Use of Melamine Formaldehyde Resin as a Water Reducing Admixture in Concrete

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Abstract— Workability expressed by slump test plays major role in heavy structures with minimum spacing of reinforcement to settle the concrete easily. Melamine Formaldehyde Resin is valueless local material can be used to improve the workability of concrete without affecting the designed strength. Melamine Formaldehyde Resin is allocate to concrete by weight of cement at dosage of 0.5%, 1%, 1.5%, 2%, 2.5%. Experimental works put forward a satisfactory research by increasing the workability of concrete. Furthermore at the rate up to 1.5% dosage compressive strength of concrete is not affected while at the dosage of 2 and 2.5% there is a small rise of compressive strength.

Keywords: Concrete, admixture, workability, compressive strength

I. INTRODUCTION

Workability of concrete is an effort to operate freshly mix concrete with a small losses of homogeneity. The depletion of water in concrete is broadly used by super plasticizer and are of high price which is considered as the disadvantage in engineering term. From the economical point of view materials like the same of super plasticizers can be used in normal concrete. Melamine Formaldehyde Resin, as a local material of low cost can be used in conventional concrete for lessening the water and lacking the affecting on the strength of concrete. Melamine formaldehyde resin is good at locally available for home made things such as bonded wood products, paper products, paints, finishes and also for increasing the workability of concrete. MF resin is thermosetting resin which changes shape under heating from fusible and soluble material. The physio -chemical properties of hardened concrete is investigated [1]. Super plasticizer, Sulfonated Melamine formaldehyde (SMF), Sulfonated naphthalene formaldehyde (SNF), Polycarboxylic ether used at different dosage for getting ultimatum strength under different curing regimes [2]. The experimental test for fresh and hardened properties for M35 grade are studied and contrasted with normal concrete. Sulfonated Melamine Formaldehyde (SMF), super plasticizer enhance the workability and little bit strength [3]. Glycosylated melamine resins were produced by using mole ratios of melamine. In their detailed studies fluidity of material, gum material behavior of solutions was evicted by increasing the mole ratio of glyoxal to melamine [4]. More than Twenty super plasticizer were made accordance to step by step. It was seen that reaction condition have an important impact on properties of SP and contact b/w them to concrete. The 4th step gives good performance as compared to 3rd step by 30 to 40 %, but have no effect on workability [5].Two series of mix consisted with eight sample of two grades C25 & C30 were prepared for this research, it was been found that physical properties of different mix with maximum dosage of SP enhance workability and compressive strength [6]. Sulfonated glyoxy melamine based resin was prepared adopting different mole ratio of melamine and glyoxal, fluidiy and softly behavior of resin solutions were evaluated with increase of sulfonation and mole ratio of glyoxal to melamine [7]. Concrete mixes with SP and retarder admixture of different dosage with water cement ratio 0.50 are used over dosage reduce the compressive strength while the optimum dosage improve the properties and characteristics of concrete [8].Different molar ratios of melamine and formaldehyde were involved for corresponding resin, molecular weight of resin is increased by increasing melamine monomer concentration [9]. Three kinds of SP, Conplast (561, 430, 264) at 3 different mix by percentage 0, 10, 20, 30 with M30 grade having/c equals to 0.3, all mix were satisfactory but the SP Conplast 430 has good workability and compressive strength [10]. This work is focused on SP having different water/binder ratios of 0.4 and 0.5 and three dosage of SP with flyash, different tests were evaluated to determine the workability of concrete such as V funnel, L box test, and slump flow based upon these results there is some linear relationship between workability and compressive strength [11].

From the upper discussion it has been noted that in this era of research of civil technology the self-compacting concrete has great significance in heavy reinforcement structure. In order to avoid the ill effect of this properties the local material likewise super plasticizers can be induced in the research of civil engineering technology. Hence this research works aims at to introduce the local material melamine formaldehyde Resin as an admixture for self-compacting concrete.

II. MATERIALS AND METHODS

A. Materials Used in Concrete Mix:

1) Cement:
Locally available Ordinary Portland cement was used sealed of 50 kg in the present study. A cement is binder when cement is mixed with aggregates produces mortar for masonry, or with sand, produces a solid form or concrete.

2) Fine Aggregate:
Fine aggregate was obtained from local dealer at jamshoro and is sieved by passing from 4.75mm sieve with fineness modulus 2.5 is used for experimental work.

3) Coarse Aggregate:
The aggregates with irregular shape such as flaky, angular which passed from 20mm sieve are used in research work for adequate strength.

4) MF Resin:
Melamine formaldehyde resin (MF Resin) as shown in Figure: 1 obtained from dynea industry (hub chownki) Karachi as a local material used for chip boards, wood products, paints. Hence it can be used to improve workability of fresh concrete.

Fig. 1: Melamine Formaldehyde Resin

B. Mix Proportion:

While designing the mix several trials were done to assess the desired strength and workability. A control mix was finally confirmed with w/c equals to 0.53. MF Resin was added at dosage incremental variation of 0.5% by weight of cement to improve the fresh and hardened properties of concrete. The table 1 shows the mix design.

Batch	OPC kg/m^3	F.A kg/m^3	C.A kg/m^3	Water lit/m^3	Admixture lit/kg
1	365	725	1095	193.45	0
1	365	725	1095	193.45	1.825
2	365	725	1095	193.45	3.65
3	365	725	1095	193.45	5.475
4	365	725	1095	193.45	7.3
5	365	725	1095	193.45	9.125

Table 1: Mix Proportion

C. Workability Test:

Slump test was conducted by a hollow frustum like a cone shape to determine the workability of concrete of all mixes. The achieved result are shown in table 2.

