AN EXPERIMENTAL OBSERVE ON COMPARISON OF KIND AND DOSAGE OF TREMENDOUS PLASTICIZERS ON EXCESSIVE ENERGY CONCRETE

D.VNV LAXMI ALEKHYA1, S.NARESH2, T.VIKAS KUMAR REDDY3.
Assistant Professor's, Dept. of Civil Eng., Anurag Engineering, Kodad, Telangana State, INDIA,508206

Abstract: - In this paper we have a tendency to area unit presents that Portland cement is that the most vital ingredient in creating concrete. Production of one ton of cement emits regarding one ton of greenhouse gas. So as to deal with the environmental effects related to Portland cement, there's got to develop various binders to create concrete. This paper describes the present level of information worldwide regarding the problems of incompatibility between cements and water reducing chemical admixtures. The definition, classification, and chemical compositions of water reducing chemicals area unit mentioned initial, followed by their mechanism of action in concrete. Take a look at strategies to judge effectiveness of plasticizers also is reviewed. Specific problems with incompatibility area unit then self-addressed, namely, loss of workability, alteration of setting behavior, reduced rates of strength gain, and alter in long run behavior. The factors dominant the compatibility area unit mentioned next intimately, as well as the role of the chemistry (of cement and admixture), the presence of different mineral and chemical admixtures, and therefore the proportioning of concrete. Finally, a close insight into the requirements for more analysis is provided. During this analysis the influence of proportion of super plasticizers on the strength of high strength concrete activated by exploitation enough proportion area unit studied. Tests were disbursed on one hundred fifty millimeter × one hundred fifty millimeter × one hundred fifty millimeter and 150mm diameter 300mm length cylindrical specimens. The tests are disclosed that because the correct proportion of super softener will increase the compressive strength and split tube strength.

Keywords: Super plasticizer, Setting time, compressive strength and tensile strength behavior.

1. INTRODUCTION:-

Concrete is taken into account as sturdy and robust material. Concrete is one in every of the foremost well-liked materials used for construction round the world. Concrete is exposed to deterioration in some regions particularly in coastal regions. So researchers round the world area unit leading their efforts towards developing a replacement material to beat this downside Invention of huge construction plants and instrumentation round the world additional to the hyperbolic use of fabric this state of affairs ends up in the utilization of additive materials to boost the standard of concrete.

1. 1. Historical Background: -

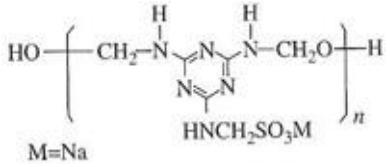
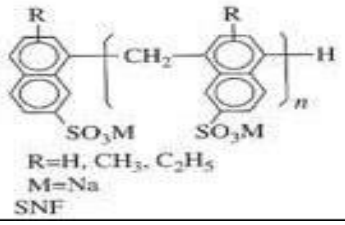
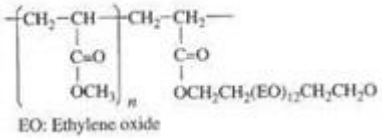
Although high strength concrete is usually thought of comparatively new materials, its development has been gradual over a few years. In USA, within the Nineteen Fifties concrete with a compressive strength of 34mpa was thought of high strength, within the 1960's, concrete with forty one to 52mpa compressive strength was used commercially. Within the early 1970', 62mpa concrete was being made. Within the world situation, however, within the last fifteen years, concrete of terribly high strength entered the sector of construction, particularly constraint of high-rise buildings and long span bridges. In step with code IS 456-2000 compressive strength over 110mpa has been thought of for the applications in cast-in-place buildings and pre-stressed concrete members. However recently reactive concrete could be a one that having nearly compressive strength of 250mpa. It's fully supported pozzolanic materials

