

Superplasticizing Additive Material on Concrete Performance and Effect on Concrete Performance in the Self-Locating Concrete Production: Literature Review

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Abstract

This survey presents a literature review on the superplasticizing additive material on concrete performance and effect on concrete performance in the self-locating concrete production with given a literature review and survey. That done through spotlight on the concrete and its properties, as well as, clarify the effect of chemical additives on fresh and hardened of the concrete. Explain the importance of superplasticizing additive material, and clarify the effect of adding material on concrete performance. The study concluded that substantial improvement in the concrete properties after use of the superplasticizer with high range water reducer, superplasticizer has given results that are more promising.

Keywords: Concrete; Superplasticizing; performance; properties; and effect.

1. Introduction

To non-specialists, the production of quality concrete seems a relatively simple task [1]. Concrete additions and building chemicals have become basic science in the field of construction engineering. The civilization of the nations is measured by the use of these modern materials. These materials increase the functional life of the concrete structures, thus positively affecting their national economy [2, 3].

Concrete additions have many uses, whether they are used in mixing processes on the site or in prefabricated concrete or pre-stressed concrete factories and the development of the use of additives as well. They have entered the building materials industry such as brick and cement factories to reduce waste or to produce production with high-pressure resistance. In addition, do not forget to note that these additions double-edged sword must be applied according to the instructions of the manufacturer attached to the technical bulletin.

Chemical additives or superplasticizer is substances other than sand, cement and water. Added to the concrete mixture during the mixing process in very small quantities for giving fresh or hardened concrete [4]. Certain properties required such as improving the operability of the concrete without increasing mixing water, accelerating or delaying the doubt, improving the ability to pump concrete, increasing the early resistance of concrete, as well as to obtain concrete that is not waterproof or concrete with special characteristics. It is recommended to use these additives in hot areas such as Libya where mixing water is lost faster than in temperate areas to maintain concrete operation for longer periods and to help with good finishing of building elements. to producing of durable and sustainable concrete by providing workability enhancement at low water to cement ratios, which given advantages to superplasticizers to be an essential component in modern concretes [5].

1.1 Aims and Importance

The aim of the research is to investigate spot the light on the concrete and its addition, as well as, clarify the effect of chemical additives on fresh and hardened of the concrete. Moreover, the importance of research can be listed as following:

- Spotlight on the concrete and its properties
- Spotlight on additional material
- Explain the importance of superplasticizing additive material
- Clarify the effect of adding material on concrete performance.

2. Concrete

Concrete is generally defined as a mixture of specific and measured proportions of gravel, sand, water, cement and some other additives (solid or chemical). Water and cement form the so-called cement paste that binds the grit to each other, as well as filling the remaining spaces between the beads [6-8]. The most important factors affecting the quality and quality of concrete:

- Type of cement used and calibrated.
- Quantity of water or W/C ratio.
- Properties of the used gravel materials and their metallurgical structure.
- The technology of the concrete industry includes mixing, mixing and processing during and after casting.

As commercial, residential and industrial of the development of infrastructures the concrete performance plays a vital role [1].The concrete industry needs high accuracy in manufacturing because its resistance is heavily influenced by the techniques used. Mechanical resistance can reach the pressure of some Portland cement mixtures to more than one follow, as well as special techniques, while this resistance does not exceed the same mixtures when neglecting certain factors affecting the Concrete resistance. In addition, Figure 1 shows the correlation between strength and w/c, where knowing the effects of the w/c ratio on the capillary porosity of concrete does not come as a surprise, the w/c ratio has also a great influence on concrete's the strength [9].

