PERFORMANCE ASSESSMENT OF ALKALI TREATED COCONUT FIBRE-REINFORCED *SENELIA SENILIS* CONCRETE

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF ENGINEERING (M.Eng) IN CIVIL ENGINEERING IN THE DEPARTMENT OF CIVIL ENGINEERING, COLLEGE OF ENGINEEERING, COVENANT UNIVERSITY, OTA, OGUN STATE

JULY, 2023

ACCEPTANCE

This is to attest that this dissertation was accepted in partial fulfillment of the requirement for the award of a Master of Engineering (M.Eng.) degree in Civil Engineering, Department of Civil Engineering, College of Engineering, Covenant University, Ota, Nigeria.

Miss Adefunke F. Oyinloye
(Secretary, School of Postgraduate Studies) **Signature and Date**

Prof. Akan B. Williams
(Dean, School of Postgraduate Studies) **Signature and Date**

DECLARATION

I, ADEBESIN JOSHUA ADEDAMOLA (14CI016655), thus declare that I undertook the study for this project under the supervision of Dr. Gideon O. Bamigboye of the Department of Civil Engineering, Covenant University. I therefore also solemnly declare that no part of this report has previously been presented in part or in whole to Covenant University or to any other institution in an application for the award of a degree. All informational sources, including academic journals, have been properly acknowledged.

ADEBESIN, JOSHUA ADEDAMOLA

Signature and Date

CERTIFICATION

We certify that this dissertation titled **PERFORMANCE ASSESSMENT OF ALKALI TREATED COCONUT FIBRE-REINFORCED *SENELIA SENILIS* CONCRETE** is original research carried out by **ADEBESIN JOSHUA ADEDAMOLA (14CI016655),** in the Department of Civil Engineering, College of Engineering, Covenant University, Ota, Ogun State, Nigeria under the supervision of Dr. Gideon O. Bamigboye. We have examined and found this work acceptable as part of the requirement for the award of Master of Engineering in Civil Engineering, Covenant University, Ota, Ogun State, Nigeria.

Dr. Gideon O. Bamigboye
(Supervisor) **Signature and Date**

Prof. Anthony N. Ede
(Head of Department) **Signature and Date**

Prof. Joseph Akinyele
External Examiner **Signature and Date**

Prof Akan B Williams
(Dean, School of Post Graduate Studies) **Signature and Date**

DEDICATION

This research work is dedicated first and foremost to God Almighty, the custodian of all wisdom, knowledge, and understanding, for His grace and favor throughout the duration of carrying out this research. To my supervisor (Dr. Gideon O. Bamigboye) for his unconditional support all through my project work. Then to my family for their endless support and love.

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ABSTRACT

Concrete technology is advancing, and eco-friendly concrete production techniques are being explored to reduce reliance on natural resources. Seashells are being considered as a waste material in concrete, but their durability and strength properties, especially when combined with alkali-treated coconut fiber, require further investigation. The alkali treated fiber-reinforced *Senilia senilis* concrete was produced by varying the proportion seashell in the ratio of 10, 15, 20, and 25 percentages with addition of 1% alkali treated coconut fiber. Physical tests such as aggregate grading, specific gravity, water absorption for aggregate, abrasion test, aggregate impact. Slump test was carried out of fresh alkali treated fiber reinforced seashell concrete and control mix. Compressive, split tensile and flexural strength tests together with durability assessment, fire resistance and microstructural analysis were performed on the hardened concrete. Specimens were produced using 150 mm cubes, 100 mm cubes, 100mm x 300mm cylinders and 100 x 100 x 500 mm beams. After demoulding, samples were submerged in water for 56 days to cure in order to conduct durability testing. Afterward, specimens were transferred into 5% sodium sulphate (Na_2SO_4), 5% NaOH, and 5% sodium chloride (NaCl) and 7.5% Na_2SO_4 and 5% NaCl solutions for additional curing periods of 56 days. On the concrete, the short-term impacts of sulphate and chloride were assessed. The resulting mixture showed notable increases in compressive strength (30.15%), split tensile strength (39.21%) and flexural strength (14.99%) as compared to the control mixture. Also, significant improvements were seen in the compressive strength of cubes after its immersion for 56 days with a 15.46% on cubes removed from 5% NaCl, 34.3% for cubes removed from 5% Na_2SO_4, 3.069% for cubes removed from a combination of 7.5% Na_2SO_4 and 5% NaCl, and a 16.38% from cubes removed from NaOH as compared to the control mix. Afterwards the alkali treated fiber reinforced seashell concretes were compared in microstructural analysis specifically SEM and EDX with control. The results provide insightful information on the usage of fiber that has been alkali-treated to increase the durability and fracture resistance of concrete, and they have a great deal of promise for real-world applications in the building sector. According to this study, combining coconut with 1% alkali-treated seashell could lessen the harmful effects of sulphate and chloride salts. The outcome of this study indicated that the application of alkali treated fiber reinforced *Senilia senilis* concrete increases the resistance against aggressive environment.

Keywords: Fiber-reinforced concrete, durability, seashell, compressive strength, coconut fiber, sulphate attack, chloride attack, sodium attack