# PROPERTIES OF CONCRETE WITH SULFONIC ACID POLYMER CONTAINING METHACRYLIC ACID

Faculty of Engineering, Hiroshima university,Member. Yonekura Asuo.
Chemical Research Laboratory,Lion Corporation. Masatoshi Takahashi.
Graduate student,Hiroshima University,Member. ○ Benedict Mtasiwa.
Technical Department,Osaka prefectural government, Kamei Toshiaki

1. ABSTRACT: Influence of cement type and curing method on properties of concrete using a newly developed superplasticizer which possesses superior flow characteristics and high consistency maintaining capacities were investigated. In this study, properties of fresh concrete at stiff consistency and strength development were investigated.
The new superplasticizer exhibited superior compressive strength in the steam cured specimens for high early strength and normal portland cements. For standard cured specimens, compressive strength using high early strength cement was similar for all types of superplasticizers used, while in the case of normal portland cement, concrete with the newly developed superplasticizer had the compressive strength slightly higher than that of concrete with reference superplasticizers.

2. EXPERIMENTS:

In this study, bleeding, setting time and compressive strength were investigated. Specimens for compressive strength were devided into those for standard curing and steam curing.

2.1 MATERIALS

(1) Superplasticizers

The newly developed superplasticizer C was used while as reference superplasticizers, a acryl-based superplasticizer designated by D and a naphthalene based superplasticizer designated by F were used. Dosages are presented as dissolved part per weight of cement. Table 1, shows types of superplasticizers used.

Table 1. Types of superplasticizers used.

| Designation | Classification of superplasticizer | Component |
|---|---|---|
| C | Sulfonic acid polymer | Methacrylic acid |
| D | Acryl-based | |
| F | Naphthalene-based. | |

(2) Cements

Types of cements used were, normal portland cement and high early strength cements of specific gravities of 3.13 and 3.16 respectively.

(3) Aggregates.

Type of fine aggregate used was crushed sand with specific gravity of 2.54, 1.9% absorbed water , and fineness modulus of 2.51. Coarse aggregate was quartzite trychyte crushed rock of 20mm maximum size and specific gravity 2.67, 0.31% absorbed water and fineness modulus of 6.55.

Table 2. Mixture proportions. (mix 1-HPC, mix 2-NPC).

| SP | Cement | Dosage of SP | W/C (%) | s/a (%) | W(kg/m$^3$) | C(kg/m$^3$) | S (kg/m$^3$) | G (kg/m$^3$) |
|---|---|---|---|---|---|---|---|---|
| C | HPC | 0.30 | 37 | 42 | 158 | 427 | 737 | 1086 |
| D | HPC | 0.70 | 37 | 42 | 158 | 427 | 737 | 1086 |
| F | HPC | 0.75 | 37 | 42 | 158 | 427 | 737 | 1086 |
| C | NPC | 0.28 | 44.1 | 45 | 161 | 356 | 810 | 1056 |
| D | NPC | 0.56 | 44.1 | 45 | 161 | 356 | 810 | 1056 |
| F | NPC | 0.40 | 44.1 | 45 | 161 | 356 | 810 | 1056 |

2.2 TESTS FOR CONCRETE PROPERTIES:

Dosage of superplasticizers was chosen for consistency of 11.5 to 15 cm slump. Specimens for bleeding and setting test were prepared, while for strength development were devided into steam cured and standard cured ones which were tested after 24 hours and 14 days respectively.

3. TEST RESULTS AND DISCUSSION.

3.1 Bleeding

Table 2. shows the mix proportions used in this test. It can be seen from figure 1 that, for mix (1), a superplasticizer of naphthalene type(F) showed higher bleeding while a methacryl type (D) and a new superplasticizer's bleeding were similar. For mixture (2),where high early strength cement was used, no bleeding was observed.