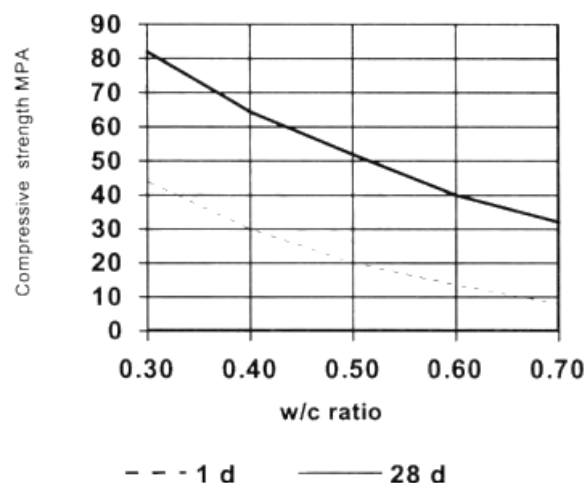


Figure 1 The relationship between strength and w/c [9].

Figure 2 shows the factors that affect the quality of concrete, where the concrete quality or durability is not only a function of its compressive strength but as much one of its porosity (impermeability) [9].

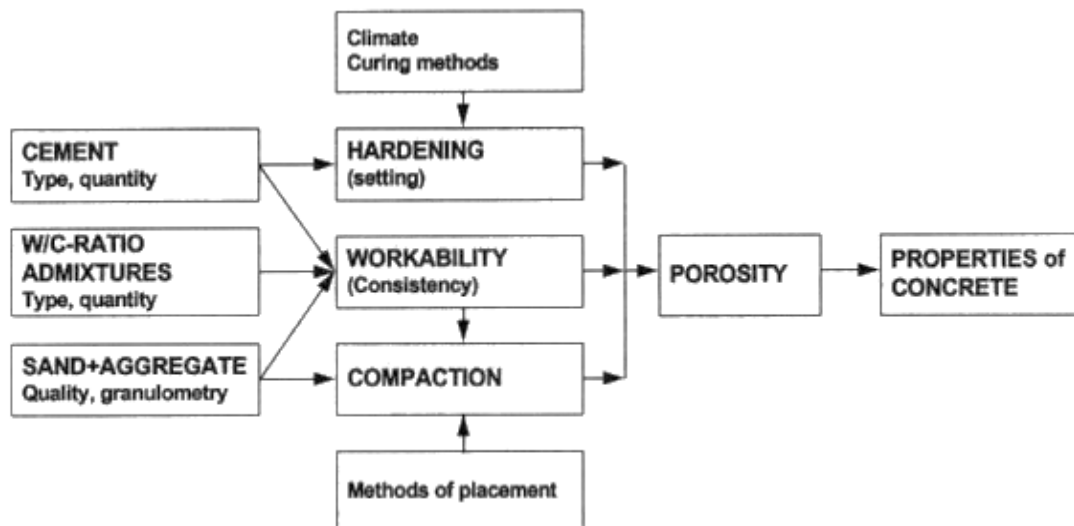


Figure 2 Factors affecting the quality of concrete [9].

3. Additives Material

Additives materials can be defined as materials or structures of several materials added to concrete during mixing to improve the properties or features of concrete mixtures. In addition, to provide new features suitable for the purposes and requirements, whether processed by the central mixing stations. Additives, prefabricated concrete plants, or in situ mixing and the development of the use of additives, which are used in the manufacture of bricks and tiles to reduce the loss or to obtain high-quality qualities. Concrete additives are those that are other than the components of the cement mixture consisting of water and cement, the material is added to the mixing water before or after mixing to give it the properties required in the working conditions. However, there are materials added after a period of time, whether concrete cracks or other Of concrete problems, so that all concrete additives are classified according to US standards.

In fact, these additions are harmful, so they should not be used except in the necessary cases and according to the manufacturer's instructions and the lowest quantities. Moreover, an attempt to rely on improving the properties of the concrete by altering its main components. The process of concrete treatment is to maintain a percentage of the mixing water added to the concrete when mixed for a period of time called the treatment period until the process of cementing the cement and maintaining the temperature of the concrete at a certain degree above the degree of hardening. The surface of the concrete may be treated with a layer of sand, wet clay, balustrade, plaster, or surface coating of concrete exposed to the atmosphere. The coating is dry and has an impermeable layer of water (often-plastic) concrete surface. Modern methods of conserving water from evaporation are to cover the surface with a layer of paraffin, bitumen or non-waterproof paper.

