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Development of high strength geopolymer mortar using industrial and agro waste

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Geopolymer is a new technology towards greener environment as it utilizes industrial waste like fly ash, metakaolin, blast furnace slag etc in bulk quantity. The geopolymer technology was first introduced by Professor Joseph Davidovits of France in 1978. His work shows that the adoption of the geopolymers could reduce the CO_2 emission caused due to cement industries. The development of geopolymer system is an important step towards the production of environment friendly materials. Geopolymerization involves a chemical reaction between various alumino silicate precursors with alkali metal silicates under strong alkaline conditions yielding polymeric –Si-O-Al-O- bonds, which lead to geopolymers by polycondensation. In present research work an attempt has been made to develop high strength geopolymer mortar using industrial waste fly ash from Satpura thermal power plant Sarni (M.P) India and Rice husk from agro industries. Sodium hydroxide and Sodium meta silicate were used as conventional alkaline activator. Rice husk was used for the synthesis of in-situ silicates for development of inorganic organic hybrid alkaline activator. For the first time this inorganic organic hybrid alkaline activator was developed by CSIR-AMPRI Bhopal India for multifunctional applications. Patent filed in India and USA and its application number is 0088NF/2016/201611019506 Dated 30, March 2016. The developed inorganic organic hybrid alkaline activator was used with conventional alkaline activator in different percentages by weight of fly ash. The percentage range chosen were 0.5%, 1%, 1.5%, 2% and 2.5%. Fly ash based geopolymer mortar cubes samples were thermal cured in hot air oven for 48 hours at 60^0C and then the cubes samples were left at ambient temperature. Five batches of inorganic organic hybrid alkaline activator and one batch of reference conventional geopolymer mortar were mix design and three cube samples for each batch were tested at 3, 7 and 14 days respectively for compressive strength. The conventional geopolymer mortar prepared with alkaline activator of optimized 12.5 molar solution. The compressive strength of conventional geopolymer mortar was found to be 35.9 MPa at 14 days which was compared with the geopolymer mortar developed using inorganic organic hybrid alkaline activator and it was found that maximum compressive strength of 55 MPa at 14 days was achieved after adding 2% of inorganic organic hybrid alkaline activator. The developed high strength geopolymer mortar can be used for production of prefabricated building components.

Biography

Manish Mudgal is presently working as Principal Scientist at CSIR-AMPRI Bhopal India. His research is concentrated on development of value added materials for Civil Engineering applications utilizing industrial wastes and has developed Fly Ash based (Cement Free) Green Concrete for Road construction and demonstrated the technology at semi pilot plant level. He has also developed Red Mud based synthetic radiation shielding aggregates using these aggregates developed radiation shielding concrete for medical installations and strategic sector. He has two US patents granted in his credit and has 24 publications in international and national journals, 59 publications in international and national conference proceedings. He is the recipient of nine Awards in different categories at CSIR-AMPRI, Bhopal India, guided 15 MTech students and two students perusing PhD under his guidance.

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