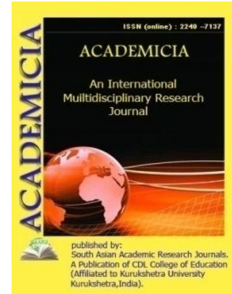
ACADEMICIA

ISSN: 2249-7137 Vol. 11, Issue 10, October 2021 Impact Factor: SJIF 2021 = 7.492

ACADEMICIA
An International Multidisciplinary Research Journal
(Double Blind Refereed & Peer Reviewed Journal)



DOI: 10.5958/2249-7137.2021.02385.5

RESISTANCE OF CEMENT AND CONCRETE TO CHEMICAL AND AGGRESSIVE FACTORS

Egamberdiev Murad Saidovich*; Mirzayev Ulugbek Telmonovich; Qurbonova Xurshida Idiyevna***; Gadoyev Asliddin Oktamovich*****

*candidate of the department of General Professional,
Disciplines Bukhara branch of Tashkent Institute of irrigation and agricultural engineers,
UZBEKISTAN

**candidate of the department of General Professional,
Disciplines Technical Sciences the Bukhara Engineering and Technological Institute,
Republic of UZBEKISTAN

***Candidate of the department of General Professional,
Disciplines Bukhara branch of Tashkent Institute of irrigation and agricultural engineers,
UZBEKISTAN

****Master student,
Bukhara branch of Tashkent Institute of irrigation and agricultural engineers,
Republic of UZBEKISTAN

ABSTRACT

The resistance of the cement mortar to aggressive influences, when exposed to Alr, lime becomes denser due to gas formation in the Alr, the durability of the garage erected in the building. It has also been found that exposure to harmful exhaust gases increases, usually in wet conditions.

KEYWORDS: *Cement Mortar, Aggressive Action, Acid, Carbonic Acid, Carbonization, Tubular Pores, Crystalline Hydrate, Calcium Hydroxide.*

INTRODUCTION

Durability of cement stone means its resistance to the aggressive effects of the external environment (fresh and mineral waters, the combined effects of water and cold, as well as high temperatures, wetting and drying, and the accumulation of salt solutions in the capillaries and pores of cement stone to other crystal hydrates). Because portland cement is a material that is very resistant to weathering. When cement stone interacts with Alr, lime condenses better and is more durable due to carbonation from carbon dioxide in the Alr.

Aggressive gases, on the other hand, can usually only affect cement in humid conditions. In this case, they often act as acids (SO_2, H_2S, CI_2, etc.). It is known that Portland cement consists of very small tubular pores. The gas penetrates these cavities very easily. With the appearance of wet conditions, the crystals of Ca $(ON)_2$, which is the mAln structural element of cement stone in tubular small cavities, are broken down. This poses a very significant risk to the strength of concrete structures.

Cement stone is a material that is not exposed to the harmful effects of Alr. When exposed to Alr, lime becomes more dense due to carbonization with carbon dioxide in the Alr, increasing its durability.

The effects of harmful gases are usually exacerbated in humid conditions. The processes of erosion in this case are almost indistinguishable from the processes under the influence of water.

To better visualize the resistance of cement stone to aqueous media, let us briefly review the history of research in this area.

The invention of Portland cement promoted his work in the field of concrete. From the second half of the XIX century, Portland cement began to be used as reinforced concrete in construction.

As a result of the widespread use of Portland cement in hydraulic structures in the 20s and 30s of the last century, it became clear that the structures were not resistant to water, and many hydraulic structures were demolished.

The degree of water resistance of Portland cement-based hydraulic structures in Russia and European countries was determined by Professor A.R. Shulyachenko, engineer V.I. Charnomsky and Academician A.A. Studied by Baykov (late nineteenth and early twentieth centuries). The science of concrete erosion was established as a result of the analysis of the causes of the deterioration of Portland cement under the influence of water, especially sea water. Scientists have also achieved certAln results in the study of the water resistance of cement in general. Consider, for example, the effect of fresh water. The best soluble among the hydration products of cement is calcium hydroxide, which is soluble in 1.3 grams per liter of water. In terms of solubility, the next place after lime is hydroaluminate, hydrosulfoaluminate (batsilla), followed by hydrosilicates. In general, cement can be completely melted, but the process is very slow.

