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Concept of Admixture

ZERO TO HERO SERIES



By Pramod sir **LIVE! 5:00 PM**

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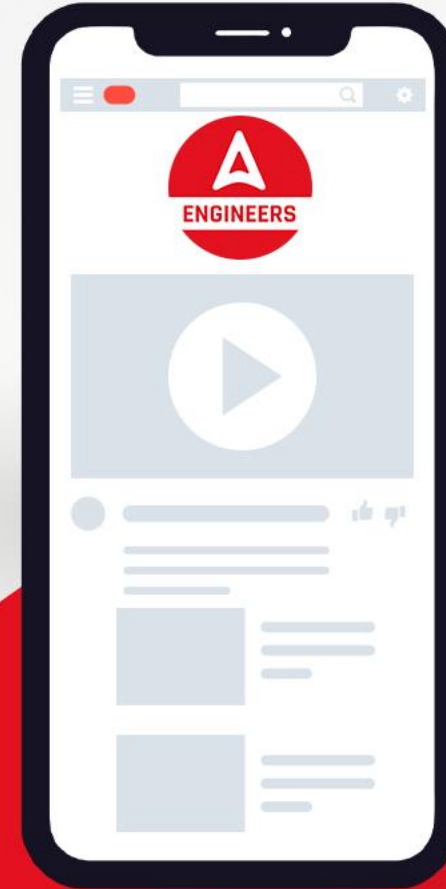
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Types of Admixtures of Concrete & Cement

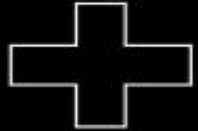



ADMIXTURE

Admixtures are formulated chemical compounds that are used to modify certain properties of concrete.

Admixtures are the material, other than

- Cement
- Water
- Aggregates



Chemical Admixture

These admixtures are added to concrete mix before or during mixing of concrete

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TYPES OF CONCRETE ADMIXTURES

Types of Admixture

Chemical Admixtures

Plasticizers

Super Plasticizers

Accelerators

Set Retarders

Mineral Admixtures

Cementitious

Pozzolanic

Blast Furnace Slag

Flyash

Silica Fume

Rice Husk



Chemical admixtures

Water-reducing admixture / Plasticizers:

These admixtures are used for following purposes:

To achieve a higher strength by decreasing the water cement ratio at the same workability as an admixture free mix.

To achieve the same workability by decreasing the cement content so as to reduce the heat of hydration in mass concrete.

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To increase the workability so as to ease placing in accessible locations

Water reduction more than 5% but less than 12%

The commonly used admixtures are Ligno-sulphonates and hydrocarbolic acid salts.

Plasticizers are usually based on lignosulphonate, which is a natural polymer, derived from wood processing in the paper industry.

Super Plasticizers:

These are more recent and more effective type of water reducing admixtures also known as high range water reducer. The main benefits of super plasticizers can be summarized as follows:

Reduced W/C ratio:

Very high early strength, >200% at 24 hours or earlier

Very high later age strengths, >100 MPa or 15000 psi.

Reduced shrinkage, especially if combined with reduced cement content.

Improved durability by removing water to reduce permeability and diffusion

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Sulphonated naphthalene formaldehyde condensates (SNF)

Sulphonated melamine formaldehyde condensates

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Accelerators:

An admixture which, when added to concrete, mortar, or grout, increases the rate of hydration of hydraulic cement, shortens the time of set in concrete, or increases the rate of hardening or strength development. Accelerating admixtures can be divided into groups based on their performance and application:

Types of accelerators :

- 1- calcium chloride
- 2- sodium carbonate
- 3- aluminum chloride
- 4- potassium carbonate
- 5- ferric salts

Accelerating admixtures have a relatively limited effect and are usually only cost effective in specific cases where very early strength is needed for, say, access reasons.

They find most use at low temperatures where concrete strength gain may be very slow so that the relative benefit of the admixture becomes more apparent.

In summary, a hardening accelerator may be appropriate for strength gain up to 24 hours at low temperature and up to 12 hours at ambient temperatures. Beyond these times, a high range water reducer alone will usually be more cost-effective.

Disadvantages of calcium chloride: '

It reduces the resistance of cement to sulphate attack.

Increases the risk of alkali aggregate reaction.

Increases shrinkage and creep of concrete.

Lowers the resistance of air-entrained concrete to freezing and thawing at later ages.

Increase the plastic shrinkage because the plastic stage is extended.

It has been found to cause corrosion to reinforcement in certain cases.

Retarders

The function of retarder is to delay or extend the setting time of cement paste in concrete. These are helpful for concrete that has to be transported to long distance, and helpful in placing the concrete at high temperatures.

When water is first added to cement there is a rapid initial hydration reaction, after which there is little formation of further hydrates for typically 2–3 hours. The exact time depends mainly on the cement type and the temperature. This is called the dormant period when the concrete is plastic and can be placed. At the end of the dormant period, the hydration rate increases and a lot of calcium silicate hydrate and calcium hydroxide is formed relatively quickly. This corresponds to the setting time of the concrete

Air Entrained Admixtures:

An addition for hydraulic cement or an admixture for concrete or mortar which causes air, usually in small quantity, to be incorporated in the form of minute bubbles in the concrete or mortar during mixing, usually to increase its workability and frost resistance.

