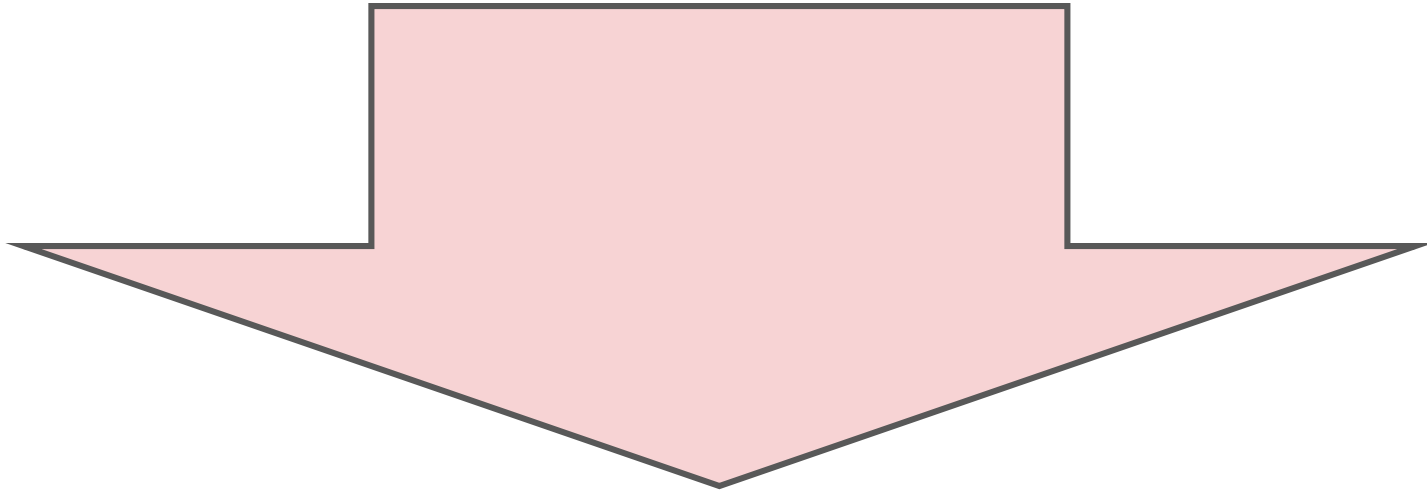
The usage of cement needs to be limited for environmental sustainability

Fly ash is an abundant material, accumulate and become dangerous goods

Suralaya Power Plant Indonesia produces coal waste

- The usage of fly ash must be done**
- **To reduce the fly ash accumulation**
 - **To minimize the environmental impact**

- **Characterization of the forming material is one of the things that need to be reviewed in generating material properties in accordance with technical specifications.**
- **Analysed the effect of material characteristics on the properties of material.**



OBJECTIVES:

- **obtain material characteristics.**
- **obtain compressive strength of geopolymer paste based on fly ash.**

LITERATURE REVIEW

2.1 Fly Ash

SNI 03-6414-2002 defines waste fly ash as a result of burning coal in the furnace steam power plant in the form of a fine, light, round, and is pozzolanic.



2.2 Geopolymer Paste

Geopolymer has been grown very rapidly as a unique, important, and environmentally friendly material in building material industry and highway construction.

Geopolymer has the advantage of easy to reach hardness or strength compared to conventional cement.



METHODE

Laboratory investigation:

- **Material and Concrete Laboratory ITS Surabaya.**
- **Material characterization was conducted in Material and Metallurgy Laboratory ITS Surabaya.**

Materials :

- **Fly ash, NaOH flake, distilled water, Na_2SiO_3 .**
- **Fly ash was obtained from Suralaya Power Plant Indonesia.**
- **Fly ash was sieved by sieve No. 200.**
- **NaOH flake has a 99% purify, it was produced by China. The grade of Na_2SiO_3 is 58%.**
- **Distilled water was purchased at chemicals store in Surabaya.**
- **NaOH solution was made in 6 Molar and 8 Molar.**

GEPOLYMER PRODUCING PROCESS



MATERIAL TEST

**Fly ash test consists of
XRF and SEM.**

**Geopolymer paste test consists of
SEM and compressive strength.**

**Compressive strength test of
geopolymer paste was conducted at
28 days with Universal Testing
Machine (capacity 5 ton).**