2. WRITING SURVEY:-

2.1 Water Decreasing Chemicals: - A water decreasing substance, as the name suggests, is utilized to diminish the water substance of a solid blend while keeping up a steady workability. The resultant impact of the lessened water content is the expanded quality and sturdiness of cement. In any case, water reducers may likewise be utilized to 'plasticize' the solid, i.e. make concrete flowable. For this situation, the water substance (or water to bond proportion) is held steady, and the expansions of the admixtures improve the solid stream, while the compressive quality (which is a component of the water to concrete proportion), and aren't influenced. Another utilization of water reducers is to bring down the measure of bond (since water is proportionately decreased) without influencing both quality and workability. This makes the solid less expensive and earth cordial, as less concrete is expended. Water reducers are characterized extensively into two classes: (1) Typical and (2) High range. The ordinary water reducers are additionally called 'plasticizers', while the high range water reducers are called 'super plasticizers'. While the typical

water reducers can decrease the water request by 5 – 10%, the high range water reducers can cause a diminishment of 15 – 40%. Water decreasing chemicals are by and large provided as fluid definitions, with the dynamic solids content in the scope of 30 – 40%. Ordinary water reducers are ordinarily utilized at doses of 0.3 – 0.5% fluid by weight of concrete. At higher doses, there is a peril of inordinate hindrance, dying, and air entrainment. High range water reducers don't have these issues and are fit for being utilized at higher doses of 0.7 – (at least 1%) fluid by weight of concrete. Lignosulphonate salts of sodium and calcium, hydroxycarboxylic acids (citrus and glycolic corrosive) and sugars (corn syrup and dextrin) are cases of typical water reducers. The subjects of enthusiasm for this examination, to be specific superplasticizers are for the most part chemicals of the sort exhibited in Table 1. All the super plasticizers are water dissolvable polymers. With respect to different polymers, the conduct of super plasticizers is additionally a component of the structure and the level of polymerization.

Table-1: Super Plasticizing Chemicals

CLASS	ORIGIN	STRUCTURE (TYPICAL REPEAT UNIT)	RELATIVE COST
(Sulphonated melamine formaldehyde SMF)	Manufactured by normal resinification of melamine – formaldehyde		4
Sulphonated naphthalene formaldehyde (SNF)	Produced from naphthalene by oleum or SO3 sulphonation; subsequent reaction with formaldehyde leads to polymerization and the sulphonic acid is neutralized with sodium hydroxide or lime		2
Polycarboxylic ether (PCE)	Free radical mechanism using peroxide initiators is used for polymerization process in these systems		4

Lignosulphonates are for the most part viewed as 'first era' super plasticizers, while the sulphonated formaldehyde condensates are called 'second era', and the polycarboxylates and polyacrylates are named as third era super plasticizers. Presently, the most broadly utilized super plasticizers are the sulphonated formaldehyde condensates. In any case, the valuable impacts of polycarboxylates are guaranteeing a progressive move towards these chemicals.

As far as expenses, polycarboxylic ether and sulphonated melamine formaldehyde are relatively equivalent (gone up against a compelling solids premise), sulphonated naphthalene formaldehyde is about a large portion of the cost of the PCE, while lignosulphonate is the least expensive (about ¼ of PCE). In any case, as far as adequacy to accomplish a particular workability of the solid, the measure of PCE required is significantly lesser than SNF or lignosulphonate. In this way, the general cost of ordinary plasticized cement would not be influenced in view of the decision of the substance (except for SMF, which are more costly thinking about the coveted workability of concrete).

3. TEST ON MATERIALS:-

3.1. Cement: - Cement is a coupling material, which is the mix of two crude materials called calcareous and argillaceous materials. Zuari-53 review conventional Portland bond adjusting to IS: 12269 were utilized as a part of concrete. The physical properties of the cement as shown in below table 2

Table-2: Physical Properties of the Cement

S.NO.	PROPERTIES	TEST RESULTS	IS: 12269-1987
1.	Normal consistency	0.32	
2.	Initial setting time	60min	Minimum of 30min
3.	Final setting time	320min	Maximum of 600min
4.	Specific gravity	3.14	
5.	Compressive strength (a) 3days strength (b) 7days strength (c) 28days strength	 29.4Mpa 44.8Mpa 56.53Mpa	 Minimum of 27Mpa Minimum of 40Mpa Minimum of 53Mpa

3.2. Aggregates:-

A crushed granite rock with a maximum size of 20mm was used as a coarse aggregate. Natural sand from Swarnamukhi River in Srikalahasti was used as fine aggregate. The individual aggregates were blended to get the desired combined grading. The specific gravity and water absorption of the aggregate are given in table. The individual grading of aggregates is given in table-3 and table-4

