

A study on mechanical properties of concrete incorporating aluminum dross, fly ash, and quarry dust

ABSTRACT

The amount of waste, associated waste disposal costs, and environmental contamination may be minimized by identifying effective recycling approaches. These promising approaches will also lead to the protection of natural resources and economic gains. One example of waste disposal may be by using it as a filling material or as a pozzolanic material for the production of concrete. In this regard, this study proposes to partially replace cement with aluminum dross and fly ash, and partially replace natural sand with quarry dust. Aluminum dross, cement, sand, and quarry dust were used in a variety of proportions with a constant percentage of fly ash for the design of nine concrete mixtures. Aluminum dross was replaced by 5, 10, 15, and 20% of the cement mass. At first, the optimum replacement of aluminum dross without using quarry dust was determined at a constant percentage of fly ash-15% based on the strength results. Later, by introducing the optimum substitution of aluminum dross with cement and fly ash, the quarry dust was partially replaced at 10, 20, 30, and 40% of river sand to determine the overall optimum mix. The mechanical and durability characteristics of the concrete using the three mixtures were analyzed. It has been observed that the mechanical and durability characteristics of a concrete mixture incorporating a fly ash-15%, aluminum dross-10%, and quarry dust-20% are better than that of standard concrete. Production of concrete using industrial waste can minimize infrastructure construction costs and reduce environmental impacts.

Keyword: Hazardous waste; Aluminum dross; Concrete; Quarry dust; Fly ash; Compressive strength; Water absorption