3.1 Importance

- Accelerate the time of doubt for greater resistance.
- For boot ability.
- In the case of hot weather, the additives are useful to slow the doubt.
- To resist corrosion and endurance.
- To improve cohesion between old and new concrete.
- Production of light concrete.
- Increases concrete stability.
- Reduce permeability.
- Obtain a waterproof, chemical-resistant or friction resistant concrete.

4. Superplasticizer

The superplasticizer are shared a common principle, which is improvement in fresh state properties is achieved by preventing the flocculation of cement particles, although there is different action mechanisms [10]. That features bridging effects in between cement particles and water. In addition,

flocculation causes water entrapment between cement particles and is caused by Van der Waals and electrostatic interactions between different cement particles and cement particles and water [11, 12]. Polycarboxylic-based and lignosulfate-based are the most popular superplasticizer that currently in use. Where the recycled aggregates concrete (RAC) have been tested the concerns mechanical properties both of them [13-16].

The electrostatic repulsion is the Lignosulfate superplasticizer mechanism, where through the repulsive effects caused by the negative charge of the SP particles, the particles are adsorbed to the surface of the cement particles and the Van der Waals and electrostatic interactions of the latter are neutralized [11, 12, 17]. The flocculation prevents by that repelling effect and provides pathways for mixing water. The melamine and naphthalene-based are the other sulfonated superplasticizer, which is share the same mechanism of lignosulfate superplasticizer [11]. In the 1990's has been developed the Polycarboxylic-based superplasticizer as a recent generation of superplasticizer, where their main mechanism is steric hindrance. As comb, with a main chain and long-range graft chains the superplasticizer molecular structure of these resembles [18].

5. Literature survey

After read, some articles a literature survey has been prepared in the superplasticizing additive material on concrete performance and effect on concrete performance in the self-locating concrete production, and after reading reference, we obtained some important points are as follows:

(L. Coppola, S. Lorenzi & others, 2017) studied the Performance and Compatibility of Phosphonate-Based Superplasticizers for Concrete. Where, to evaluate the workability retention performances of the innovative superplasticizer, the specimens of concrete were produced by considering a constant initial workability, equal to 220 mm slump at the end of the mixing procedure. Workability was measured at 0, 30, and 60 min. the research results showed better performance by the PNH-based admixture in terms of water reduction and workability retention [19]. According to (Wolfram Schmidt & H.J.H. Brouwers, 2014), the influences of superplasticizer modification and mixture composition on the performance of self-compacting concrete at varied ambient temperatures has been examined. The results showed that the at low temperatures, the self-compacting concrete is rich in powder components showed robust performance, while at high temperatures the self-compacting concrete with low powder content was favorable [14].

According to (C. D. Johnston, 1993), what is optimal from the point of view of slump retention may not be optimal in terms of air retention. The performance of the admixture system as a whole must be considered when using superplasticizers in air-entrained concrete that is much more important for long-term durability than slump retention. On other hand, Concrete Admixtures Handbook shows that the admixtures belonging to this class are variously known as superplasticizers," "superfluidizers," "superfluidifiers," "super water reducers," or "high range water reducers." These superfluidizers have advantages such as production of concrete having high workability for easy placement, as well as production of high strength concrete with normal workability but with a lower water content [20]. (Saeed Ahmad, 2005) study the effect of superplasticizers on workability and strength of concrete. The study results showed that substantial improvement in the concrete properties after use of the superplasticizers with high range water reducer, superplasticizer has given more promising results as compared with other types [21].

6. Conclusions

A literature review support and helps to visualize the concrete and its main behavior. Moreover, analyze the influence of the superplasticizing additive material on concrete performance and effect on concrete performance in the self-locating concrete production. Which is improvement in fresh state properties is achieved by preventing the flocculation of cement particles, although there is different action mechanisms. The study concluded that substantial improvement in the concrete properties after use of the superplasticizer with high range water reducer, superplasticizer has given more promising results as compared with other types.

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