



## Sustainable Green Environment through Utilization of Waste Soda-Lime Glass for Production of Concrete

O.M. Olofinnade<sup>1,\*</sup>, A.N. Ede<sup>1</sup>, J.M. Ndambuki<sup>2</sup>

<sup>1</sup>Department of Civil Engineering, Covenant University, P.M.B 1023, Ota, Ogun State, Nigeria

<sup>2</sup>Department of Civil Engineering, Tshwane University of Technology, Pretoria, South Africa

Received 13 Jul 2016,  
Revised 12 Dec 2016,  
Accepted 15 Dec 2016

### Keywords

- ✓ waste soda-lime glass,
- ✓ coarse aggregate,
- ✓ workability,
- ✓ compressive strength,
- ✓ split tensile strength

O.M. Olofinnade  
[rotimi.olofinnade@covenantuniversity.edu.ng](mailto:rotimi.olofinnade@covenantuniversity.edu.ng)  
+234 802 856 1616

### Abstract

Recycling and reuse of waste materials remains a major option for waste reduction, preserving the natural resources from further depletion and reduction in greenhouse gases emission thereby contributing to sustainable green environment. In this study, focus on the reuse of waste soda-lime glass crushed into coarse aggregate sizes as a substitute for natural coarse aggregate in normal concrete was investigated. The variables in this study is coarse aggregate while the cement, sand and water-cement ratio were held constant. The crushed waste glass was varied from 0 – 100% in steps of 25% by weight to replace the coarse aggregate in the concrete mix. Concrete mixes were prepared using a mix proportion of 1:2:4 (cement: sand: granite) at water-cement ratio of 0.5 targeting a design strength of 20 MPa. Slump tests were carried out on fresh concrete mixes and tests were also carried out on total number of 60 concrete cube specimens of size 150 x 150 x 150 mm and 60 concrete cylinder specimens of dimension 100 mm diameter by 200 mm height after 3, 7, 28 and 90 days of curing. Results on the slump tests shows a decrease in the concrete workability as the glass content increases. Test results also indicated that the compressive and split tensile strength of the hardened concrete decreases with increasing waste glass content compared with the control. However, concrete mix made with 25% waste glass content compared significantly well with the control and can be suitably adopted for production of normal concrete.

## 1. Introduction

The utilization of waste glass in the concrete industry is one attractive option that could help in achieving the effective management of waste glass disposal in landfill sites thereby preventing environmental pollution. Moreover, the other benefits of reusing waste glass in the production of concrete include; the preservation of natural resources from further depletion, reduction of greenhouse gases emission and energy savings thereby achieving environmental greening and sustainability [1, 2]. Estimation by [3] that, yearly, concrete production consumes about 1.5 billion tonnes of cement, 9 billion tonnes of aggregate and 1 billion tonnes of water for mixing and [2] pointed out that this consumption rate has a huge impact on the environment resulting in depletion of natural resources, intensive energy consumption and greenhouse gases emission. Again, with the demand for concrete expected to increase by the year 2050 to about 18 billion tonnes owing to increasing construction activities, it can be inferred that concrete would hold great significance in the nearest future [2]. According to [4], sustainability has become a critical issue in the construction industry, especially sustainability of construction materials. Of recent, research efforts have been invested on using concrete as a means of managing solid waste, and from the studies of [5, 6, 7, 8], it was reported that concrete provide a real potential means of reusing large quantities of solid waste materials like glass, fly ash and rice husk as substitute for concrete constituents. Moreover, [9] reported that reusing of waste materials in the construction industry is among the most effective options to manage waste because a significant quantity of these waste materials can be reuse in concrete with or without high conditions of quality. Reusing waste glass in production of fresh concrete is attracting an increasing