The Effect of Bagasse Fibers Material with Pumice as A Partial Substitution of Coarse Aggregate to Increase Compressive Strength and Tensile Strength on Lightweight Concrete

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Outline of Presentation

Introduction

Method of Research (Experimental)

Result and Discussion

Conclusion and Recommendation

introduction

Bagasse Fiber

No	Content	Levels (%)
1.	Ash	3,82
2.	Lignin	22,09
3.	Cellulose	37,65
4.	Ekstrak	1,81
5.	Pentosan	27,97
6.	SiO_2	3,01

Problem Background

Based on data from the Indonesian Sugar Plantation Research Center (P3GI) bagasse produced 32% of the weight of ground sugar cane. Data obtained from the Indonesian Sugar Expert Association (IKAGI) shows the number of sugar cane milled by 57 sugar mills in Indonesia reaches around 30 million tons, so the bagasse produced is estimated to reach 9,640,000 tons. However, as much as 60% of the sugarcane bagasse ash is used by sugar factories as fuel, raw material for paper and others. Therefore, it is estimated that 40% of the sugarcane bagasse ash has not been utilized.

Solution : **Sugarcane Bagasse used as fibre material as an alternative for lightweight concrete**

Research purposes

General purpose

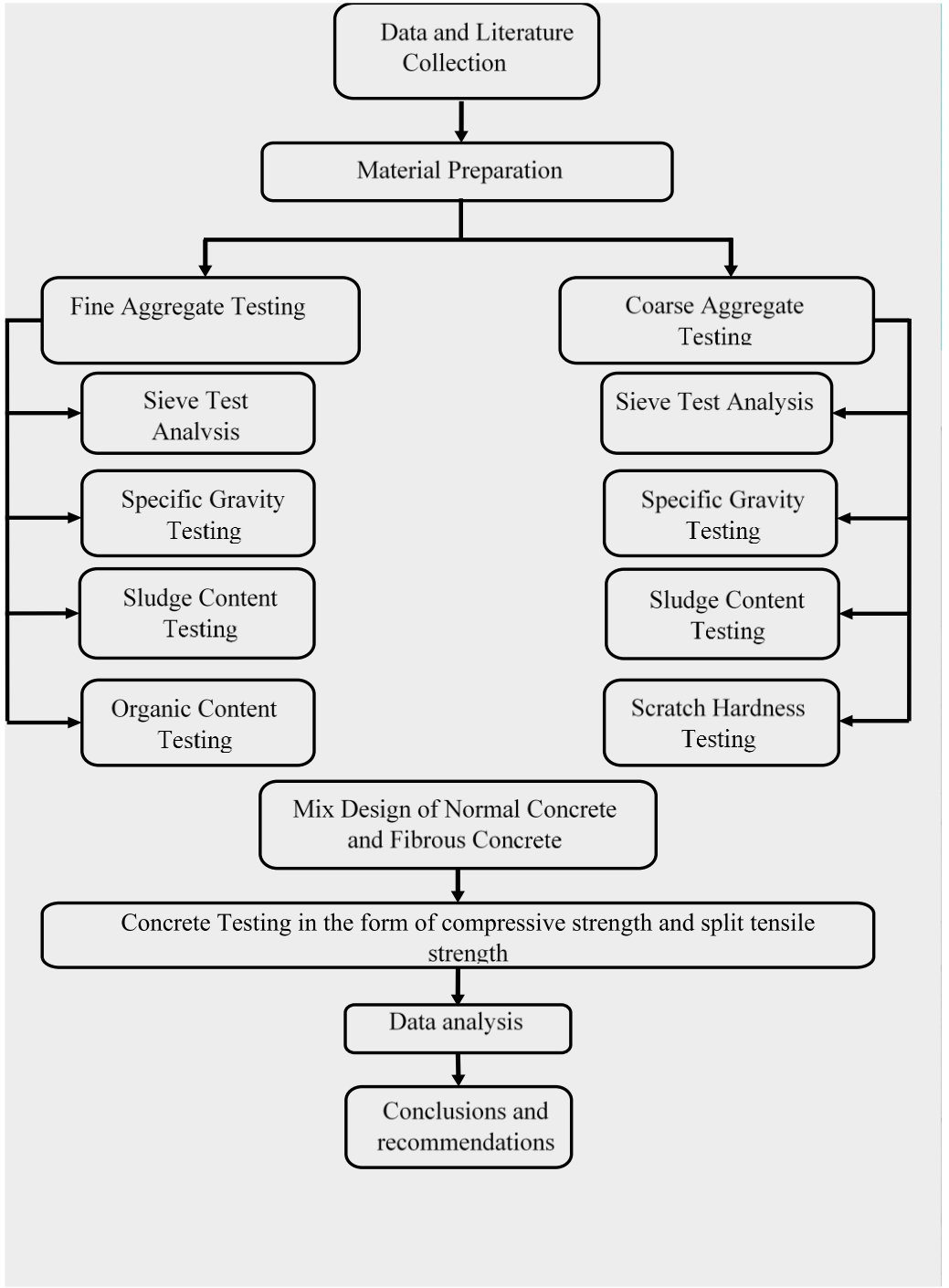
Provide references for further studies on the use of bagasse fiber in lightweight concrete

