

Solidification of Organic Waste Oil in Geopolymer using Graphene Oxide as the Emulsion Stabiliser

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Abstract

The recycling and recovery of waste oil from various sources is a critical process, ultimately leading to its disposal in a diminished or non-hazardous state compared to its original form. Solidification is one of the promising methods of disposal of hazardous organic and inorganic wastes. Due to the hindrance of hydration of Ordinary Portland Cement (OPC) by organic compounds present in the oil, metakaolin-based geopolymer was selected as a suitable solidifying agent. Incorporating organic oil into the geopolymer via pre-emulsification, with Graphene Oxide (GO) nanosheets serving as Pickering particles for emulsion stability, ensures successful stabilization. The stability conferred by GO-stabilized Pickering emulsion of alkali activator-oil emulsion facilitates the effective incorporation and solidification of waste oil in metakaolin-based geopolymer. Furthermore, the addition of GO enhances the strength properties of the resultant geopolymer, albeit with a diminishing effect on strength and flowability with increasing oil content. This research underscores the significance of emulsion stability in pre-emulsified alkali activator-oil emulsion and demonstrates excellent leaching results, indicating the effective removal of organic components from solidified samples. Post-solidification experiments confirm the success of organic oil solidification through pre-emulsification utilising GO as an emulsion stabilizer.

Keywords: waste oil; solidification; geopolymer; metakaolin; graphene oxide

Graphical Abstract