**The cylinder specimens were stored in
an airtight box at room temperature.**

**The surface of cylinders specimens
applied by capping (6 specimens of
each variation).**



RESULT AND DISCUSSION

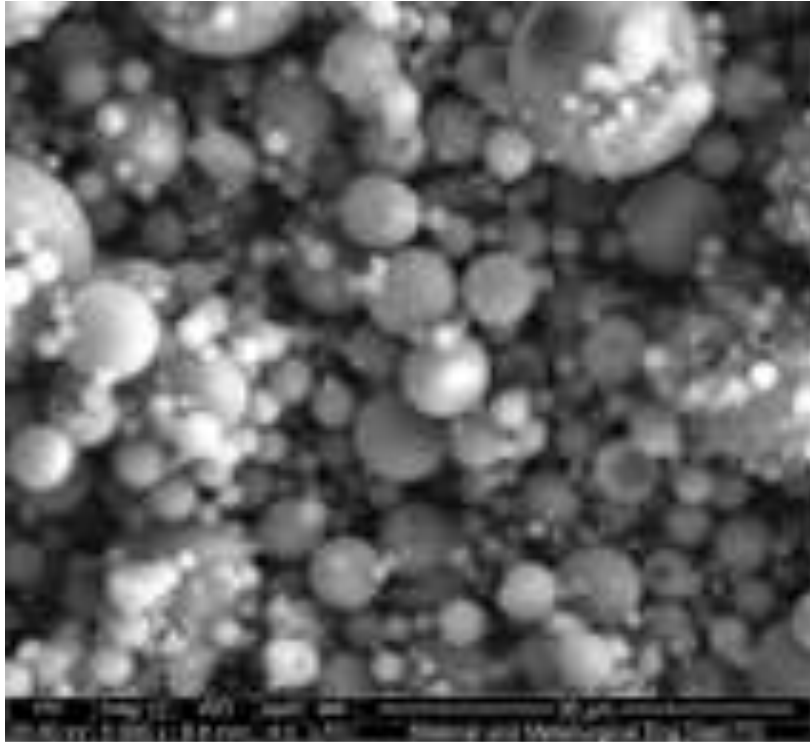
Chemical Composition



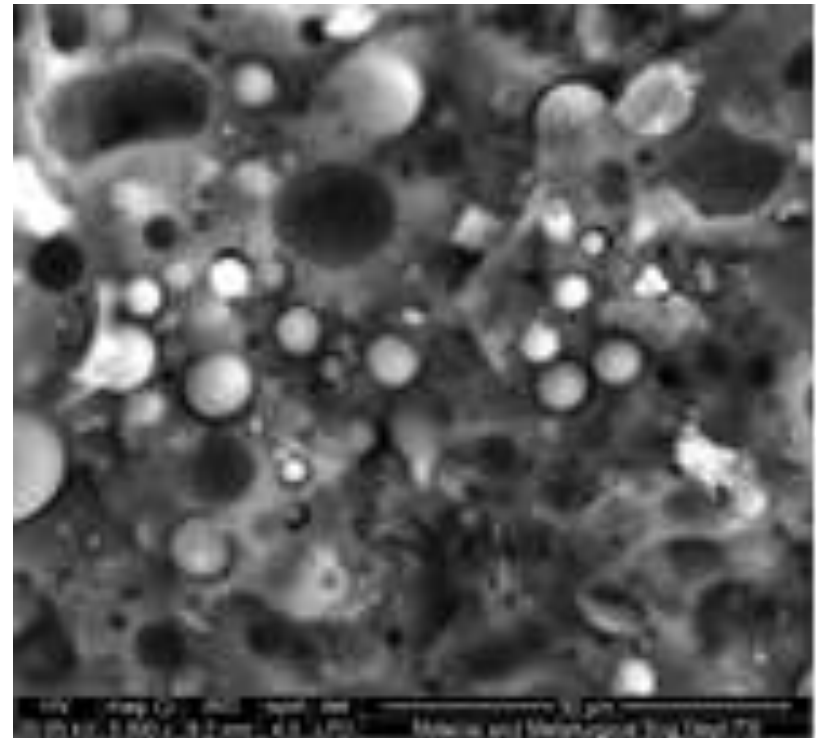
Oxide	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	MgO	Cr ₂ O ₃	K ₂ O	Na ₂ O	SO ₃	P ₂ O ₅
%	43.84	23.00	10.58	0.86	10.20	4.32	0.01	1.65	2.96	0.96	0.14