Specific Purpose

1. Analyzing the increase in the tensile value of concrete with a mixture of bagasse fiber (4 cm long and 10 mm in diameter) with a fiber variation of 0%; 0.25%; 0.5%; and 0.1% by weight of concrete.
2. Analyzing the increase and decrease in the value of the compressive strength of concrete with a mixture of bagasse fiber.
3. Analyzing the results of the compressive strength test and split tensile strength at the age of 28 days, with a compressive strength plan f'c = 10 Mpa.

Method of research

Research Flow



Research methodology for making the specimen test material of lightweight concrete with pumice coarse aggregate substitution as follow:

1

Studying of literature of sugarcane bagasse experiment for concrete technology, include the physical and chemical properties

2

Preparing sugarcane bagasse fibre in concrete with varrying content of 0%, 0.25%, 0.5%, and 1% of the volume of the concrete mix

3

Specimen used in this study is a specimen with a diameter of 15 cm and a height of 30 cm, 3 specimens each for various content of sugarcane baggase fibre

4

Curing

5

Examining the weight and volume of the specimen

6

Testing concrete specimens at the age of 28 days in normal condition compressive strength and tensile strength of the concrete

Result and Discussion

Analysis of Test Results

Fine Aggregate Testing Result

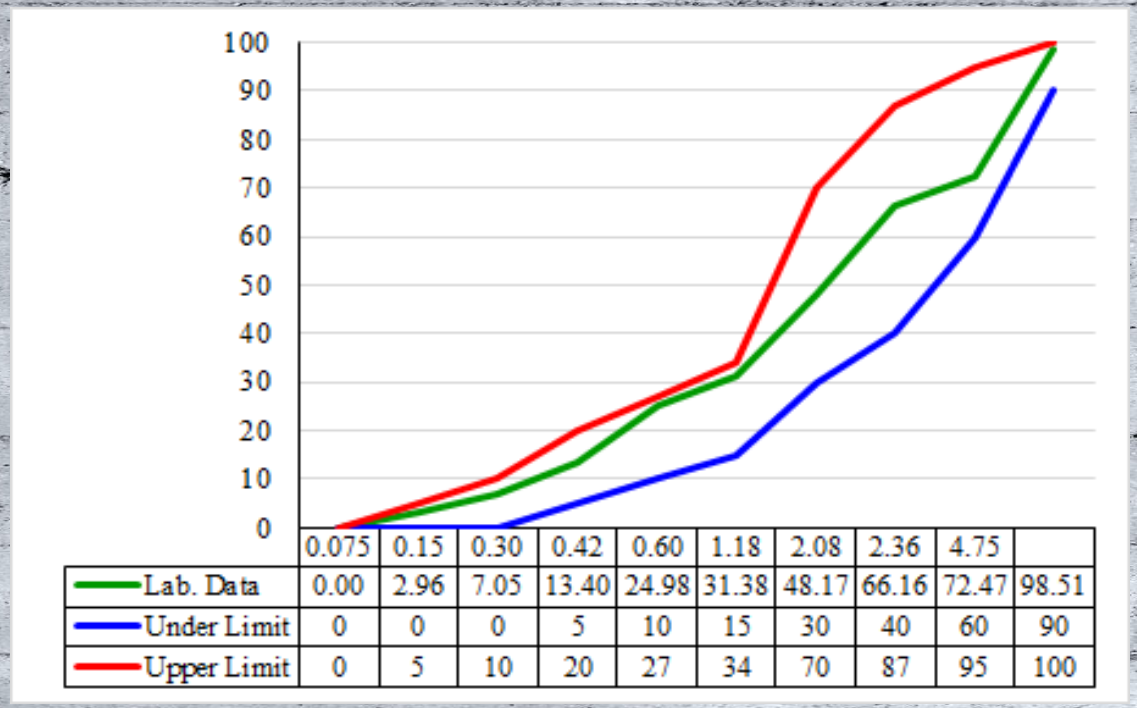
	Test Result	ASTM C-33 Standard	Conclusion
Bulk Specific (SSD)	2.65 gr/cm3	2,5-2,7	Qualify
Absorbtion	4.82 %	5%	Qualify
Mud Conntent	4.6 %	5%	Qualify
Durability	37.7%	Clear or light yellow	Qualify