Batch No	Description	(Slump mm)
1	Conventional Concrete	52
2	MF Resin 0.5 %	69
3	MF Resin 1 %	95
4	MF Resin 1.5 %	114
5	MF Resin 2 %	127
6	MF Resin 2.5 %	140

Table 2: Slump Cone Test

D. Casting and Curing of specimens:

Six mixes were adopted out of them 3 cubes of size (100x100x100) mm were made of each mix. Pouring and compaction was done accordance with ASTM code as shown in Fig: 2. After 24 hours cubes are withdrawn from molds and left for some time in open air.

Fig. 2: Casted Concrete Cubes

The casted specimen on other day are cured 28 days under drinking water as shown in Figure 3.

Fig. 3: curing of specimen

E. Strength Test:

After the completion of curing days of cubes were dried at room temperature for 24 hours. Strength of these cubes was determined by the UTM (Universal Testing Machine). The UTM was setup at rate of load 500 N/sec. The load was applied until the failure as shown in fig: 4.The compressive strength values were recorded at the time of failure and is listed in table 3

Fig. 4**:** Test Setup of compressive strength of concrete

Batch No	Description	Compressive strength (N/mm^2)
1	Conventional Concrete	28.32

2	MF Resin 0.5 %	28.46
3	MF Resin 1 %	28.76
4	MF Resin 1.5 %	28.89
5	MF Resin 2 %	29.5
6	MF Resin 2.5 %	30.7

Table 3: Compressive strength of Concrete

III. RESULTS AND DISCUSSIONS

A. Workability Tests of MF Resin Concrete.

Workability is one of the important property of fresh concrete and plays vital role in self-compacting concrete. Different admixtures or super plasticizer are used to enhance this property of concrete. Test was conducted on mix proportion by varying the dosage of melamine formaldehyde resin 0.5%, 1%, 1.5%, 2%, 2.5% by weight of cement with proper control and workmanship. Test values were recorded by slump cone test method. The following trend line gives suitable rise. The test results values are shown in Fig: 5 and above table 2.

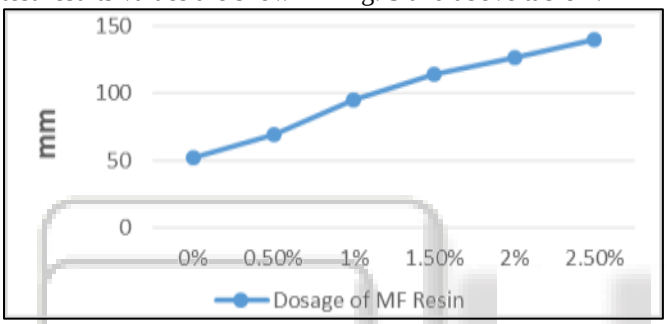

Fig. 5: Showing Increasing Workability

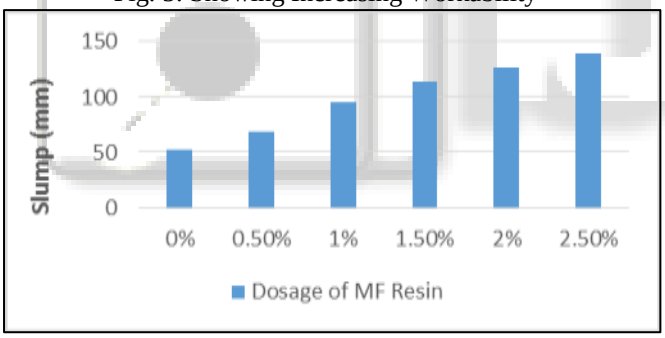

Fig. 6: Workability of Fresh Concrete

B. Compressive Strength of MF Resin Concrete.

Concrete is known by its compressive strength and it is highly important property of hardened concrete. It cannot be ignored in mega construction projects. In this research compressive strength tests was evaluated in accordance with ASTM code under using 500 N load per second by UTM (Universal Testing Machine) in concrete laboratory of Department Civil Engineering MUET Jamshoro. A set of three Specimen after 1 day left out from curing tank are set at machine with the rate of load of 500N/sec and gradually increased until the failure occur. The recorded values are shown below and above table 3.

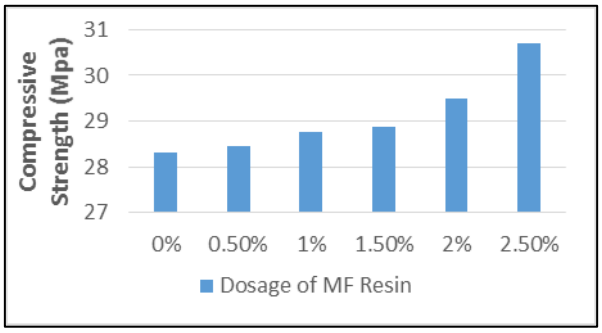

Fig. 7: Compressive Strength of Concrete

IV. CONCLUSIONS

[1] An increase the dosage of MF resins enhances the workability values.
[2] Compressive strength of concrete up to the dosage of 1.5% of MF resin is not affected.
[3] While at upper dosage the strength values are little bit increased.
[4] Hence it can be used as worldwide material for increasing the workability in the mega construction projects.
[5] It is locally available material at the reasonable rate.

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