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Review and Experimental Investigation of Retarder for Cement

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ABSTRACT

Retarding additives do not reduce water absorption or interfere with all hydration processes, so they have a limited impact on processability loss. Materials other than cement, water, and aggregate that are used as ingredients in concrete and are added to the batch immediately before or during mixing are called admixtures. It is used to adapt the properties of concrete to your needs. Chemical additives for concrete construction have achieved great success in recent decades. Proper use of admixtures can improve quality, accelerate or retard curing time, improve frost and sulfate resistance, control strength development, improve workability, and improve finishability. This method reduces construction costs and is widely recognized as a means to reduce the occurrence of unforeseen problems during the construction process. Various tests must be carried out to determine the effect of admixtures on the quality of concrete produced using specified working materials, using different construction methods, under expected environmental conditions. there is. Chemical additives such as retarders play an important role in modern concrete materials and technology. Chemical admixtures have improved the quality of the concrete mentioned above and have contributed to the development of new concrete technologies.

Keywords- Admixtures, Durability, Concrete, Retarder, Strength

I. INTRODUCTION

Compared to other materials used for similar tasks in Libya, concrete accounts for 90-95 percent of the building materials market for structural and non-structural applications. Concrete is a product made of cement, water, and aggregate, to which admixtures are added to change the concrete's properties. The chemically active component is cement, but its reactivity is activated only by mixing with water. Aggregates do not participate much in chemical reactions, but they not only strengthen the durability of concrete but also resist volumetric changes that occur in concrete after mixing, making it useful as a low-cost filler and rigid composite material. . When concrete hardens, it becomes stone-like and has excellent compressive strength. Concrete in its plastic state can be formed into any shape and used for architectural or purely decorative

purposes. Since concrete has low tensile strength, it is combined with reinforcing steel to withstand the tensile stress of reinforced concrete. Concrete is often used for foundations, columns, beams, and slabs, as well as structural shells, bridges, sewage treatment plants, roads, cooling towers, and sleepers. Concrete is commonly used in the precast concrete industry as concrete blocks, cladding panels, pipelines, piles, utility poles, etc.

The ready-mixed concrete industry currently produces over 70% of all in-situ concrete in Libya. Retardant additives are used by ready-mix concrete manufacturers and are available from numerous suppliers. Retarding admixtures slow down the initial reaction rate of cement and water, thereby increasing the time it takes for concrete to set. Retarders are admixtures that extend curing time and maintain workability, which is especially important for concrete in hot climates such as Libya. Retardant additives slow down the hydration process, leaving more water for better workability and allowing enough time for concrete to place, harden, and finish. Additionally, mixing concrete at extreme temperatures should be avoided as it may reduce the effectiveness of the admixture . Admixtures are widely used because they can provide significant physical and economic benefits to concrete. However, the use of additives cannot solve the poor concrete quality caused by difficulties caused by inappropriate mix proportions, poor concrete mixing technology, or poor raw materials. In hot conditions, retarders are used to slow down the hydration process.

II. RETARDING ADMIXTURES

The term “retarder” refers to an additive that retards the setting time of concrete. The ASTM classification for this type of admixture is Type B. Retarders reduce the strength development of concrete but do not affect the composition of the hydration products. Due to the effects specified in standard early cure criteria, these admixtures are classified as "water-reducing and retarding admixtures" in most publications. Moisture requirement and compressive strength are two further characteristics that distinguish them . Retarders are generally used in hot weather because high temperatures can shorten the curing time of concrete and cause cold joints to form. If concrete takes a long time to harden, it can be transported, installed, and compacted while still in its plastic state. This can have implications for structural design, as it allows continuous large-scale casting with controlled delays instead of segmented construction methods. Great care must be taken when using retarders, as too high a dose will prevent the concrete from

curing . Additionally, retarders can significantly minimize the heat generated when concrete hydrates. Large structures such as dams can be prevented from cracking by reducing the heat. The use of retarders in concrete improves workability by slowing down the setting time and allowing proper compaction without segregation.