Coarse Aggregate Testing Result

	Test Result	ASTM C-33 Standard	Conclusion
Bulk Specific (SSD)	2.69 gr/cm3	2,5-2,7	Qualify
Absorbtion	3.68 %	-	-
Mud Conntent	1.5 %	-	-
Durability	9.08%	-	-

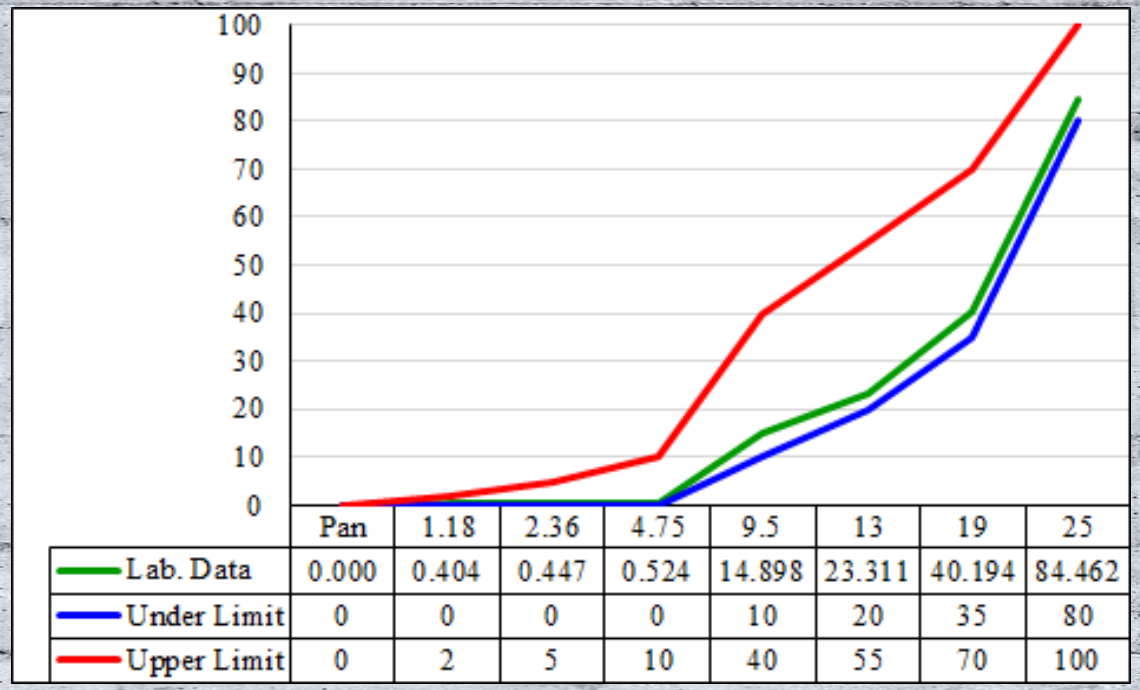
Graph of Sieve Test Results

Fine Aggregate Graph



	0.075	0.15	0.30	0.42	0.60	1.18	2.08	2.36	4.75	
Lab. Data	0.00	2.96	7.05	13.40	24.98	31.38	48.17	66.16	72.47	98.51
Under Limit	0	0	0	5	10	15	30	40	60	90
Upper Limit	0	5	10	20	27	34	70	87	95	100