Table-3: Properties of Aggregates

Specific Gravity of coarse aggregate	2.80
Specific Gravity of fine aggregate	2.70

Table – 4: Grading of Fine and Course Aggregate

Sieve size(mm)	20mm	Natural Sand
40	100.00	100.00
20	90.20	100.00
10	7.60	100.00
4.75	1.20	99.50
2.36	___	97.00
1.18	___	81.50
0.6	___	59.00
0.3	___	4.05
0.15	___	2.00
0.075	___	1.07

3.3. Water:-

Convenient water was utilized as a part of the test work for both getting ready and curing. The pH estimation of water taken isn't under 6

3.4. Admixtures:-

In the least complex case, Portland bond concrete is a four-part blend of water, Portland bond, fine total and coarse total. Extra parts, for example, synthetic admixtures (air entraining operators, super plasticizers) and mineral admixtures (coal fly fiery debris, silica smolder, impact heater slag), might be added to the essential blend to upgrade certain properties of the new or solidified cement. Elite solid blends, which might be required to meet a few execution criteria (e.g., compressive quality, Elastic modulus, fast chloride penetrability) all the while, regularly contain no less than six parts. In this manner, improving blend extents for superior cement can be a troublesome and tedious errand.

3.4.1 What Are Admixtures:-

Admixtures are characteristic or made chemicals which are added to the solid previously or amid blending. The regularly utilized admixtures are Fly cinder, silica Fume, Air entraining operators, water reducers, water lessening retarders and quickening agents.

3.4.2. Why We Use Admixtures:-

Admixtures are utilized to give extraordinary properties to crisp or solidified cement. Admixtures may improve the solidness, workability or quality attributes of a given solid blend. Admixtures are utilized to conquer troublesome development circumstances, for example, sweltering or cool climate positions, pumping necessities, early quality prerequisites, or low water bond proportion determinations. Utilizations are

- Increase in workability
- Increase in quality
- Increase in cohesiveness and homogeneity
- Increase or decline of setting time
- Increase in property of protection of erosion
- Increase in water sealing property
- Increase in durability
- Increase in soundness

3.4.3. Kinds of Admixtures:-

- Chemical admixtures
- Mineral admixtures
- Compound admixtures

The compound admixture which we utilized as a part of this present venture is polycarboxylic ether.

3.4.4. Strategy for Use:-

Poly Carboxylic ether is specifically included into the water that is utilized for the blending of cement. Lessens water measurements for required consistency

3.4.5. Properties:-

- Supply forms : Liquid.
- Color : Brown
- Particular gravity : 1.02
- Chloride contents : Nil.

3.4.6. Recommended Dosage:-1.8% of concrete ought to be utilized for the powerful workability. In those above concoction admixtures super plasticizers are utilized as a part of this venture in various extents.

3.4.7. Super plasticizers:-

Super plasticizers are outstanding synthetic admixtures for concrete utilized as a part of the decrease of water to bond proportion without influencing workability, and to keep away from molecule collection in the solid blend. These are otherwise called high range water reducers (HRWR), fluidifiers, and dispersants as these are equipped for lessening water to bond proportion by 40.0%. These substance admixtures are included the solid just before the solid is set. These admixtures help to enhance quality and stream attributes of the solid. Super plasticizers are basic sulfonic mixes connected to the polymer spine at standard interims. These can be included at a scope of 0.15% to 3.0% of the heaviness of bond that is higher when contrasted with plasticizers. Stream qualities and droop of cement changes with sort, measurement, and time of expansion of cement super plasticizer.

Super plasticizers can be grouped into four sorts, for example, Sulfonated melamine-formaldehyde condensates (SMF), Sulfonated naphthalene-formaldehyde condensates (SNF), Modified lignosulfonates (MLS), and Polycarboxylate subsidiaries (PC). The determination of cement super plasticizer depends on the kind of cement utilized, in particular prepared blend, precast, high quality, elite, self compacting, and so forth. The SMF, SNF, and MLS are exceptionally old however as yet the very devoured in the present solid applications are. The main downside with these solid super plasticizer is high droop misfortune and not ideal in cool climate conditions that can be overwhelmed with polycarboxylates. Polycarboxylates, with predominant execution attributes, are the new age super plasticizers, fit for water decrease of up to 40.0%, and are additionally best in sweltering climate conditions.

