Development of Environmentally Clean Construction Materials Using Industrial Waste from Kazakhstan

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Abstract : The sustainable use of industrial waste has recently increased due to increased environmental problems in landfills. One of the best ways to utilise waste is as a road base material. Industrial waste is a less costly and more efficient way to strengthen local soils than by introducing new additive materials. This study explored the feasibility of utilising red mud, blast furnace slag, and lime production waste to develop environmentally friendly construction materials for stabilising natural loam. Four different ratios of red mud (20, 30, and 40%), blast furnace slag (25, 30, and 35%), lime production waste (4, 6, and 8%), and varied amounts of natural loam were combined to produce nine different mixtures. The results showed that the sample with 40% red mud, 35% blast furnace slag, and 8% lime production waste had the highest strength. The sample's measured compressive strength for 90 days was 7.38 MPa, its water resistance for the same period was 7.12 MPa, and its frost resistance for the same period was 7.35 MP; low linear expansion met the requirements of the Kazakh regulations for first-class building materials. The study of mineral composition showed that there was no contamination with heavy metals or dangerous substances. Road base materials made of red mud, blast furnace slag, lime production waste, and natural loam mix can be employed because of their durability and environmental performance. The chemical and mineral composition of raw materials was determined using X-ray diffraction, X-ray fluorescence, scanning electron microscopy, energy dispersive spectroscopy, atomic absorption spectroscopy, and axial compressive strength were examined.

Keywords : blast furnace slag, lime production waste, natural loam stabilizing, red mud, road base material
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