

EFFECT OF SODIUM SILICATE ON PROPERTIES OF BANANA FIBRE REINFORCED CONCRETE

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Abstract: - This study explains the strength behaviour of concrete with the addition of banana fibres and sodium silicate to improve the strength and practices of concrete. A constant percentage of banana fibre is added with varying proportion of sodium silicate to the concrete. Silica fume is also added to the concrete to balance the effect of sodium silicate in concrete. In this paper banana fibre having a length of 40mm with a constant proportion of 3% is used and three different proportions of sodium silicate 3%, 4% and 5% is added to the concrete. Ordinary Portland cement of grade 53 and M₂₅ grade concrete were used. This study explains the use of banana fibre and sodium silicate in concrete and its effect on workability of concrete, compressive strength, split tensile strength and flexural strength of concrete.

Keywords: Banana fibre, Sodium Silicate, Concrete, Silica fumes

1. INTRODUCTION

Strength and durability of concrete has a great role in determining the stability of structures. Several experiments and investigations are enhanced through modern technologies every day to increase the strength and durability of structures. Banana fibre and sodium silicate helps in improving the strength of concrete. Mechanical and ecological properties are good in banana fibre. It is also easily available and eco-friendly. Addition of banana fibre in concrete will increase strength and workability of concrete and also reduces the cracks into the structures. Sodium silicate is found as a crystalline solids or white powders. It is used as a setting accelerator and will enhance water proofing and durability of concrete will be improved. The addition of sodium silicate in concrete will decrease the compressive strength of concrete. In order to enhance the compressive strength silica fume is added.

2. OBJECTIVE

- To study the properties of concrete with the addition of banana fibre and sodium silicate.
- To evaluate the compressive strength and split tensile strength of concrete by using banana fibre in same proportion and sodium silicate in different proportions.
- To study strength of normal concrete with concrete mixed with banana fibre and sodium silicate.

3. EXPERIMENTAL INVESTIGATION

In this project, the following materials were used.

- Banana fibre
 - Sodium silicate
 - Silica fumes
 - Fine aggregate
 - Coarse aggregate
 - Cement
 - Water
- Banana fibre:** Banana fibres are obtained from the pseudo stem of banana plant after leaves and fruits were used. The fibre used in this investigation was collected online through Indiamart. These fibres are cut into uniform length of 40mm size.
 - Sodium silicate:** In this investigation we are using powdered form of sodium silicate. They are collected online through Indiamart. It reduces the porosity in concrete and makes concrete durable and water repellent.
 - Silica fumes:** Silica fumes are highly reactive pozzolan processed from natural white silica deposit. The fumes used in this project is obtained from a shop at, Edappally, Cochin.
 - Fine aggregate:** Cheaply available M- Sand is used in this experimental investigation. The physical properties are as follows:

Table 1 Properties of fine aggregate

Sl. No	Properties	Value
1	Specific gravity	2.75
2	Water absorption	2.2
3	Fineness modulus	3.34
4	Bulk density	Compacted-1.6 kg/l Loose-1.21 kg/l
5	% voids	41.81%

e) **Coarse aggregate:** Crushed or broken stones obtaining from stone quarries are used in this investigation. The physical properties are as follows:

Table 2 Properties of coarse aggregate

S1. No	Properties	Values
1	Specific gravity	2.69
2	% voids	44.98 %
3	Fineness modulus	8.26
4	Water absorption	0.6%
5	Bulk density	Compacted- 1.48 kg/l Loose- 1.4 kg/l

f) **Cement:** In this experimental investigation 53 Grade Ordinary Portland cement is used. The physical properties of cement tested in the lab is as follows:

Table 3 Physical properties of cement

S1. No	Properties	values
1	Standard consistency	0.33
2	Specific gravity	2.74
3	Initial setting time	55 min
4	Final setting time	600min

g) **Water:** Potable water from laboratory is used for mixing of concrete as well as for curing of concrete specimens.

4. MIX PROPORTIONS

Concrete mix design is developed for M₂₅ grade concrete. The procedure for the design of concrete mix is as per the guidelines given in Indian standard code for concrete mix proportioning.

5. RESULTS

a) Workability of Concrete

Table 4 Workability of concrete

Sl. No.	% of Banana Fibre	% of Sodium Silicate	Slump (mm)
1	0	0	25
2	3	3	30
3	3	4	34
4	3	5	41

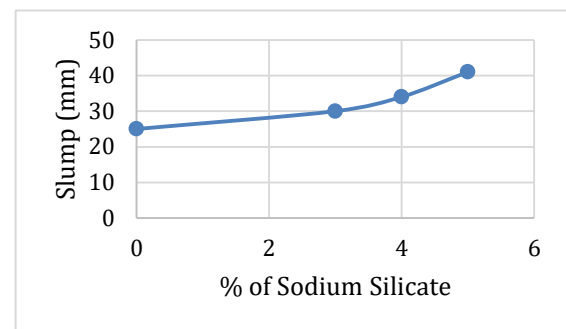


Fig 1 Workability of banana fibre reinforced concrete with various % of sodium silicate

b) Compressive Strength

Table 5 Compressive strength of concrete

Sl. No.	% of Banana Fibre	% of Sodium Silicate	Compressive Strength (N/mm ²)
1	0	0	30.22
2	3	3	20.44
3	3	4	27.56
4	3	5	35.11