Figure-1: Different Types of Admixtures

The interest for these admixtures is impacted by the developing consciousness of the capacity to lessen water to concrete proportion, where an alternate measurement reflects diverse execution. With the developing interest for development industry the market for concrete super plasticizer is likewise anticipated that would develop later on. Super plasticizers are application particular and are accessible comprehensively. There are distinctive evaluations of super plasticizers accessible in the market among the previously mentioned four writes. These super plasticizers can be powder and fluid construct contingent on the end-client's advantage. For the most part, fluid structures are utilized as it is hard to blend the powder in the solid.

As of now, super plasticizers are mostly gathered in Asia-Pacific, Middle East and Africa (ME&A), trailed by Europe and North America. The Asia-Pacific and ME&A markets are relied upon to develop at a higher rate later on. This report gauges the market size of the solid super plasticizer advertise as far as utilization and esteem, both provincially and in end-client markets. The report gives an extensive audit of the significant market drivers, difficulties, and key issues in the market. This market is additionally divided and anticipated for real areas, for example, Asia-Pacific, Europe, North America, and ROW. Top players of the business are profiled in detail with their current advancements and other vital industry exercises. The division by sort of super plasticizer as far as utilization and incentive for every area is likewise talked about in this report.

3.4.8. By Type:-

- SNF (SULPHONATED NAPTHALENE-FORMALDEHYDE CONSATES)
- SMF (SULPHONATED MALANIE –FORMALDIHYDE)
- PC (POLY-CARBOXYLATE)
- Others

3.4.9. By Application:-

- Ready-mix concrete
- Precast concrete
- High-Performance concrete
- Short create
- Fly Ash concrete
- Others

3.4.10. By Form:-

- Powder
- Liquid

4. MIX DESIGN (AS PER IS 10262-2009):-

4.1. Mix Design for M45:-

4.1.1. Stipulations for Proportioning:-

- Grade designation = M45
- Type of cement = OPC 53 grade
- Mineral admixture = No
- Maximum nominal size aggregate = 20 mm
- Maximum water content = 0.34
- Workability = 100mm (slump)
- Exposure condition = Severe (reinforced concrete)
- Degree of supervision= Good
- Type of aggregate =Crushed angular aggregate
- Chemical admixture = SMF, SNF, PCE

Step-1: Target mean strength (ft= f ck + 1.65 s)

Where

- ft = Target average compressive strength at 28 days,
- f ck= Characteristic compressive strength at 28 days,
- s= Standard deviation
- From IS code, standard deviation, s = 5 N/mm2
- Therefore target strength = 45 + 1.65 x 5 = 53.25 N/mm2

Step-2: Selection of Water Cement Ratio

- From IS: 456-2000, maximum water cement ratio = 0.45, Based on experience adopt water cement ratio as 0.34. 0.34 < 0.45, hence ok

Step-3: Selection of Water Content

- From IS code, maximum water content = 186 liters , (For 25mm – 50mm slump range and for 20 mm aggregates)
- Estimated water content for 100 mm slump = 186 x 9/100 +186 = 203 liters
- As super plasticizer is used, the water content can be reduced up to 26 percent Hence the water content arrived = 203 x 0.76 =152.32 liters

Step-4: Calculation of Cement Content

- Water cement ratio = 0.34
- Cement content = 152/0.34 = 448 kg/m3
- From IS: 456, minimum cement content for severe exposure condition = 320 kg/m3. 448 kg/m3 > 320 kg/m3, Hence OK
- For proportioning fly ash concrete, the suggested steps are
- Water content = 152.32 kg/m3
- Water cement ratio = 152/448 = 0.34

Step-5: Proportion of Volume of Course Aggregate and Fine Aggregate Content

- From IS code, volume of coarse aggregate corresponding to 20 mm size aggregate and fine aggregate (Zone I) for water-cement ratio of 0.50 =0.60
- In the present case w/c= 0.340. The volume of coarse aggregate is required to be increased to decrease the fine aggregate content.
- As w/c ratio is lower by 0.10, increase the coarse aggregate volume by 0.02 (at the rate of -/+ 0.01 for every +/- 0.05 change in water cement ratio). Therefore, corrected volume of coarse aggregate for w/c of 0.340 =0.62.
- Volume of coarse aggregate = 0.62 x 0.9= 0.56
- Volume of fine aggregate content= 1- 0.56 = 0.44

