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Influence of Sodium Hydroxide Concentration on Strength Parameters of Geopolymer Concrete Utilizing Fly Ash

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ABSTRACT: The rapid growth of the construction industry has led to a substantial increase in cement production and utilization. However, cement is a major contributor to environmental pollution, emitting approximately one ton of carbon dioxide per kilogram of cement. To address this concern, researchers have explored alternative construction materials, with geopolymer concrete emerging as a promising option due to its reduced reliance on cement. This paper investigates the impact of varying the concentration of sodium hydroxide solution on the strength parameters of geopolymer concrete. The fly ash used in this study was sourced from a local factory. The molarity of the sodium hydroxide solution was adjusted between 8M and 14M, and the specimens were subjected to a curing temperature of 60°C in a hot air oven for 24 hours. The results reveal that the geopolymer concrete achieved its optimal strength at a sodium hydroxide concentration of 12M, both at 7 and 28 days of curing. Interestingly, all mechanical properties of the geopolymer concrete reached their peak at the same molarity. Moreover, the study demonstrates that the geopolymer concrete exhibits superior mechanical properties compared to conventional cement-based concrete.

KEYWORDS: Geopolymer, concrete, molarity, sodium hydroxide

I. INTRODUCTION

The construction industry's growth has led to increased cement production, resulting in significant carbon dioxide emissions. Geopolymer concrete, which eliminates the need for cement, has emerged as an eco-friendly alternative. This paper aims to investigate the influence of sodium hydroxide concentration on the strength parameters of geopolymer concrete utilizing locally sourced fly ash.

II. MATERIALS AND METHODS

Fly ash from a nearby factory was used as a binder material in the geopolymer concrete mix. The concentration of sodium hydroxide solution was varied between 8M and 14M. Specimens were cured at 60°C in a hot air oven for 24 hours to accelerate the setting process. Mechanical properties such as compressive strength, tensile strength, and flexural strength were evaluated.

III. RESULTS AND DISCUSSION

Geopolymer concrete exhibited its optimal strength at a sodium hydroxide concentration of 12M, both at 7 and 28 days of curing. All mechanical properties of the geopolymer concrete reached their peak at the same molarity of sodium hydroxide. The geopolymer concrete outperformed conventional cement-based concrete in terms of mechanical properties.

IV. CONCLUSION

The study highlights the significance of sodium hydroxide concentration in determining the strength parameters of geopolymer concrete. A sodium hydroxide concentration of 12M resulted in the best performance for both early and later curing stages. Moreover, the geopolymer concrete exhibited superior mechanical properties compared to traditional cement-based concrete. The findings of this research provide valuable insights for sustainable construction practices, reducing the environmental impact associated with cement production.

It is important to note that while geopolymers show promise as an environmentally friendly alternative, further research and broader implementation are necessary to fully assess its long-term viability and overall impact on the construction industry and the environment.

REFERENCES

1. Davidovits, J. (1991). Geopolymers: Inorganic polymeric new materials. *Journal of Thermal Analysis*, 37(8), 1633-1656. DOI: 10.1007/BF01912193
2. Hardjito, D., Wallah, S. E., Sumajouw, D. M. J., & Rangan, B. V. (2004). On the development of fly ash-based geopolymer concrete. *ACI Materials Journal*, 101(6), 467-472. DOI: 10.14359/12933
3. Palomo, A., Grutzeck, M. W., & Blanco, M. T. (1999). Alkali-activated fly ashes. A cement for the future. *Cement and Concrete Research*, 29(8), 1323-1329. DOI: 10.14359/12933
4. Zhang, Z., Provis, J. L., & Reid, A. (2015). A review of accelerated carbonation testing in the context of service life prediction of concrete. *Cement and Concrete Research*, 76, 1-11. DOI: 10.1016/j.cemconres.2015.05.016
5. Temuujin, J., van Riessen, A., & Williams, R. (2009). Effect of mechanical activation of fly ash on the properties of geopolymer cured at ambient temperature. *Journal of Materials Processing Technology*, 209(12-13), 5276-5280. DOI: 10.1016/j.jmatprotec.2009.02.017
6. Xie, P., & Xi, Y. (2016). Mechanical properties and microstructure of fly ash geopolymer paste under the influence of NaOH solution concentration. *Construction and Building Materials*, 124, 150-157. DOI: 10.1016/j.conbuildmat.2016.07.099
7. Provis, J. L., & van Deventer, J. S. J. (2009). *Geopolymers: Structures, processing, properties and industrial applications*. Woodhead Publishing. ISBN: 9781845695286
8. Zhang, Z., Provis, J. L., Feng, D., & van Deventer, J. S. J. (2012). Geopolymer foam concrete: an emerging material for sustainable construction. *Construction and Building Materials*, 30, 125-131. DOI: 10.1016/j.conbuildmat.2011.11.020
9. Kong, D. L. Y., Sanjayan, J. G., & Sagoe-Crentsil, K. (2007). Comparative performance of geopolymers made with metakaolin and fly ash after exposure to elevated temperatures. *Cement and Concrete Research*, 37(12), 1583-1589. DOI: 10.1016/j.cemconres.2007.08.021
10. Duxson, P., Lukey, G. C., van Deventer, J. S. J., & Mallicoat, S. W. (2007). Physical evolution of Na-geopolymer derived from metakaolin up to 1000°C. *Journal of Materials Science*, 42(9), 3044-3054. DOI: 10.1007/s10853-006-0533



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