Coarse Aggregate Graph

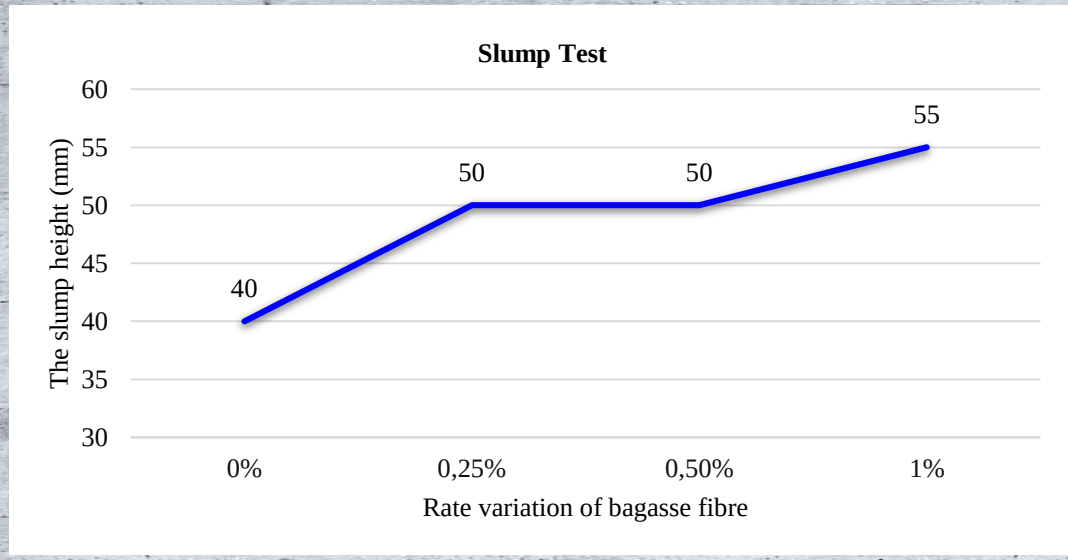


	Pan	1.18	2.36	4.75	9.5	13	19	25
Lab. Data	0.000	0.404	0.447	0.524	14.898	23.311	40.194	84.462
Under Limit	0	0	0	0	10	20	35	80
Upper Limit	0	2	5	10	40	55	70	100

Slump Test Result

The results of testing the slump value in concrete with various types of mixtures of 0%, 0.25%, 0.50%, and 1% bagasse fiber.

Slump plan 30-60 mm



Compressive Strength Test Results

ASTM C 805-02 Standard Test Method for Rebound Number of Hardened Concrete

Variation Content 0% Sample 1

Concrete Hammer Test (Bagasse Fiber Variation 0%)							
Sample 1							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	22	21	20	22,00	1,03	22,66	13,20
		21	22	22		1,03		
		24	22	24		1,03		
Middle	0°	26	23	24	22,89	1,03	23,58	14,30
		21	22	21		1,03		
		22	26	21		1,03		
Upper	0°	24	20	20	20,67	1,03	21,29	11,80
		20	22	20		1,03		
		20	20	20		1,03		
Average σbm								13,10

Variation Content 0% Sample 2

Concrete Hammer Test (Bagasse Fiber Variation 0%)							
Sample 2							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	24	20	16	21,67	1,03	22,32	13,10
		16	20	17		1,03		
		24	26	22		1,03		
Middle	0°	22	24	27	23,89	1,03	24,61	15,20
		21	24	22		1,03		
		25	26	24		1,03		
Upper	0°	20	24	24	23,22	1,03	23,92	14,40
		26	22	22		1,03		

Variation Content 0% Sample 3

Concrete Hammer Test (Bagasse Fiber Variation 0%)							
Sample 3							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	20	18	18	20,44	1,03	21,06	11,20
		21	20	22		1,03		
		21	22	22		1,03		
Middle	0°	21	23	20	22,00	1,03	22,66	12,20
		23	26	23		1,03		
		18	22	22		1,03		
Upper	0°	22	18	18	19,56	1,03	20,14	10,10
		21	19	18		1,03		

Variation Content 0,25% Sample 1

Concrete Hammer Test (Bagasse Fiber Variation 0,25%)							
Sample 1							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	27	22	20	22,33	1,03	23,00	13,90
		24	19	19		1,03		
		22	30	18		1,03		
Middle	0°	26	22	24	22,78	1,03	23,46	14,20
		21	28	21		1,03		
		22	20	21		1,03		
Upper	0°	19	28	24	22,89	1,03	23,58	14,30
		20	18	26		1,03		

Variation Content 0,25% Sample 2

Concrete Hammer Test (Bagasse Fiber Variation 0,25%)							
Sample 2							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	24	20	16	21,67	1,03	22,32	13,10
		16	30	17		1,03		
		24	26	22		1,03		
Middle	0°	22	24	24	24,00	1,03	24,72	15,25
		21	24	24		1,03		
		25	26	26		1,03		
Upper	0°	20	24	24	23,22	1,03	23,92	14,30
		26	22	22		1,03		

Variation Content 0,25% Sample 3

Concrete Hammer Test (Bagasse Fiber Variation 0,25%)							
Sample 3							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	19	19	19	20,11	1,03	20,71	10,50
		25	23	20		1,03		
		19	19	18		1,03		
Middle	0°	19	23	22	21,56	1,03	22,20	13,05
		24	21	20		1,03		
		24	21	20		1,03		
Upper	0°	23	27	28	23,56	1,03	24,26	15,05
		22	21	23		1,03		

Variation Content 0,5% Sample 1

Concrete Hammer Test (Bagasse Fiber Variation 0,5%)							
Sample 1							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	26	25	20	21,67	1,03	22,32	13,92
		25	20	20		1,03		
		20	19	20		1,03		
Middle	0°	23	26	32	25,67	1,03	26,44	18,00
		25	28	26		1,03		
		22	29	20		1,03		
Upper	0°	24	26	24	26,56	1,03	27,35	19,60
		26	30	28		1,03		

Variation Content 0,5% Sample 2

Concrete Hammer Test (Bagasse Fiber Variation 0,5%)							
Sample 2							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	20	20	20	20,11	1,03	20,71	10,25
		24	20	20		1,03		
		18	19	20		1,03		
Middle	0°	22	20	24	22,00	1,03	22,66	13,20
		20	21	20		1,03		
		22	29	20		1,03		
Upper	0°	20	19	20	19,67	1,03	20,26	10,20
		20	20	19		1,03		