If the concrete hardens without reaching the rhythm, its pores are large and water penetrates through them, then the harmful effects of water are clearly visible. Due to the carbonization of the lime separated from the concrete, white saline spots appear on its surface. In most cases, these moldy spots are referred to as salinization of concrete.

Salinity of concrete is the leaching of lime milk from the concrete mass. This process, in turn, weakens the bond with the fillers, thereby reducing the strength of the structure.

The solubility effect of water increases with increasing water hardness. Extremely hard water can also strengthen concrete due to its ability to form calcium carbonate in the pores and surface.

Often concrete also decomposes under the influence of carbonic acid water. Initially, dissolved carbonic acid reacts with Ca $(ON)_2$ to form

ISSN: 2249-7137 Vol. 11, Issue 10, October 2021 Impact Factor: SJIF 2021 = 7.492

$CaSO_3$: Sa (ON) $_2$ + SO_2 = $CaSO_3$ + N_2O.

The advantage of this process is that well-soluble Ca (ON) $_2$ is converted to 40 times less soluble SaSO3 than itself. However, when SO_2 is 250,300 milligrams per liter, the following secondary process occurs.

$SaSO_3$ + SO_2 + N_2O = Sa (NSO_3) $_2$.

The easily soluble calcium bicarbonate Ca (NSO_3) $_2$ is then washed out of the cement stone. Instead, Sa (ON) $_2$ is formed agAln. Thus, almost all of the cementite minerals are soluble. Water with a temporary hardness of not more than 24 ° C is not dangerous for concrete.

To save concrete from salinization, the surface of concrete structures is plastered with bitumen, varnish, natural stone, and even lead tin. But these are very expensive and at the same time do not last long. It is also possible to compact the surface of concrete by vibration. the effectiveness of these measures is less. This is because if the top protective layer is damaged by impact, the concrete will break down more easily.

The problem of water erosion under the influence of water was solved by the German scientist Mexaelis and the Russian scientist A.A. Baykov makes the right decision, they have made extensive use of putstsolan and similar trass, tuff, pumice additives to increase the water resistance of free lime, which is well soluble in water in hardening portland cement.The emergence of Portland cement had put the use of puttsolan unused.

At an international congress in St. Petersburg in 1908, Russian cementers proposed the mandatory placement of Portland cement used in the construction of hydraulic structures, but this was in fact nothing new.

Putstsolan cement is mAlnly used in the construction of structures under water and underground, as well as in groundwater. In ancient times, for example, in Bukhara, in the construction of foundations, dahma walls, pools, baths in sernam, wet and saline soils, lime putstsolan cement, which is called "ridge", was widely used. “Kir” mAlnly acted as a surfactant for plant ash, lime (sometimes a mixture of gypsum), grape seed and egg white.

Thus, in Russia, hydraulic compounds such as trepel, opoka, diatomite, trass and tuff, which are not inferior to Italian puttsola, began to be widely used. Previously, 10..15% admixture was used in Portland cement in factories, but later it was added to 20..40% to the extent that it does not affect the strength of cement. This both increases the water resistance of the cement and lowers its cost.

If the water absorbed into the concrete contAlns dissolved salts, the chemical melting process will also go away. Salts are present in almost all waters and degrade the quality of cement. One ton of river water contAlns on average up to 1.5 kilograms of salt. Salts of river water: consists of calcium sulfate and calcium carbonate, while salts of sea water contAln: table salt 78%, magnesium chloride 11%, magnesium sulfate 5% and various salts of calcium 4%. For this reason, conventional Portland cement is not used in the construction of underwater hydraulic structures at sea. For this purpose it is necessary to create special cements.

It is known from construction experience that concrete sometimes cracks under the influence of water contAlning calcium, magnesium, sodium, ammonium salts of sulfuric acid and their

ISSN: 2249-7137 Vol. 11, Issue 10, October 2021 Impact Factor: SJIF 2021 = 7.492

mixtures. This is because such substances in water chemically react with the hydroaluminate $3SaO \cdot AL_2O_3 \cdot 6N_2O$) in ordinary Portland cement, which solidifies to form needle-like crystals reminiscent of bacilli. Often such a compound is also called a “cement bacilli”. Its chemical expression is as follows:

$3CaO \cdot AL_2O_3 \cdot 3CaCO_4 \cdot 31H_2O$.