Step-6: Mix Calculations

- The mix calculations per unit volume of concrete shall be as follows
- Volume of concrete = 1 m3
- Volume of cement = [448/3.15] x [1/1000] = 0.142 m3 Volume of water = [140/1] x [1/1000] = 0.152 m3
- Volume of all in aggregates (e) = a – (b + c)
  = 1 – (0.142+ 0.152)
  = 0.706 m3
- Volume of coarse aggregates= e x Volume of CA x specific gravity of CA
  = 0.706 x 0.56 x 2.8 x 1000 = 1107 kg
- Volume of fine aggregates= e x Volume of FA x specific gravity of FA
  = 0.706 x 0.44 x 2.81 x 1000 = 872 kg

Step-7: Mix Proportions

- Cement = 448 kg/m3
- Water = 152 kg/m3
- Fine aggregate = 872 kg/m3
- Coarse aggregates = 1107 kg/m3
- Water cement ratio = 0.34

Aggregates are assumed to be in SSD. Otherwise corrections are to be applied while calculating the water content. Necessary corrections are also required to be made in mass of aggregates.

5. EXPERIMENTAL PROGRAM:-

The materials used in the present research are:

- Three types of super plasticizers SNF, PC, SMF - obtained from AKARSH industries, CHENNAI.
- Cement –OPC 53 Grade (DECCAN)
- Sand- local river sand

5.1. Storage of Materials:-

The materials were procured from respective places as mentioned above. Further the task ahead was the storage of these materials. The materials had to be stored in dry place, which is free from moisture, as these materials have tendency to deteriorate and lose their properties. Therefore extra care should be taken in this regard. The materials were stored in the laboratory. Hence, sufficient care was needed to keep these materials intact without any wastage at the same time attaining the optimum usage of the materials.

5.2. Mixing, Casting and Curing:-

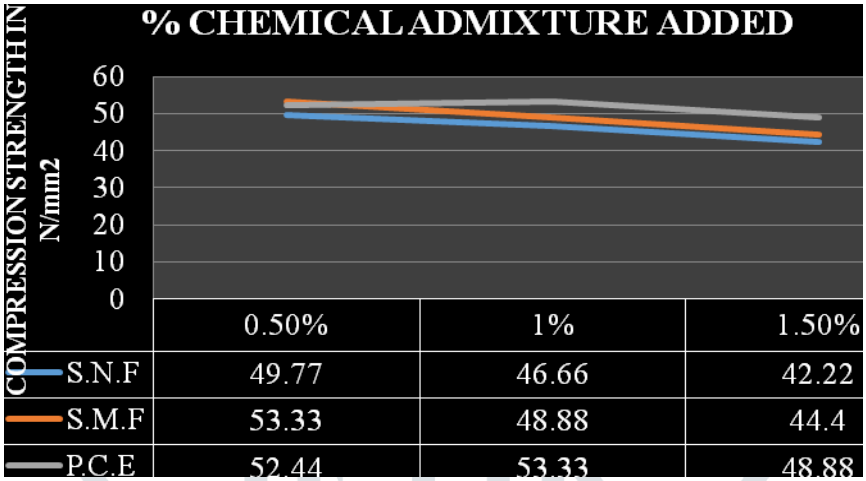
The required quantities are weighed for a given proportion and are mixed in a mixer. All the dry materials are mixed for about 3 minutes in a mixer and the wet mixing after adding the superplastizer in three different proportions(1%,1.5%,2%) continued for another 4 minutes. The cubes and cylinders are casted in 150 × 150 mm cubes and 150mm diameter 300m length sizes respectively. An example of calculating the required quantities of different materials for a considered proportion is given below:

- Dimension of the cube= 150mm= 150×10-3m.
- Volume of the cube= (150×10-3)3=3.372 ×10 -3m3
- Let, density of mortar=24KN/m3= 24×1000⁄9.81= 2242.61kg/m3
- We know that, mass =density × volume