Variation Content 0,5% Sample 3

Concrete Hammer Test (Bagasse Fiber Variation 0,5%)							
Sample 3							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	18	20	20	19,78	1,03	20,37	10,22
		19	19	21		1,03		
		21	20	20		1,03		
Middle	0°	22	20	18	20,22	1,03	20,83	11,35
		21	20	18		1,03		
		21	20	22		1,03		
Upper	0°	18	20	23	22,33	1,03	23,00	13,90
		23	22	20		1,03		

Variation Content 1% Sample 1

Concrete Hammer Test (Bagasse Fiber Variation 1%)							
Sample 1							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	18	18	26	20,22	1,03	20,83	11,35
		25	20	18		1,03		
		18	19	20		1,03		
Middle	0°	26	20	18	20,22	1,03	20,83	11,35
		22	20	18		1,03		
		20	20	18		1,03		
Upper	0°	23	27	20	22,00	1,03	22,66	13,20
		20	25	20		1,03		

Variation Content 1% Sample 2

Concrete Hammer Test (Bagasse Fiber Variation 1%)							
Sample 2							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	18	21	22	21,22	1,03	21,86	12,10
		21	20	23		1,03		
		21	22	23		1,03		
Middle	0°	28	18	20	20,78	1,03	21,40	11,95
		22	20	20		1,03		
		19	22	18		1,03		
Upper	0°	20	22	20	20,56	1,03	21,17	11,75
		20	21	20		1,03		

Variation Content 1% Sample 3

Concrete Hammer Test (Bagasse Fiber Variation 1%)							
Sample 3							
Location Code	Firing Angle	Rebound Number			Rebound Average	Tool Correction Factor	Average After Calibration	Compressive Strength (σb) (N/mm²)
1	2	3			4	5	6	7
Under	0°	19	23	22	21,56	1,03	22,20	13.15
		24	21	20		1,03		
		24	21	20		1,03		
Middle	0°	19	19	19	20,11	1,03	20,71	10,50
		25	23	20		1,03		
		19	19	18		1,03		
Upper	0°	20	19	19	20,22	1,03	20,83	11,35
		18	20	22		1,03		

Result of Tensile Strength of Concrete

ASTM C496 Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens

Variation Content 0%

Tensile Strength of Concrete(Bagasse Fiber Variation 0%)			
Sample	Split Time Load(KN)	Tensile Strength (MPa)	Time (S)
1	115	1,63	30
2	75	1,06	31
3	130	1,84	34
Average		1,51	

Variation Content 0,25%

Tensile Strength of Concrete(Bagasse Fiber Variation 0,25%)			
Sample	Split Time Load(KN)	Tensile Strength (MPa)	Time (S)
1	150	2,12	60
2	135	1,91	30
3	100	1,41	59
Average		1,81	