When this compound, sometimes called calcium hydrosulfoaluminate, is formed, the hardened cement tends to expand in volume. As a result, the internal tension increases and cracks appear in the cement. This is because the accumulation of dissolved gypsum with insoluble $3CaO \cdot AL_2O_3 \cdot 6N_2O$ causes an increase in the volume of formation of insoluble hydrosulfoaluminate (relative to insoluble $3CaO \cdot AL_2O_3 \cdot 6N_2O$) by about 4.6 times. As the cement stone expands, its structure deteriorates, its strength decreases, and it breaks down. Cement bacilli are dangerous for concrete, and are especially dangerous when combined with salinity. Under the influence of bacilli, the structure cracks and cracks, opening the way for water in the concrete. Consequently, favorable conditions are created for the dissolution of calcium hydrate. Thus, the "cement bacilli" accelerates the salinization of cement.

Proper selection of binding materials is important in increasing the water resistance of concrete. This in turn extends the service life of the concrete. To increase the resistance of Portland cement to sulphate water, it is necessary to remove $3CaO \cdot AL_2O_3$ from it. But there is a downside to this measure. When this mineral is completely removed from the cement composition, the hardening of the cement is greatly slowed down. To prevent this, it is necessary to limit the amount of $3CaO \cdot Al2O_3$ in the resulting cement. In the production of such cement, great attention is pAld to the composition of the raw material. In this way, the spread of "cement bacilli" is reduced.

Also, cement made on the basis of clinker, which releases less lime during hardening, is resistant to washing of lime.

If the water that seeps into the concrete is contaminated with industrial effluent, it will have a worse effect on the concrete. Because concrete is an alkaline product, it contAlns a lot of free-standing lime hydrate. It is therefore, by its very nature, resistant to the effects of acid. Lime dissolves very quickly under the influence of acid. Therefore, the concrete floors of contAlners, pipes and appliances, walls and ceilings, cellulose, some types of fertilizers, lactic acid and foodstuffs are quickly destroyed.

Alkaline solutions (NaOH, KOH) have different effects on Portland cement. Low concentrations of alkaline solutions do not damage the concrete. From time to time the alkali solution on the cement stone begins to carbonize and crystallize in the presence of carbon dioxide gas. The alkaline salts formed form wet hydrates with the moisture in the Alr. The cement stone then expands in size, but such dangerous expansion is rare under the constant action of dilute alkaline solutions.

Alkaline solutions with very high concentrations break down the cement.

Under such conditions, the solubility of $Ca\ (ON)_2$ decreases due to the presence of the same ions (ON), but the solubility of other components in the cement stone, especially aluminate compounds, is greatly increased. Under the influence of high concentrations of alkaline solutions, the cement stone breaks down quickly. Thus, increasing the chemical resistance of cement stone is an issue of great importance in the national economy.

V.M.Moskvin has divided the following three mAln types of cement stone depending on the mAln signs of corrosion (deterioration) in the aqueous medium:

Type 1 corrosion - cement stone is damaged as a result of melting of components;

Type 2 corrosion - cement stone is broken as a result of exchange reactions between substances in water and cement components;

Type 3 corrosion - cement stone is broken down as a result of precipitation and crystallization of insoluble salts in the pores of cement paste.

A complete classification of the mAln types of corrosion of concrete under the influence of natural waters was developed by V.V.Kind.

1. Spontaneous melting of calcium hydrate oxide in cement stone, leaching and alkalinization corrosion;

2. Erosion due to the action of acids with a pH value of at least 7 - acid corrosion;

1. Carbonic acid corrosion, which is somewhat similar to acid corrosion and causes the erosion of cementite;

2. Sulfate corrosion, which in turn is divided into: a) corrosion of sulfoaluminate, which occurs under the influence of ions with a concentration of 0.25 ... 0.3 to 1 g / l;

b) sulfoaluminate - gypsum corrosion, the concentration of which in the solution is more than 1 g / l, formed mAlnly under the influence of sulfate ions (SO_4);

c) gypsum corrosion caused by water contAlning large amounts of Na_2SO_4 and K_2SO_4;

5. Magnesium corrosion, which in turn is divided into: a) magnesium corrosion caused by the action of magnesium cations in the absence of SO_4- ions in water;

These types of corrosion can occur under the influence of natural waters, industrial and domestic wastewater. In addition, the combined effect of gypsum and acid can also be of great importance. Corrosion under the influence of hydrogen sulfide is unusual. In addition, cement and concrete structures can also be exposed to beef fat, vegetable oil, carbohydrates, alcohol, phenol, sugar, various acids and alkalis.