6. RESULTS & DISCUSSION:-

6.1. Compressive Strength Behavior of Concrete:-

- The percentage decrease in compressive strength is more in 1% volume replacement of cement with S.N.F and S.M.F. The average percentage decrease in compressive strength of concrete with S.N.F and S.M.F is 8.65% and average percentage increase in compressive strength of concrete by adding P.C.E is 1.69%

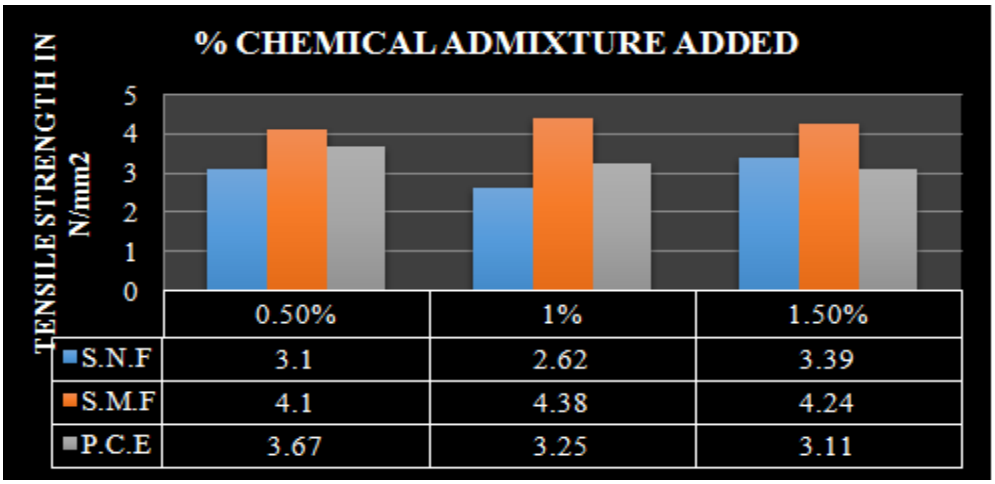


	0.50%	1%	1.50%
S.N.F	49.77	46.66	42.22
S.M.F	53.33	48.88	44.4
P.C.E	52.44	53.33	48.88

Figure-2:- Compressive strength variation of concrete M45 grade with chemical admixtures and varying % of particles after 28days

6.2. Split Tensile Behavior of Concrete:-

- The 28-day split tensile strength of both normal concrete without and with super plasticizer of High Strength Concrete was evaluated. The split tensile strength of concrete is observed to be higher when P.C.E is added. The reasons for increment in split tensile strength are same as that of compressive strength as explained above.
- From the below figures, it can be observed the as the percentage of chemical admixture added increase tensile strength increase upto 1% for S.N.F and S.M.F. As percentage admixture increase beyond that resulted in reduction of tensile strength of concrete. Hence when load applied on the specimen crack starts on the specimen slowly and extends.
- The tensile strength of concrete with P.C.E decreased with an increase in percentage of chemical admixture at 0.5% and beyond 0.5% the tensile strength decreases. But these results when compared without chemical admixture and its strength increased. But when compared with reduction in compressive strength, tensile strength reduction is moderate.
- The percentage decrease in tensile strength is more in 0.5% volume replacement of cement with and without chemical admixture of SMF and SNF increases. The average percentage decrease in tensile strength of concrete with SMF and SNF is 18.65% and average percentage decrease in tensile strength of concrete with increase in P.C.E is 7.5%



	0.50%	1%	1.50%
S.N.F	3.1	2.62	3.39
S.M.F	4.1	4.38	4.24
P.C.E	3.67	3.25	3.11

Figure-3:- Tensile strength variation of concrete M45 grade with chemical admixtures and varying % of particles after 28days

