2.4 WATERPROOFERS

Waterproofing admixtures may be obtained in powder, paste or liquid form and may consist of pore filling or water repellent materials.

The chief materials in the pore filling class are silicate of soda, aluminium and zinc sulphates and aluminium and calcium chloride. These are chemically active pore fillers.

In addition they also accelerate the setting time of concrete and thus render the concrete more impervious at early age. The chemically inactive pore filling materials are chalk, fullers' earth and talc and these are usually very finely ground. Their chief action is to improve the workability and to facilitate the reduction of water for given workability and to make dense concrete which is basically impervious.

Some materials like soda, potash soaps, calcium soaps, resin, vegetable oils, fats, waxes and coal tar residues are added as water repelling materials in this group of admixtures.

In some kind of waterproofing admixtures inorganic salts of fatty acids, usually calcium or ammonium stearate or oleate is added along with lime and calcium chloride.

Calcium or ammonium stearate or oleate will mainly act as water repelling material, lime as pore filling material and calcium chloride accelerates the early strength development and helps in efficient curing of concrete all of which contribute towards making impervious concrete.

Some type of waterproofing admixtures may contain butyl stearate, the action of which is similar to soaps, but it does not give frothing action. Butyl stearate is superior to soap as water repellent material in concrete.

Heavy mineral oil free from fatty or vegetable oil has been proved to be effective in rendering the concrete waterproof. The use of Asphalt Cut-back oils have been tried in quantities of 2 1/2, 5 and 10 per cent by weight of cement. Strength and workability of the concrete was not seriously affected.

Production of concrete of low permeability depends to a great extent on successful uniform placing of the material.

An agent which improves the plasticity of a given mixture without causing deleterious effects or which limits bleeding and thereby reduces the number of large voids, might also be classified as a permeability reducing admixture.

Air entraining agents may also be considered under this, since they increase workability and plasticity of concrete and help to reduce water content and bleeding.

An air entrained concrete has lower absorption and capillarity till such time the air content do not exceed about 6 per cent.

Among many other aspects, the w/c ratio used in the concrete, the compaction, curing of concrete, the admixture used to reduce the w/c ratio, the heat of hydration, the micro-cracking of concrete and many other facets influence the structure of hardened cement paste and concrete, which will have direct bearing on permeability, damp-proofing and waterproofing.

Uses

- It is essential to water proof a structure to prevent the seepage of water for its durability.
- Provide water proofing solutions for basements, sunken portions, roofs, terrace gardens and expansion joints etc.

Types of Waterproofers

- Polymer Modified Cementitious Membranes
- Polyurethane Membranes
- Injection Grouting
- Bituminous membranes
- EPD (ethylene-propylene-diene) Membrane
- PVC Membrane

Effect of water proofer on concrete properties:

- To reduce either the surface adsorption into the concrete and the passage of water through the hardened concrete.
- Reducing the size, number and continuity of the capillary pore structure
- Blocking the capillary pore structure
- Lining the capillaries with a hydrophobic material to prevent water being drawn in by absorption / capillary suction.

Functions of Waterproofers

- It reduces the size of capillary pores, their numbers and continuity inside the concrete structure.
- It blocks the capillary pores of concrete, or
- It may line the capillary pores with hydrophobic materials. This prevents the absorption of water in the pores due to capillary absorption.

Materials:

- Hydrophobic or water-repellent chemicals such as oils, petroleum products which can block the entry of water into the pores by forming a layer along the pores in concrete. These materials do not fill the pores.
- Crystalline materials with hydrophilic nature which increases the density of calcium silicate hydrate and / or generate the pore-blocking deposits to resist water penetration.

2.5.1 AIR ENTRAINING ADMIXTURES

One of the important advancements made in concrete technology was the discovery of air entrained concrete.

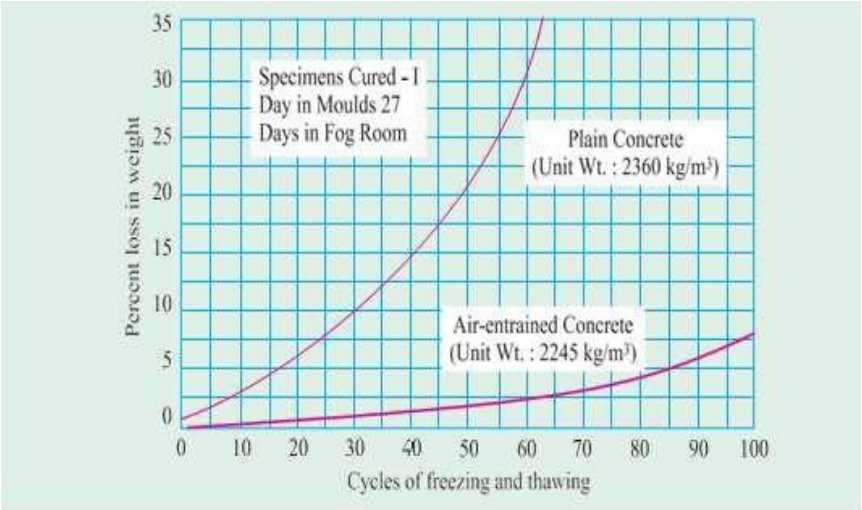
- In the United States and Canada, due to the recognition of the merits of air entrained concrete, about 85% of concrete manufactured in America contains one or the other type of air entraining agent.
- By mixing a small quantity of air entraining agent or by using air entraining cement.
- Minute spherical bubbles of size ranging from 5 microns to 80 microns distributed evenly in the entire mass of concrete.
- These incorporated millions of non-coalescing air bubbles, which will act as flexible ball bearings and will modify the properties of plastic concrete regarding workability, segregation, bleeding and finishing quality of concrete.
- It also modifies the properties of hardened concrete regarding its resistance to frost action and permeability.

Types of Air Entraining Admixtures

The following types of air entraining agents are used for making air entrained concrete.

- Natural wood resins
- Animal and vegetable fats and oils, such as tallow, olive oil and their fatty
- Acids such as stearic and oleic acids.
- Various wetting agents such as alkali salts or sulphated and sulphonated organic compounds.
- Water soluble soaps of resin acids, and animal and vegetable fatty acids.
- Miscellaneous materials such as the sodium salts of petroleum sulphonic
- Acids, hydrogen peroxide and aluminium powder, etc.
- Vinsol resin and Darex are the most important air-entraining agents.

Effect on Freezing and Thawing



Effect on Bleeding