No matter how different the substances that cause corrosion, we will consider some of the classifications of V.M.Moskvin and V.V.Kind the corrosion under their influence.

Sulfoaluminate corrosion is a type of sulfate corrosion that occurs under the influence of sulfate waters contAlning 0.25..1g / l ions in cement and concrete. If the amount of SO_4- ions exceeds the specified amount, this corrosion will turn into sulfoaluminate gypsum corrosion. If the concentration of sulfate ions drops below 0.25 g / l, according to V.V.Kind, this will not be dangerous for Portland cements.

Natural waters or industrial effluents contAln $SaSO_4$, Na_2SO_4, $MgSO_4$,MgCl2, NaCl, and similar salts may be present in varying amounts:

Sa (ON) $_2$+ $Na_2CO_4 + 2N_2O = CaSO_4 \cdot 2N_2O + NaOH$.

$3SaO \cdot Al_2O_3 \cdot 6N_2O + 3\ CaCO_4 \cdot 2N_2O + 19N_2O = 3CaO \cdot Al_2O_3CaSO_4 \cdot 31N_2O$.

Sodium hydrate oxide is a well-soluble substance that is washed away from the cement stone, forming a sparingly soluble calcium hydrosulfoaluminate during the reaction. As it crystallizes, it absorbs 30..32 moles of water, expands in volume by about 4.6 times, resulting in a sharp deterioration in the strength of the cement stone.

Calcium hydrosulfoaluminate crystals consist of long thin needles that look like some bacilli. Because of this similarity, as well as its very dangerous effect on cement stone, calcium hydrosulfoaluminate is called “cement bacilli”.

In the first period, when calcium hydrosulfoaluminate (ettringite) is formed (even when the gypsum is saturated), it contributes to the compaction of the cement, but as a result of the accumulation of sulphate water, the cement begins to break down rapidly.

USED LITERATURE

1. Timashev V.V.,Suleymanov A.T.,Sichkaraeva :A.Yu,Tleuberganova A.I. Improving the qualityof cement based on high silk raw materials with the help of barium contAlning additives,’Cement’,1979,No.5.

2. Luginina I.G., Khudyakova T.M., SinkaraevaA.Yu. The influence of magnesium oxide huskd=s on the properties of hydrotechnical cement.’Cement’,1976.

3. VolkonskyB.V.,Konovalov P.F., MakashevS.D.Mineralizers in the cement industry. 1964.

4. Egamberdiyev M.S. A new method of obtAlning high density concrete.The Republic Of Uzbekistan-Government Agencies scientific – practical conference on energy saving problems (Scientific articles collection)- Bukhara, 1993. 304 – 306 p.

5. Egamberdiyev M.S.,Atakuziev T.A. Role of cement exothermy and the formation of the temperature field of the solid concrete mixture during layer-by-layer concreting.//New ingorganic materials and technical conferences dedicated to the fifth anniversary of independence of the Republic of Uzbekistan with the participation of foreign scientists-1996.p.130

6. Egamberdiyev M.S. A new method of obt Alning high density concrete// Resources of the people’s Republic of Uzbekistan on the network scientific practical conference “neck and energy saving problems” (Scientific summaries) Bukhara, 1993.1.

7. https://scholar.google.com/citations?view_op=view_citation&hl=ru&user=mA18-8IAAAAJ&citation_for_view=mA18-8IAAAAJ:dBIO0h50nwkC

8. https://scholar.google.com/citations?view_op=view_citation&hl=ru&user=mA18-8IAAAAJ&citation_for_view=mA18-8IAAAAJ:HIFyuExEbWQC