World Journal of Research and Review (WJRR)
ISSN: 2455-3956, Volume-14, Issue-2, February 2022 Pages 01-04

A Durability and Strength Analysis of M-25 Concrete Using Tobacco Waste Ash and Bamboo Fibers

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***Abstract*— In this study development of concrete by making an efficient mix design with few mineral admixtures tends for high strength concrete. The development of the mix design method plays a key role in concrete technology. It involves the process of experimental determination of the most appropriate concrete mixtures to achieve maximum resistance with at least economic costs.**

In India, approximately 750 mn kg tobacco production occurs tobacco annually. From this high amount waste is also produce which has a great potential for concrete technology. Tobacco waste ash is a material that needs to be investigated with its potential to show puzzolanic activity due to its properties such as fineness, amorphous form and high silica content. So it can be said that tobacco waste ash may be used in concrete as a mineral admixture.

In this Research, replacement of cement is done by Tobacco waste ash in certain percentage (25%) replacement and with addition of various percentages of Jute and Bamboo fiber (0%, 1%, and 3%) in concrete. By using the results of tests compressive and flexural strength of specimens were calculated.

The experimental results reveal that the compressive and flexural strength specimens decrease as the increasing of the tobacco waste ash content. And optimum compressive and flexural strength specimens are obtained as the increasing of the tobacco waste ash content. While no improvements were observed on the monitored properties of mortar specimens containing tobacco waste ash compared to control mortar, it can be suggested that the usage of the admixture providing ecological and economic benefits by consumption of this non-renewable waste.

***Index Terms*— Tobacco Waste Ash, Concrete, Compressive Strength, Fibers, Jute, Bamboo.**

I. INTRODUCTION

A. Tobacco Waste Ash

Tobacco waste is produced annually in large quantity by processing and cigarette making industry.

B. Fiber Reinforced Concrete

The low tensile strength of the concrete material is the basic concept of reinforced concrete. In the concept of reinforced concrete, tensile stress reinforced to the steel as reinforcement. When the tensile strain reached the maximum concrete strain, the area will be in a state of tension cracks. This causes water vapor and aggressive materials enter and cause of corrosion of the reinforcement. It can damage the concrete. The addition of fiber in the tensile area is conducted. The fibers can transfer the load to the internal micro cracks. Durability of the concrete is improved to reduce in the crack width.

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II. LITERATURE REVIEW

T. Ozturk, MuzafferBayrakl(2005) This study was carried out to determine the possibilities of using tobacco wastes in lightweight concrete producing. The samples were produced with mixture combinations of materials such as tobacco waste, pumice, sand and cement. The results showed that produced material samples were in lightweight concrete class according to values of consistency, unit weight, porosity, compactness, compressive strength and thermalconductivity. It was determined that the unit weight of lightweight concrete material samples ranged between 0,50 – 0,56 kg dm-3,compressive strength values ranged between 0,20 - 0,60 N mm- 2 and thermal conductivity coefficients ranged between 0,194 – 0,210 W m-1 K-1. According to the observations, tests, experiments and evaluations on lightweight concrete material samples, it was concluded that the lightweight concrete with tobacco waste additives can be used as a coating and dividing material in constructions

S.CELIKTEN, M. CANBAZ(2007) In this conducted study, two type of tobacco waste ashes partially replaced with cement by weight at 0, 10, 20 and 30% proportions. 4 x 4 x 16 cm prism specimens prepared with mortars produced by using the binary blends of cement and ashes were cured 28 days in a water-curing tank with controlled weight and ultrasonic tests were performed on the specimens at 28 days. By using the results of tests compressive and flexural strength, unit weight, ultrasonic pulse velocity, dynamic modulus of elasticity values of the mortar specimens were calculated. The experimental results reveal that the compressive and flexural strength, unit weight, ultrasonic pulse velocity, dynamic modulus of elasticity values of the mortar specimens decrease as the increasing of the tobacco waste ash content. While no improvements were observed on the monitored properties of mortar specimens containing tobacco waste ash compared to control mortar, it can be suggested that the usage of the admixture providing ecological and economic benefits by consumption of this non-renewable waste.

Sri Murni Dewi1, Ming Narto WijayThis study presents the evaluation of the use of bamboo fiber to improve

the performance of bamboo reinforced concrete at the tension crack area. To achieve this objective, a series of tests were conducted. The size object of concrete beam is 15 cm x 20 cm x 160 cm with reinforcement of bamboo and pumice stone aggregate. Bamboo reinforcement was coated with sand to become rough of the surface. The type of bamboo obtained from skewer producers in the Cemoro Kandang Malang is called Ori bamboo. The fiber were used vary in length. The fiber coated with paint and covered with sand to prevent the hygroscopic properties and increased the weight to prevent the float of bamboo fibers when mixed in the concrete mixer. The results were showed that bamboo fiber can reduce crack-width and deflection of concrete and increase beam post-cracking load-carrying capacity. The amount of fiber has effect on workability and quality of concrete. However, bamboo fiber can prevent the growth and propagation of cracks.