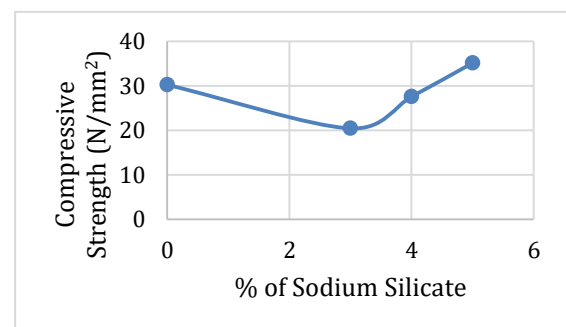


Fig 2 Compressive strength of banana fibre reinforced concrete with various % of sodium silicate

c) Flexural Strength

Table 6 Flexural strength of concrete

Sl. No.	% of Banana Fibre	% of Sodium Silicate	Flexural Strength (N/mm ²)
1	0	0	4.8
2	3	3	4.4
3	3	4	5.2
4	3	5	6

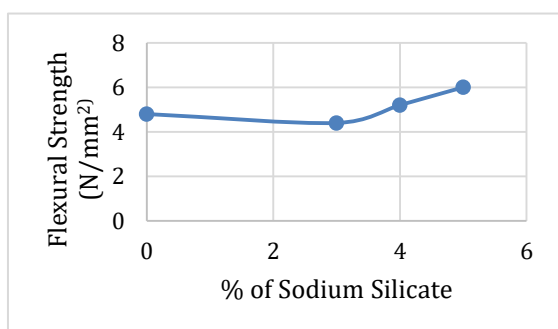


Fig 3 Flexural strength of banana fibre reinforced concrete with various % of sodium silicate

d) Splitting Tensile Strength

Table 7 Splitting tensile strength of concrete

Sl. No.	% of Banana Fibre	% of Sodium Silicate	Splitting Tensile Strength (N/mm ²)
1	0	0	3.96
2	3	3	4.24
3	3	4	4.52
4	3	5	5.09

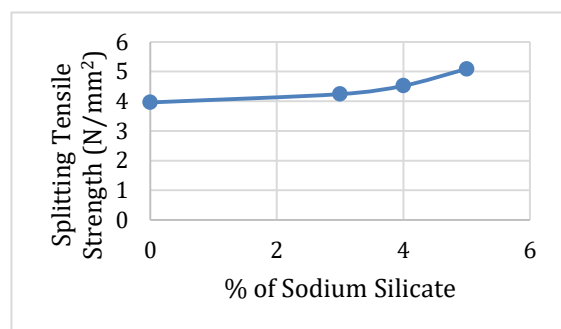


Fig 4 Splitting tensile strength of banana fibre reinforced concrete with various % of sodium silicate

6. CONCLUSIONS

After analysing the test results, addition of banana fibre and sodium silicate in concrete when compared with normal concrete gives:

1. Workability increases, as the percentage of sodium silicate increases.
2. The experimental tests revealed that the strength properties of concrete has improved with the addition of banana fibre and sodium silicate to the concrete than the normal concrete.
3. From this study we conclude that on the addition of banana fibre and sodium silicate for strengthening of concrete establish an increase in the workability of concrete, compressive strength, split tensile strength and flexural strength than the normal concrete. Also, the addition of banana fibres in concrete gives an environmental friendly solution to support sustainable construction.

REFERENCES

1. K. Chandramouli, N. Pannirselvam, (2019) Experimental investigation on banana fibre reinforced concrete with normal concrete, IJRTE, Volume 7, Issue 6.
2. J. Sivasubramanian, Y. Gino (2019) Effect of sodium silicate on hardening property of concrete, IJCIET, Volume 10, Issue 5.
3. Dr. K. ChandraMouli, V. Anitha and Sree Naga Chaitanya "Comparative Study of Banana Fibre Reinforced Concrete with Normal Concrete" SSRG International Journal of Civil Engineering (SSRG-IJCE) special issue ICITSET Sep 2018.
4. S. Kesavraman, "Studies on Metakaolin Based Banana Fibre reinforced Concrete" in International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 1, January 2017, pp. 532-543, Article ID: IJCIET_08_01_061.
5. Ifrah Habib Lone, Abdul Muneeb, Javid Ahmad, Syed Mohammad Jasim, Mintazir Ali, Mushtaq Ahmad Khan and Amir Hussain Malik "Experimental Study of Effect of Sodium Silicate (NA2SiO3) on Properties of Concrete" International Journal of Civil Engineering and Technology (IJCIET) Volume 6, Issue 12, Dec 2015