

Influence of Organic Additives on Mechanical Properties of Concrete

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Abstract:

Presence of voids in microstructure effects the strength of concrete and hence durability. The present work is an attempt to evaluate the effect of Trigonella foenum-graecum, an organic additive commonly called as fenugreek and Cyamopsis tetragonoloba commonly called as gaur gum as additives on mechanical properties of concrete. 0.2% of Trigonella foenum-graecum when used as additive to cement yielded promising results.

Keywords: Organic additives, microstructure, gaur, fenugreek.

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I. INTRODUCTION

Concrete is the most flexible material before setting which when hardens provides the necessary strength and help in creating civil wonders. To enhance the pre-set and post-set properties of concrete use of chemical admixtures has become unavoidable. However they also cause pollution. In this regard an attempt is made to evaluate organic admixtures to improve properties of concrete. M20, M25 and M30 grade concretes are designed and the organic materials namely Trigonella foenum-graecum and Cyamopsis tetragonoloba are used as additives to cement to evaluate the mechanical strength properties of different grades of concrete.

II. LITERATURE REVIEW

Prior et.al. [3] in their work have mentioned that admixtures are the surface-active agents which help in dispersion of cement particles and thereby creating greater mobility and avoid water to influence formation of flocculated system. Izaguirre et al [4]. presented the effect of work on potato starch as a modifier in lime-based mortars. Chandra.S.et.al [5] highlighted that use of cactus extract in Portland cement mortars increase resistance to freeze and thaw. Indrajith ray et.al.[6] showed that milk of rubber can be used in combination with superplasticizer or individually in Portland cement mortars. Chandra.S.et.al [7] reported use of black gram in mortar and concrete.

III. MATERIALS USED

53 grade cement procured locally is used in this experimental work. Fine aggregate conforming

to zone II of Indian standard [2] and 20mm down coarse aggregate from granite source is used.. Water, of potable quality conforming to standards is used. Organic materials namely Trigonella foenum-graecum is used in powder form and is a water soluble poly saccharides with sapogenins. Sapogenins is steroid linked to glycosides, usually through 3B Hydroxyl group which exhibits surfactant properties. Cyamopsis tetragonoloba is a ploy saccharide, that is high on galactose and mannose and has ability to hydrate rapidly in cold water to attain uniform and very high viscosity at relatively low concentration and is a effective thickener and stabilizer.

IV. METHODOLOGY

Concrete mix design for M20, M25 and M30 grade concretes is done in confirmation with IS 10262-2009 [1] with a w/c ratio of 0.5. Experimental work includes evaluating strength properties of concrete namely, compressive and tensile. 150mm size cubes and cylinders of 150mm X 300mm were cast and cured for 28 days to determine the mechanical strength properties. Trigonella foenum-graecum and Cyamopsis tetragonoloba are added at 0.1%, 0.2 and 0.3% as additive to cement separately for all the three grades of concrete. 18 cubes and 9 cylinders are cast for each combination and are tested for 28-day strength.

V. RESULT AND DISCUSSION

The 28 days compressive strength of the concrete with different percentages of additive for all the grades of concrete are as depicted in Table1 and Table2 . Tensile strength of all grades with and

without admixtures is as shown in Table 3 and Table 4. Figures 1,2 and 3 represent compressive strength of M20, M25 and M30 concrete with organic additives respectively and Figure s4,5 and 6 represent Tensile strength of M20, M25 and M30 grade concretes respectively.

Table 1. Compressive strength with *Trigonella foenum-graecum* as additive

| % Additive | Compressive Strength (Mpa) | | |
|------------|----------------------------|-------|-------|
| | M20 | M25 | M30 |
| 0.0 | 29.8 | 38.82 | 41.32 |
| 0.1 | 31.5 | 40.64 | 44.6 |
| 0.2 | 33.1 | 42.1 | 45.3 |
| 0.3 | 27.5 | 39.6 | 41.2 |

Table 2. Compressive strength with *Cyamopsis tetragonoloba* as additive

| % Additive | Compressive Strength (Mpa) | | |
|------------|----------------------------|-------|-------|
| | M20 | M25 | M30 |
| 0.0 | 29.8 | 38.82 | 41.32 |
| 0.1 | 23.06 | 29.1 | 32.4 |
| 0.2 | 22.09 | 27.8 | 31.08 |
| 0.3 | 20.9 | 26.3 | 29.43 |

Table 3. Tensile strength with *Trigonella foenum-graecum* as additive

| % Additive | Tensile Strength (Mpa) | | |
|------------|------------------------|------|------|
| | M20 | M25 | M30 |
| 0.0 | 2.19 | 2.4 | 2.9 |
| 0.1 | 3.03 | 3.2 | 3.3 |
| 0.2 | 3.45 | 3.67 | 3.78 |
| 0.3 | 3.4 | 3.45 | 3.5 |

Table 4. Tensile strength with *Cyamopsis tetragonoloba* as additive

| % Additive | Tensile Strength (Mpa) | | |
|------------|------------------------|------|------|
| | M20 | M25 | M30 |
| 0.0 | 2.19 | 2.4 | 2.9 |
| 0.1 | 2.18 | 2.38 | 2.8 |
| 0.2 | 2.1 | 2.41 | 2.6 |
| 0.3 | 1.9 | 2.3 | 2.36 |