3.2 Setting time.

From figure 2 and 3 it can be seen that, a reference superplasticizer (F) was fastest, followed by an acryl type(D) and a new superplasticizer(C). These results are in agreement with the bleeding test results, where bleeding of concrete with the reference type (F) superplasticizer seized earlier. In mixture (2) it can be seen that , concrete with the naphthalene- type of superplasticizer had the shortest setting time of all.

3.3 Compressive strength.

From figures 4 and 5, it can be seen that, although no significant differences were observed for compressive strength of concrete using different types of superplasticizers, the compressive strength of steam cured concrete using the new superplasticizer was slightly superior to those with reference superplasticizers.

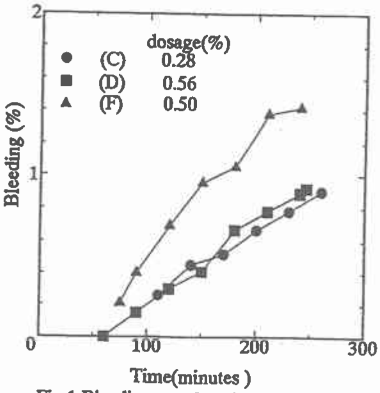

Fig 1.Bleeding as a function of type of SP

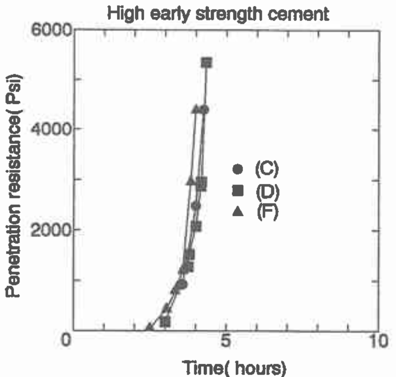

Fig 2.Setting as a function of type of superplasticizer

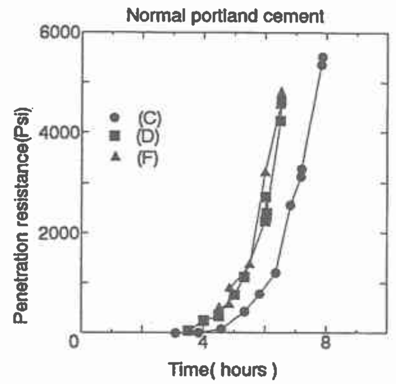

Fig 3.Setting as a function of type of superplasticizer

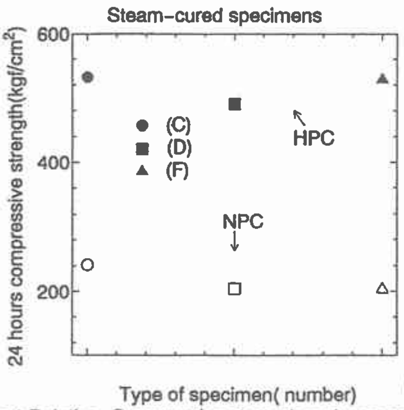

Fig 4.Relation-Compressive strength and cement type

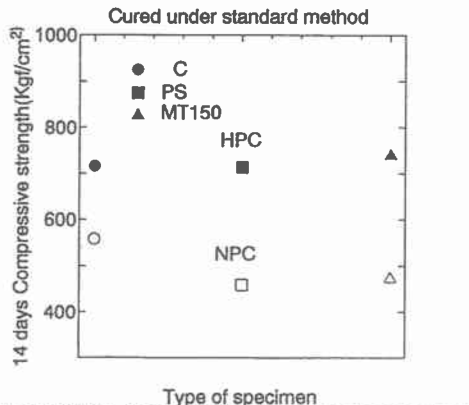

Fig 5.Relation- Compressive strength and cement type

4. CONCLUSION

Compressive strength of concrete with the new superplasticizer is slightly higher than that of others when steam cured for mixes with normal portland cement and high early strength cement while when standard cured,, concrete with the new superplasticizer has compressive strength superior to others when NPC is used while when HPC is used they perform similarly. These results show that it can be effectively used for pre-cast concrete.