Variation Content 0,5%

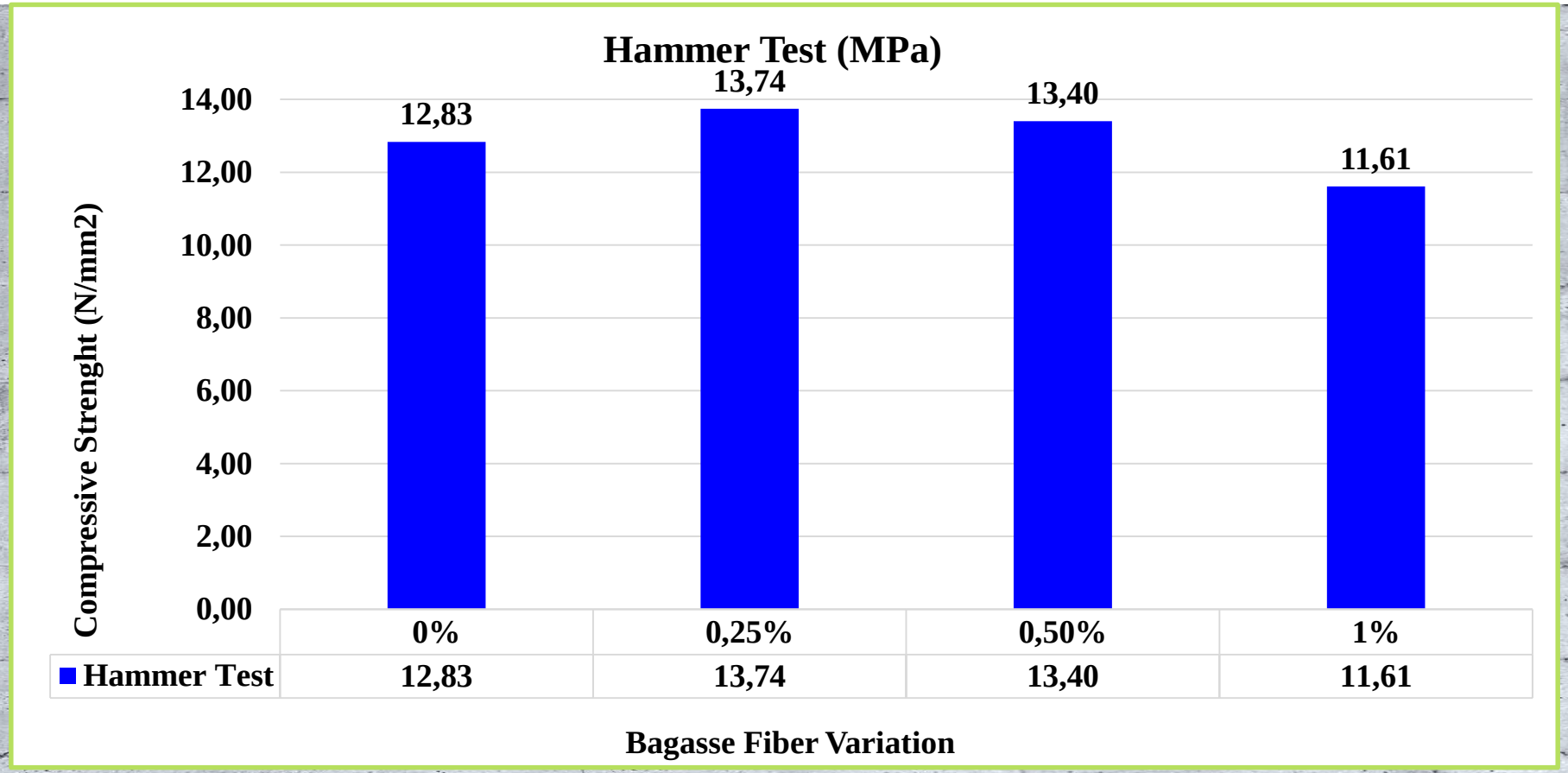
Tensile Strength of Concrete(Bagasse Fiber Variation 0,5%)			
Sample	Split Time Load(KN)	Tensile Strength (MPa)	Time (S)
1	125	1,77	62
2	130	1,84	72
3	110	1,56	84
Average		1,72	

Variation Content 1%

Tensile Strength of Concrete(Bagasse Fiber Variation 1%)			
Sample	Split Time Load(KN)	Tensile Strength (MPa)	Time (S)
1	95	1,34	67
2	120	1,70	64
3	115	1,63	54
Average		1,56	

Discussion on the Analysis of Concrete Compressive Strength Test Results and Concrete Tensile Strength