III. RESULT AND DISCUSSION

A. Workability of Concrete

Table No. 5.1 Slump for Control mix of M25

S. No.	Control Mix	Slump (mm)
1	M25	75

Table No. 5.2 Slump with 10% Tobacco waste Ash and Bamboo Fiber

S. No.	Bamboo Fiber %	Slump(mm)
		M25
1	0.0	70
2	0.5	68
3	1.0	64
4	1.5	61
5	2.0	59

B. Compressive Strength Test

Table 5.3 Compressive Strength of M25 grade

Bamboo Fiber %	Com pressive Strength(N/mm^2)		
	7 Days	14 Days	28 Days
0.0	16.09	21.46	26.82
0.5	17.95	23.78	29.93
1.0	20.52	26.94	33.64
1.5	21.24	27.85	34.82
2.0	18.17	22.24	27.70

C. Split Tensile Strength of Concrete

Table 3.3 Splitting Tensile Strength of M25 grade

Bamboo Fiber %	Splitting Tensile Strength(N/mm^2)		
	7 Days	14 Days	28 Days
0.0	1.38	1.79	2.24
0.5	1.49	1.94	2.41
1.0	1.66	2.18	2.73
1.5	2.02	2.58	3.26
2.0	1.39	1.77	2.27

D. Flexural Strength of Concrete

Table 5.7 Flexural Strength of M25 grade

Bamboo Fiber %	Flexural Strength (N/mm^2)	
	7 Days	28 Days
0.0	1.58	2.6
0.5	1.76	2.9
1.0	2.01	3.3
1.5	2.07	3.4
2.0	1.67	2.7

Durability of concrete

A. For M25

i) Observation Table and Calculations : (Resistance against Acid Attack)

Table 5.9Resistance against Acid Attack of M25 grade

S. No.	Mix Combination Designation	Dry weight of cube specimen (W1) in kg	Weight of cube specimen after immersed in solution (W2) in kg	Percent weight loss in kg $\frac{W1-W2}{W1} \times 100 = \%$
1	TOBACCO WASTEASH 10%	8.178	8.102	0.92

2	TOBACCO WASTEASH 10% +0.5%PF	8.150	8.072	0.95
3	TOBACCO WASTEASH 10% + 1% PF	8.060	7.973	1.07
4	TOBACCO WASTEASH 10%+1.5% PF	7.998	7.886	1.40
5	TOBACCO WASTEASH 10%+ 2% PF	7.970	7.832	1.73

IV. CONCLUSION

A. Compressive Strength:

The compressive strength increased as increase the percentage (%) of Bamboo fiber (0% to 1.5%) after 1.5% of PEF compressive strength decreases for both 14 days & 28 days cube strength.
It was concluded that optimum percentage increment in compressive strength of concrete was
29.82% at 28 days of curing respectively.

B. Split Tensile Strength:

The minimum split tensile strength was obtained at 0% addition of Bamboo fiber while optimum split tensile strength was obtained at 1.5% addition of Bamboo fiber at 14 and 28 days curing of cubes.
It was concluded that optimum percentage increment in split tensile strength of concrete was
45.53% at 28 days of curing respectively.

C. Flexure Strength:

It was noted that flexural strength of concrete increase gradually with addition of Bamboo fiber and minimum flexural strength was obtained at 0% while optimum flexural strength was obtained at 1.5% addition of Bamboo fiber at 14 and 28 days of curing respectively. It was concluded that optimum percentage increment in flexural strength of concrete was
30.76% at 28 days curing respectively.

D. Durability:

It was concluded that the percent loss of weight of cube specimens for resistance against acid attack was found to be -

- For Tobacco wasteAsh 10% at 90 days - **0.92 %**
- For Tobacco wasteAsh 10% and PF 0.5% to 2.0% at 90 days found increasing - **0.95 to 1.73 %**

The results revealed that the percent loss of weight of cube specimens for resistance against alkali attack was found to be -

- For Tobacco wasteAsh 10% at 90 days - **0.26%**
- For Tobacco wasteAsh 10% and PF 0.5% to 2.0% at 90 days found increasing - **0.31 to 0.51 %**

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