SEM

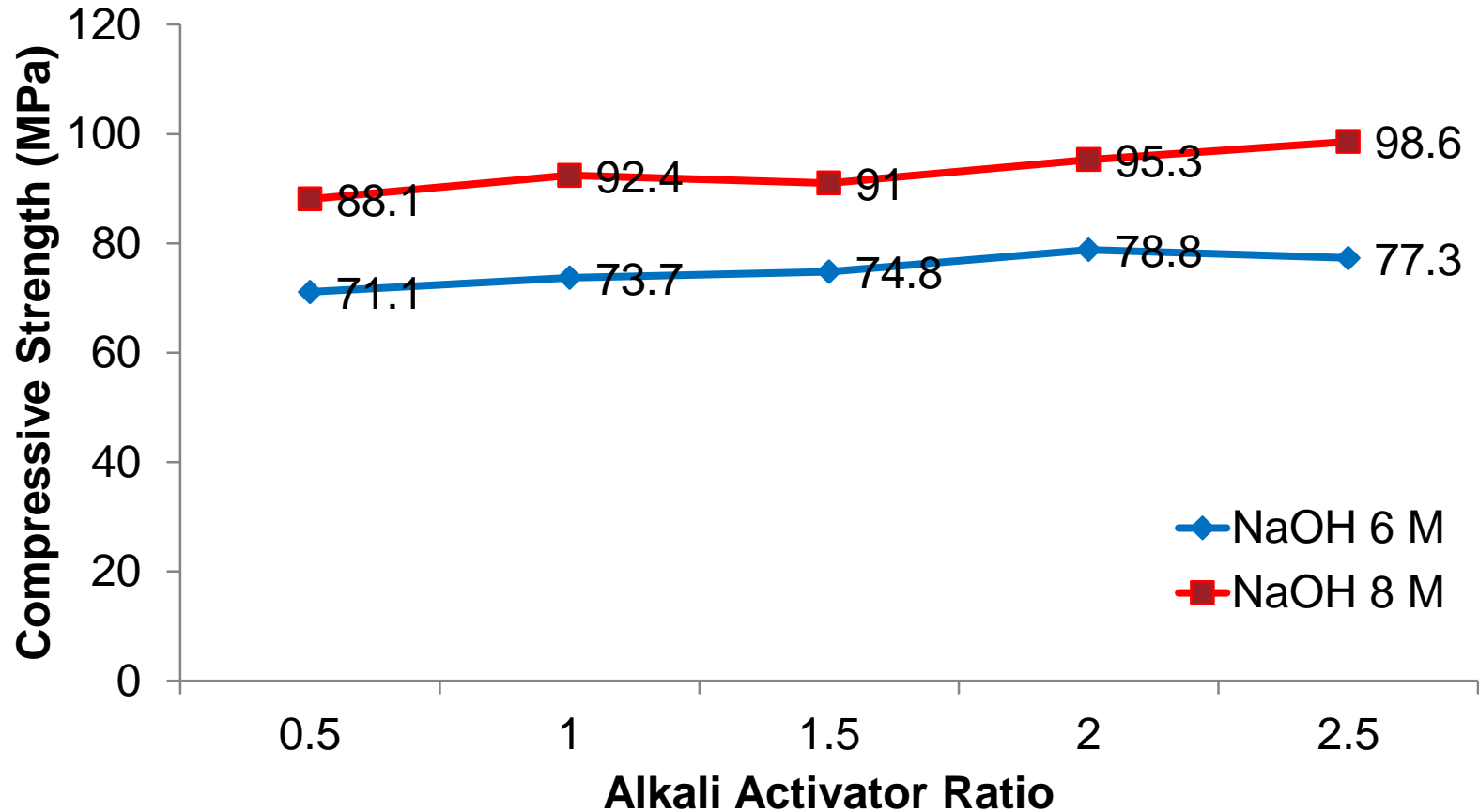
FLY ASH



GEOPOLYMER



COMPRESSIVE STRENGTH



CONCLUSIONS

- 1. Fly ash from unit 1-7 Suralaya is classified as fly ash class F. The largest component of fly ash is SiO_2 of 43.84%. The value of component $\text{SiO}_2+\text{Al}_2\text{O}_3+\text{Fe}_2\text{O}_3$ is 77.42 (% by weight). Fly ash class F or low Calcium fly ash is the most excellent for the producing of fly ash geopolymer concrete.**
- 2. The shape particle of fly ash is round and smooth. Particle size is between 1-10 μm . SEM of geopolymer paste shows the merging of fly ash and alkali activator. Some fly ash still has not reacted perfectly with alkali activator.**
- 3. The highest compressive strength was obtained with 75% Fly Ash, NaOH 8 Molar and alkali activator ratio of 2.5. This composition produces compressive strength of 98.6 MPa. The compressive strength of geopolymer paste shows the larger value in higher NaOH molarity. The addition of NaOH molarity increases the compressive strength of geopolymer paste.**

Thank you

TERIMA KASIH