III. NECESSITY FOR RETARDER

Hot weather causes problems in placing and mixing concrete, so the use of retarders is necessary to avoid the above problems and ensure the production of high quality concrete. Accordingly, these issues are now briefly explained as follows.

1. Increased water demand

Higher temperatures during concrete mixing require the use of additional water to achieve acceptable workability during compaction and pouring. Excess water reduces performance as we age.

2.Plastic shrinkage

Water is lost from the surface when the evaporation rate is greater than the blood loss rate under high temperature conditions. Moisture loss causes tensile stress in the surface layer due to its volume reduction. This causes plastic shrinkage cracks to form on the surface of immature concrete.

3.Thermal cracking

The heat generated during the hydration process increases the temperature of the concrete. When concrete is poured at high temperatures, the peak temperature increases. Therefore, as the concrete cools, the possibility of cracking increases due to large temperature differences.

4.Strength

Higher temperatures promote hydration and increase initial strength, but the final strength of concrete is compromised by uneven distribution and unstructured hydration products. As a result, the compressive strength of concrete placed after 28 days at room temperature decreases.

5.Durability

Mixing concrete at high temperatures results in greater porosity in the final product due to insufficient compaction. This makes concrete susceptible to damage from freeze-thaw cycles, weather effects, powerful ion attacks, and carbon dioxide and moisture intrusion.

6.Rapid loss of workability

Rapid hydration, combined with high temperatures and evaporation processes, accelerates the loss of concrete workability. If the paste hardens too quickly, workability will be impaired and concrete compaction efficiency will be reduced. As a result, the final product is concrete with low strength and durability.

IV. Retarder's Effects

Since the presence of retarders in concrete has various effects, previous studies should be examined to gain better insight into the behavior of retarders and their effects on concrete properties.

1. The Influence of the Retarder on the Setting Times

The primary function of retarders is to extend the time it takes for concrete to harden (both initial and final). Increasing the dose will improve cure delay, but overdosing can cause serious cure problems. The effectiveness of retarders on setting time depends on many factors including mixing temperature, water-cement ratio, type of cement used, etc.. This experiment is designed to measure the effect of ambient temperature on the initial and final setting times of concrete using a wide range of water/cement ratios. Before starting the experiment, concrete samples were prepared with water-cement ratio ranging from 0.40 to 0.65 in steps of 0.05 . Additionally, different doses of the additive were used to investigate the effect of dose variation. Experiments have shown that concrete at higher temperatures has lower workability, faster curing time, and lower final strength. He explained that high temperature reduces the setting time of pure concrete, and the smaller the water-cement ratio, the shorter the setting time. Adding a retarder increases the curing time of concrete.

Workability and Slump Loss as a Result of Retarder

Retarders are known to use less water, be more effective, and last longer than standard concrete. The adsorption of retarder and the resulting dispersion of cement particles improves the workability of retarded concrete. On the other hand, hydroxycarboxylic acid-based retarders can help increase the bleeding rate and ability of plastic concrete. This is practical in hot and dry weather. When molasses is used as a water-reducing and retarding additive in concrete, the slump of concrete with water-reducing agent is higher than that of concrete with molasses, even if the water-cement ratio and additive dosage are the same. Higher doses of additive will increase slump. Furthermore, the water reduction for both admixtures was found to be similar, approximately 10% compared to concrete without admixture. The results showed that the efficiency of this type of retarder can be comparable to that of water reducers. The pattern of slump loss for molasses-containing concrete is identical. H. Decrease over time. Except for the first 30 to 60 minutes, the study showed higher slump losses for lignosulfonate concrete than for molasses concrete. In contrast, Konya molasses containing a significant proportion of invert sugar behaved similarly to other molasses.

CONCLUSIONS

Admixtures develops concrete additives and has come to the following conclusions based on research into retarder additives. Therefore, it is widely used around the world to improve the quality, strength, and workability of concrete structures. Workability can be improved by adding retarders to concrete. However, too high doses of both additives tend to reduce the cohesive strength of the concrete. Adding set retarders to concrete extends the setting time. Retarders, on the other hand, have a long-term effect on concrete hardening time.

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