Discussion on the Analysis of Concrete Compressive Strength Test Results

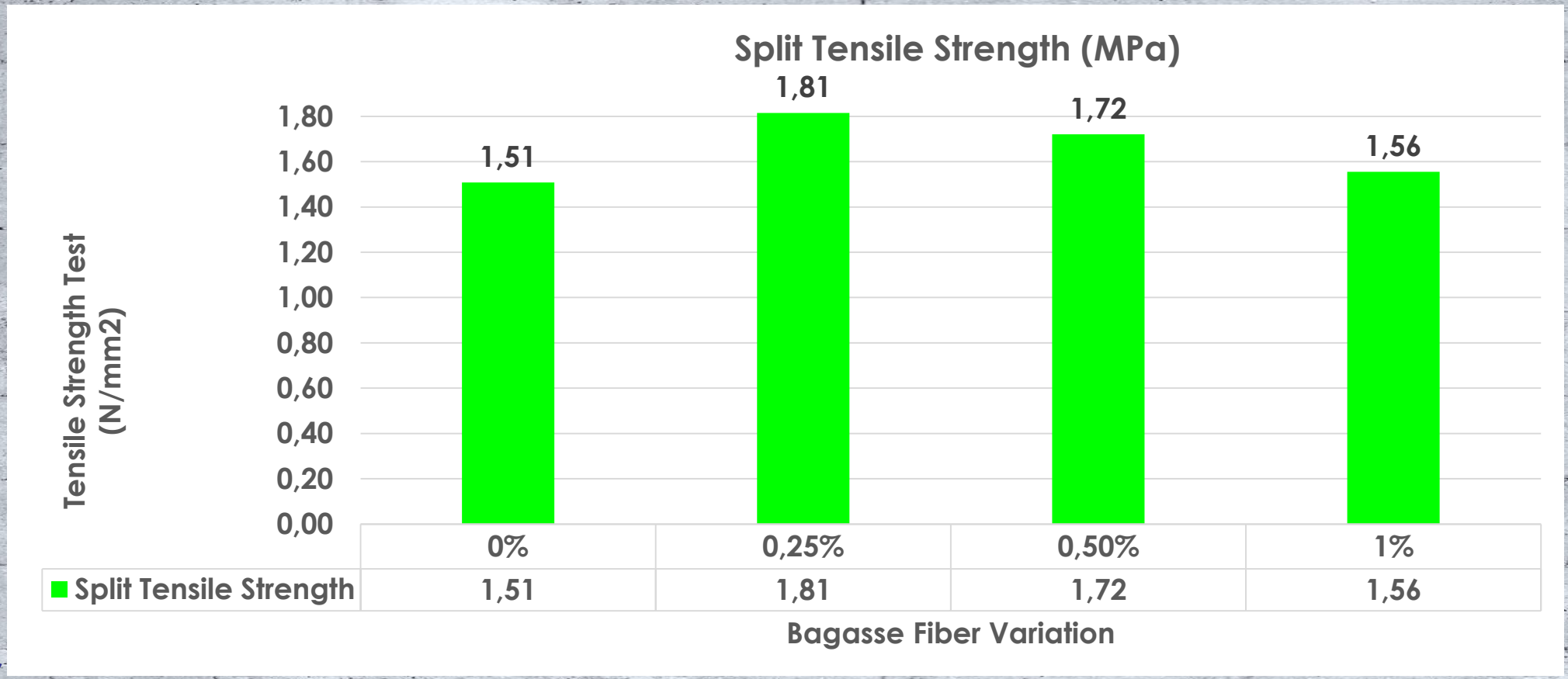


Discussion on the Analysis of Concrete Compressive Strength Test Results

In Figure above shows the compressive strength increase for bagasse fibre content 0.25% of 13.74 MPa. Instead the compressive strength decrease 13.40 ,11.61 and 12.83 MPa respectively when 0%, 0.5%, 1% baggase fibre. There is an increase of 7.09% of compressive strength for 0.25% bagasse fibre and a decrease 2.53% up to 15.41% for bagasse fibre more than 0.25%. This is because the bagasse fibre has a flat and slippery texture, causing weak adhesion to other materials and causes a decrease in the compressive strength of the concrete.

According to SNI 03-3449-2002 compressive strength of lightweight concrete is 6.89-17.24 MPa. Thus, results of lightweight concrete tested meet the standards required.

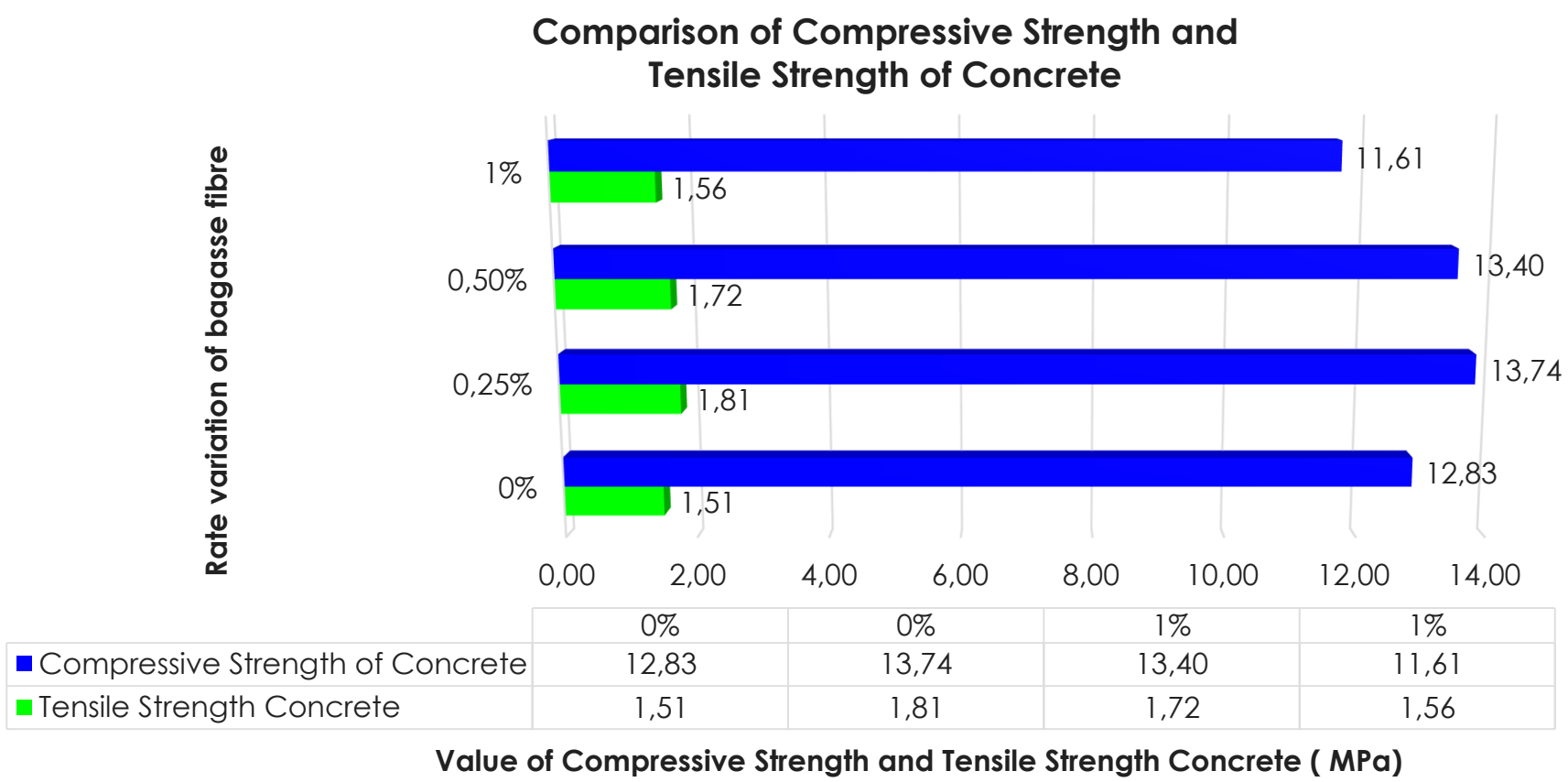
Discussion on Analysis of Concrete Tensile Strength Test Results