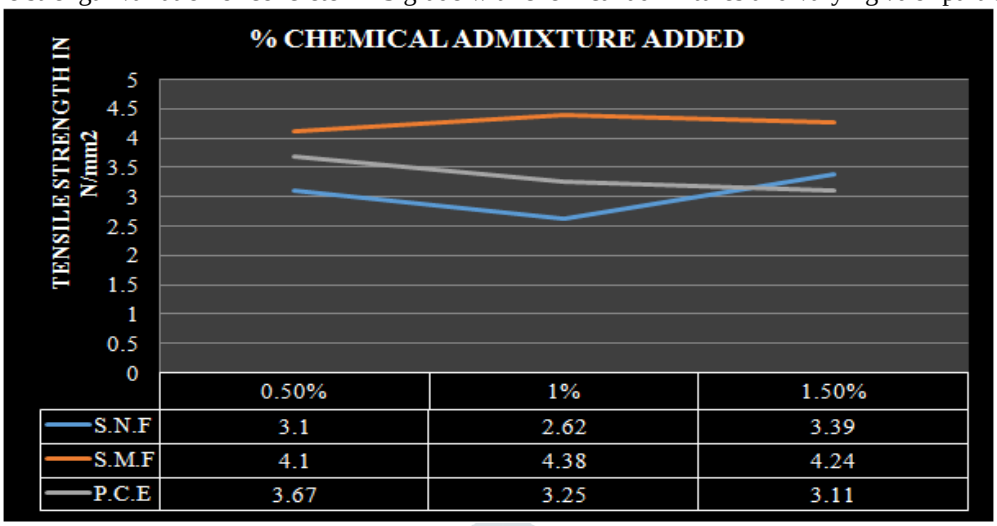


Figure-4:- Tensile strength variation of concrete M45 grade with chemical admixtures and varying % of particles after 28days

7. CONCLUSION:-

- The principal objective of the study is to High strength concrete by adding super-plasticizers in different volume proportions (0.5%,1%,1.5%) is to increase the strength of concrete.
- Compared the behaviour of M45 grade concrete (1:1.812:2.5:0.37) by adding additional % of super plasticizers.
- The mechanical properties such as compressive strength and tensile strength found. The percentage decrease in compressive strength is more in 1% volume replacement of cement with S.N.F and S.M.F.
- The average percentage decrease in compressive strength of concrete with S.N.F and S.M.F is 8.65% and average percentage increase in compressive strength of concrete by adding P.C.E is 1.69%.
- The percentage decrease in tensile strength is more in 0.5% volume replacement of cement with and without chemical admixture of SMF and SNF increases.
- The average percentage decrease in tensile strength of concrete with SMF and SNF is 18.65% and average percentage decrease in tensile strength of concrete with increase in P.C.E is 7.5%.

8. REFERENCES:-

[1]. Mehta, P. K. (1983). Mechanisms of Sulphate Attack on Portland cement Concrete- Another Look. Cement and Concrete Research, 13(3), 401-406.

[2]. Joseph Davidovits (1987), "Ancient and modern concretes: What is the real difference?" Concrete International, pp.23-28.

[3]. Davidovits, J. (1994b). Properties of Geopolymer Cements. In Kiev (Ed.), First International Conference on Alkaline Cements and Concretes (pp. 131-149).Kiev, Ukraine: KievStateTechnicalUniversity.

[4]. Davidovits, J. (1988b). Geopolymer Chemistry and Properties. Paper presented at the Geopolymer '88, First European Conference on Soft Mineralogy,Compiegne, France.

[5]. Davidovits, J. (2005). Green-Chemistry and Sustainable Development Granted and False Ideas About Geopolymer-Concrete. Paper presented at the InternationalWorkshop on Geopolymers and Geopolymer Concrete (GGC), Perth, Australia.

[6]. Rangan, B. V., Hardjito, D., Wallah, S. E., &Sumajouw, D. M. J. (2005a). Fly ashbasedgeopolymer concrete: a construction material for sustainabledevelopment. Concrete in Australia, 31, 25-30.

[7]. Xu, H., &Deventer, J. S. J. V. (2000). The geopolymerisation of alumino-meta silicate minerals. International Journal of Mineral Processing, 59(3), 247-266.

[8]. Davidovits, J. (1999, 30 June - 2 July 1999). Chemistry of GeopolymericSystems, Terminology. Paper presented at the Geopolymere '99 International Conference, Saint-Quentin, France.

[9]. Davidovits, J. (1988c). Geopolymers of the First Generation: SILIFACE-Process. Paper presented at the Geopolymer '88, First European Conference on Soft Mineralogy, Compiegne, France.

[10]. Davidovits, J. (1988d). Geopolymeric Reactions in Archaeological Cements and inModern Blended Cements. Paper presented at the Geopolymer '88, First European Conference on Soft Mineralogy, Compiegne, France.