WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

BACTERIA CURING EFFECT OF LIQUEFIED FERMENTED LOCUST BEANS USED AS SELF-HEALING CONCRETE

Bamitale Dorcas Oluyemi-Ayibiowu[1], Igibah Christopher Ehizemhen[2], Lucia Omolayo Agashua[1],

[1]Civil Engineering Department, Federal University of Technology Akure, Ondo State, Nigeria.
[2]Civil Engineering Department, Federal University Oye-Ekiti, Ekiti State, Nigeria.
**Corresponding author: igibahchrist1@gmail.com, agashualight@gmail.com, lightjesuniyi@yahoo.com.*

A B S T R A C T

The study was aimed at producing a cost-effective self-healing concrete for the curing of crack formation on the surface of concrete structures using locally sourced materials. Fermented locust beans from several locations in Ogun state, Nigeria was mixed with concrete to produce a bacteria concrete. The results revealed that the 30%–70% ratio of Ota liquefied fermented locust beans to concrete mix was the most effective and optimal mix. This was in terms of compressive strength for grade 20 concrete at 28 days, 21.75-21.80N/mm^2 above minimum of 20N/mm^2, split tensile strength was between 1.58-2.97MPa within average ratio of 0.87-2.9MPa and Flexural strength lowest value of 0.58MPa is within limit of 0.305–0.7Mpa. About 10.28% savings when 1m^3 of liquefied fermented locust beans added at concrete production state compared with crack repair after construction.

Keywords*: Self-healing, Concrete, Fermented locust beans.*

1. INTRODUCTION

Self -healing concrete have been used in different parts of the world as a means of mending cracks that appear on the surface of structural concrete through production of limestone biologically. The application of liquefied fermented locust beans isn't solely a brand novel and trendy approach, but it minimizes cost and locally available materials, though is food flavor as well as nutritional values enhancement. The use of liquefied fermented beans and concrete from Ogun State, south-west Nigeria is worth delve into for use as self -healing concrete materials. Bacterial and concrete had been used in previous studies for various self-healing purpose [1–3].

METHODS

Fermented locust beans (Parkia biglobosa) sampled from different localities (Ota, Sango, Iju, Atan and Iyesi) in Ogun State, Nigeria were pulverized and dissolved in water. Concrete was produced from Portland cement (conforming to Bs 8500-1:2006-53 grade), sand (less than 4.75 mm), granite (greater than 4.75) and reinforcement (Y12 diameter bar, Y8mm syrrup) gotten from stores in Ogun state. Totally fermented bacteria water was added to concrete mix in suspension state to form a mouldable paste. These were cured after 24 hours in water at different aged so as to prevent loss of moisture and strength gain. The aged casted cubes, cylinders and rectangular beams were tested for consistency (slump) and mechanical strengths [4]. Bacteria Oxygen demand (BOD), carbondioxide, Chemical oxygen demand (COD) and calcium (Ca) test were carried out on the liquefied samples.

2. RESULTS AND CONCLUSIONS

The Physicochemical properties values and colour of the Ogun liquefied fermented locust beans samples are listed in Table 1. The consistency values of fresh bacterial concrete (Table 2). The mechanical strengths were measured at age 3 and 28 (Table 3). From the results, Ota liquefied fermented locust beans and concrete in 30%:70% ratio had the highest performance level in terms strengths and physicochemical values.

Table1

The Physicochemical properties of the Ogun liquefied fermented locust beans (LFLB) samples.

LFLB samples	Colour	BOD (mg/l)	COD (mg/l)	Ca (mg/l)	Carbondioxide (ppm)
Ota	colourless	7.50	6125	56	1.46
Sango	colourless	7.40	6123	55	1.45
Iju	colourless	7.35	6120	54	1.47
Atan	colourless	7.45	6124	56	1.38
Iyesi	colourless	7.51	6126	55	1.44

Table 2

Consistency (slump) test of various LFLB to concrete mix ratio (bacterial concrete).

% LFLB to %		Slump test for compressive and flexural strength (mm)					
concrete mix ratio	Ota	Sango	Iju	Atan	Iyesi	Slump type	
100:0		0.0	0.0	0.0	0.0	0.0	Collapsed
90:10		0.5	0.5	0.6	0.5	0.6	Collapsed
80:20		1.0	1.1	1.0	1.2	1.3	Collapsed
70:30		2.2	2.3	2.2	2.0	2.3	Collapsed
60:40		3.4	3.0	3.2	3,1	3.0	Collapsed
50:50		4.0	4.3	4.6	4.4	4.5	Collapsed
50:50		6.5	6.8	6.9	7.0	7.2	Collapsed
40:60		8.5	9.2	9.3	9.5	9.3	Collapsed
30:70		25.0	25.0	24.9	25.0	25.0	True
20:80		30.1	32.2	30.5	30.7	32.1	Zero or dry
10:90		40.2	41.0	42.1	43.2	45.2	Zero or dry
0:100		NS	NS	NS	NS	NS	Shear

Note. “NS” denotes “no slump” or Shear Slump (This shows incomplete result because the mix cannot be measured).

Table 3

Saving and the mechanical strengths measured at age 3 and 28.

LFLB	Mechanical strength of concrete					Saving (1m3)	
Samples	compressive (N/mm^2)			split tensile (Mpa)		flexural (Mpa)	%
	3days	28days		3days	28days	3days	28days
Ota	12.72	21.80	1.61	2.97	0.61	1.01	10.28
Sango	12.62	21.78	1.59	2.95	0.59	1.00	10.27
Iju	12.70	21.76	1.60	2.95	0.58	1.00	10.27
Atan	12.68	21.75	1.58	2.96	0.60	1.00	10.28
Iyesi	12.66	21.79	1.60	2.94	0.60	1.01	10.27

3. CONCLUSIONS

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

REFERENCES

[1] B. Arthi, K. K. Dhaarani, A study on strenght and self healing characteristics of Bacterial concrete. International Journal of Engineering Trends and Technology, 38 (2016), 3-12.

[2] Dong I, Smart realising behaviour of a chemical self healing microcapsule in the stimulated concrete pore solution, Cement and concrete composites, 56 (2015), 46-50.

[3] N. D. Belie, J. Wang J. Bacteria-based repair and self-healing of concrete. Journal of Sustainable Cement-Based Materials, 5 (2015), 35-56.

[4] BS 8500-1:2006 Concrete - Complementary British Standard to BS EN 206-1. Method of specifying and guidance for the specifier (+A1:2012).