Air-entraining admixtures are surfactants that change the surface tension of the water. Traditionally, they were based on fatty acid salts or vinsol resin but these have largely been replaced by synthetic surfactants or blends of surfactants to give improved stability and void characteristics to the entrained air.

Air entrainment is used to produce a number of effects in both the plastic and the hardened concrete. These include:

- Resistance to freeze–thaw action in the hardened concrete.
- Increased cohesion, reducing the tendency to bleed and segregation in the plastic concrete.
- Compaction of low workability mixes including semi-dry concrete.
- Stability of extruded concrete.
- Cohesion and handling properties in bedding mortars



Types of Mineral Admixtures

Cementitious Admixtures of Concrete

These have cementing properties themselves. For example:

Ground granulated blast furnace slag (GGBFS)



Pozzolanic Admixtures of Concrete

A pozzolan is a material which, when combined with calcium hydroxide (lime), exhibits cementitious properties. Pozzolans are commonly used as an addition (the technical term is "cement extender") to Portland cement concrete mixtures to increase the long-term strength and other material properties of Portland cement concrete and in some cases reduce the material cost of concrete. Examples are

Fly ash

Silica Fume

Rice Husk Ash

Metakaolin

Fly Ash:

The finely divided residue resulting from the combustion of ground or powdered coal. Fly ash is generally captured from the chimneys of coal-fired power plants; it has POZZOLANIC properties, and is sometimes blended with cement for this reason.

Fly ash includes substantial amounts of silicon dioxide (SiO_2) (both amorphous and crystalline) and calcium oxide (CaO).

Toxic constituents include arsenic, beryllium, boron, cadmium, chromium, cobalt, lead, manganese, mercury, molybdenum, selenium, strontium, thallium, and vanadium.

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Admixture which cause early setting and hardening concrete are called

(Telangana A.E. 20-09-2015)

- (a) Workability admixtures
- (b) Accelerators
- (c) Retarders
- (d) Air entraining agents

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Which of the following statement is wrong?

(NBCC JE 2018 Morning Shift)

- (a) The coarse sand produces a harsh and unworkable mix
- (b) An admixrure cannot increase the workability of concrete without increasing water content of concrete without increasing water content
- (c) Salts of manganese cause a considerable reduction in the strength of concrete
- (d) All of the above

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The most commonly used admixtures which prolong the setting and hardening time of concrete are:

(SSB Himachal Pradesh 18-11-2018)

- (a) Accelerators
- (b) Retarders
- (c) Plasticisers
- (d) Air Entraining Agents

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Which of the below is an example of plasticizer?

(SSC JE 22-01-2018 Morning Shift)

- (a) Hydroxylated carboxylic acid
- (b) Fluoro-silicate
- (c) Gypsum
- (d) Surkhi

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Which one of the following admixtures is used to check bleeding in concrete?

(M.P. Sub Engg. 04-09-2018 9.00 am)

- (a) Calcium sulphate
- (b) Potash soap
- (c) Red oxide
- (d) Paraffin wax

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Which of the following admixtures is used in concrete in cold regions to enhance concrete's freeze/thaw resistance?

(DDA JE 24-04-2018, 12:30-2:30 pm)

- (a) Plasticizers
- (b) Air entraining agent
- (c) Viscosity modifying agent
- (d) Water reducing agent

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Which admixture is used to improve workability of concrete?

(SSC JE 24-01-2018 Morning Shift)

- (a) Plasticizers
- (b) Metakaolin
- (c) Reducers
- (d) Accelerators

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Fly ash is added to concrete to improve all of the following properties EXCEPT:

(DDA JE 23-04-2018, 12:30-2:30 pm)

- (a) Early age strength gain
- (b) Workability
- (c) Long term strength
- (d) Permeability

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According to India Standard 9103, the minimum water reduction achieved using a super plasticizing admixture is:

(DDA JE 24-04-2018 First Shift)

- (a) 40%
- (b) 10%
- (c) 20%
- (d) 30%

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Which of the following is NOT an accelerator in making concrete?

(DMRC 18-04-2018 4:30 pm)

- (a) Formaldehyde
- (b) Ammonia
- (c) Sodium chloride
- (d) Calcium chloride

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Retarders are used for:

(SSC JE 27-01-2018 Evening Shift)

- (a) Construction of high rise building
- (b) Repair works
- (c) Cold weather conditions
- (d) Grouting deep oil wells

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How many types of chemical admixture are there?

(SSC JE 24-01-2018 Morning Shift)

- (a) 2
- (b) 3
- (c) 4
- (d) 5

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Pick up the incorrect statement from the following

(SSC JE 22-01-2018 Evening Shift)

- (a) Admixture accelerate hydration
- (b) Admixture make concrete water proof
- (c) Admixtures make concrete acid proof
- (d) Admixtures give high strength

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Pick up the correct statement from the following

(SSC JE 22-01-2018 Evening Shift)

- (a) Calcium chloride acts as a retarder
- (b) Gypsum (calcium sulphate) acts as an accelerator
- (c) Gypsum (calcium sulphate) acts as a retarder
- (d) None of these

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Zinc or aluminium powders are used as _____.

[MPVYPAM 08-07-2017 2nd meeting]

- (a) Retarders
- (b) Accelerators
- (c) Air entraining agents
- (d) Plasticizers

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Reasoning

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