Discussion on Analysis of Concrete Tensile Strength Test Results

Figure above shows the results of the split tensile strength test of light concrete specimen with a diameter of 15 cm and a height of 30 cm at the age of 28 days. It can be seen that there is a significant increase in bagasse fibre content at 0.25% of 1.81 MPa. Instead there is a decrease of 1.51, 1.72 and 1.56 MPa when the bagasse fibre 0%; 0.5%; and 1% respectively. There is an increase 19.86% of tensile strength for 0% to 0.25% bagasse fibre and a decrease 5.2% up to 10.25% for bagasse fibre more than 0.25%.

Comparison of Analysis of Concrete Compressive Strength Test Results and Split Tensile



	0%	0%	1%	1%
Compressive Strength of Concrete	12,83	13,74	13,40	11,61
Tensile Strength Concrete	1,51	1,81	1,72	1,56

Comparison of Analysis of Concrete Compressive Strength Test Results and Split Tensile

Parameter	Baggase Fibre			
	0%	0.25%	0.5%	1%
Compressive Strength (MPa)	12.83	13.74	13.40	11.61
Split Tensile Strength (MPa)	1.51	1.81	1.72	1.56
Ratio %	11.75	13.21	12.84	13.40

Table above shows that the percentage ratio of the compressive strength value of concrete and split tensile strength meets the requirements in the ratio of compressive strength and split tensile strength of 10% - 15%.

Discussion on Analysis of Concrete Tensile Strength Test Results

Figure above shows the results of the split tensile strength test of light concrete specimen with a diameter of 15 cm and a height of 30 cm at the age of 28 days. It can be seen that there is a significant increase in bagasse fibre content at 0.25% of 1.81 MPa. Instead there is a decrease of 1.51, 1.72 and 1.56 MPa when the bagasse fibre 0%; 0.5%; and 1% respectively. There is an increase 19.86% of tensile strength for 0% to 0.25% bagasse fibre and a decrease 5.2% up to 10.25% for bagasse fibre more than 0.25%.

Conclusions and Recommendation

Conclusions and Recommendation

The highest compressive strength of concrete is baggase fibre 0.25% and decrease if moret than 0.25%. The highest compressive strength value of concrete at the age of 28 days occurs in the bagasse fibre content 0.25% of 13.74 MPa or increase 7.09%, while the highest split tensile strength in the bagasse fibre content 0.25% of 1.81 MPa or increase 19.86%. Thus, it can be concluded that bagasse fibres has a significant effect on lightweight concrete strength in about content bagasse fibre 0.25%.

The greater the fibre content used in the concrete mixture will stimulate balling effect which is coagulation of fibres in forms like a ball. There is an increase in the slump test as well for 40 mm, 50 mm, 50 mm, 55 mm with variations bagasse fibre of 0%; 0.25%; 0.5%; 1% respectively. It can be concluded that using bagasse fibre at certain percentage will increase workability of concrete mixture.

Thank You

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CERTIFICATE

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WITH PAPER'S TITLE

"The Effect of Bagasse Fiber Material with Pumice as A Partial Substitution of Coarse Aggregate to Increase Compressive Strength and Tensile Strength on Lightweight Concrete"

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AUTHOR

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