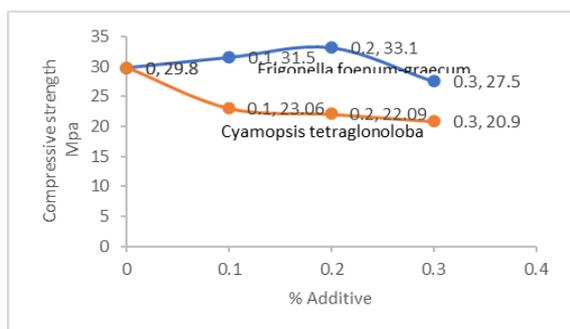


Figure 1. Compressive strength of M20 Concrete

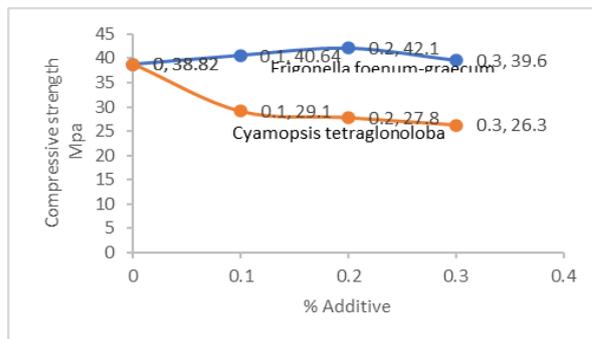


Figure 2. Compressive strength of M25 concrete

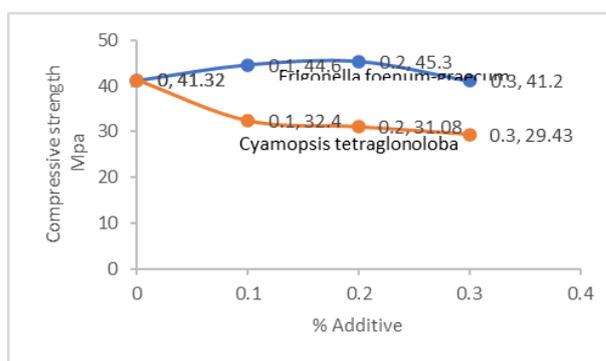


Figure 3. Compressive strength of M30 concrete

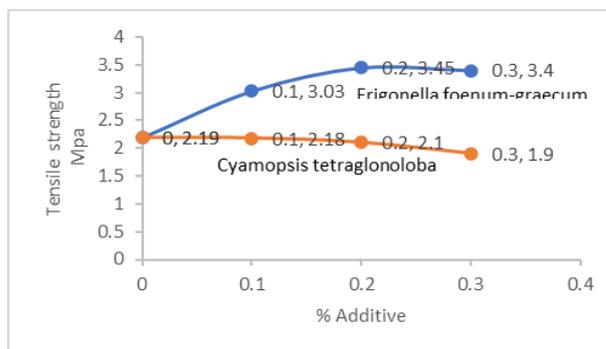


Figure 4. Tensile strength of M20 concrete

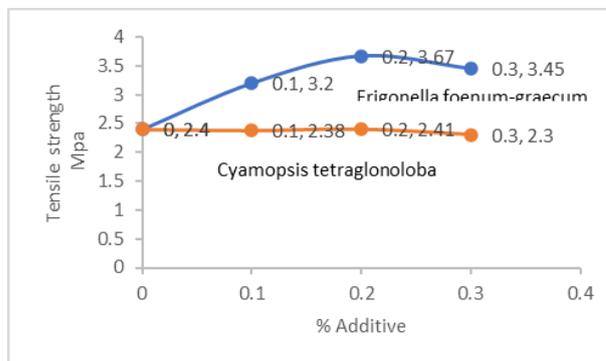


Figure 5. Tensile strength of M25 concrete

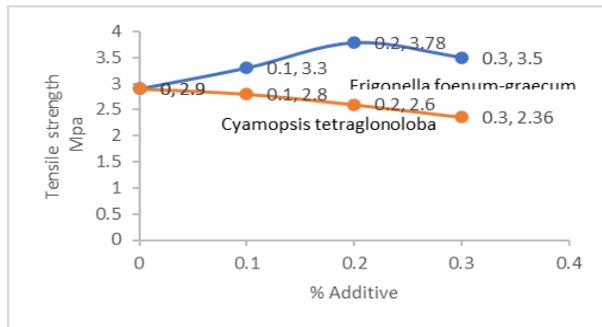


Figure 6. Tensile strength of M30 concrete

VI. CONCLUSION

1. The experimental results showed that the organic additive T Trigonella foenum-graecum powder has contributed to increase in both compressive and tensile strength for all the grades of concrete.
2. 0.2% of Trigonella foenum-graecum powder when used as additive contributed to an increase in compressive strength by around 9% when compared to that of controlled group for all grades of concrete
3. Marginal increase in tensile strength of concrete in all grades of concrete is observed on addition of 0.2% of Trigonella foenum-graecum.
4. Use of Cyamopsis tetragonoloba as additive has not contributed to either compressive strength or tensile strength, this may be attributed to the fact that the additive has absorbed most of the water effecting hydration process.

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