

2.6 MINERAL ADMIXTURES

It is a siliceous materials used to strengthen the durability properties that is classified as pozzolanic or cementitious materials. It acts as by-product agent. E.g.: fly ash.

Mineral admixtures are finely divided siliceous materials which are added to concrete in relatively large amounts, generally in the range 20 to 70 percent by mass of the total cementitious material.

Natural mineral admixture

- a. Clay and Shales
- b. Opalinc Cherts
- c. Diatomaceous Earth
- d. Volcanic Tuffs and Pumicites.

Artificial mineral admixture

- 1. Fly ash**
- 2. Silica fume**
- 3. Ground Granulated Blast Furnace Slag (GGBFS)**
- 4. Metakaoline**
- 5. Rice Husk ash**
- 6. Surkhi**

Fly ash

- ✓ Fly ash is a by-product obtained during the combustion of coal in thermal power plants.
- ✓ Fly ash is the most widely used pozzolanic material all over the world.

The fly ash or pulverized fuel ash is the residue from the combustion of pulverized coal collected by the mechanical dust collectors or electrostatic precipitous or separators from fuel gases of thermal power plants.

The most important benefit is reduced permeability to water and aggressive chemicals. Properly cured concrete made with fly ash creates a denser product because the size of the pores are reduced. This increases strength and reduces permeability. The use of fly ash can result in better workability, pumpability, cohesiveness, finish, ultimate strength, and durability. The fine particles in fly ash help to reduce bleeding and segregation and improve pumpability and finishing, especially in lean mixes.

Classification of fly ash.

Fly is classified into two classes.

Class F:

Fly ash normally produced by burning anthracite or bituminous coal, usually has less than 5% CaO. Class F fly ash has pozzolanic properties only.

Class C:

Fly ash normally produced by burning lignite or sub-bituminous coal. Some class C fly ash may have CaO content in excess of 10%. In addition to pozzolanic properties, class C fly ash also possesses cementitious properties.

Effects of Fly Ash on Fresh Concrete:

- Reduction of water demand for desired slump.
- With the reduction of unit water content, bleeding and drying shrinkage will also be reduced.

Effects of Fly Ash on Hardened Concrete:

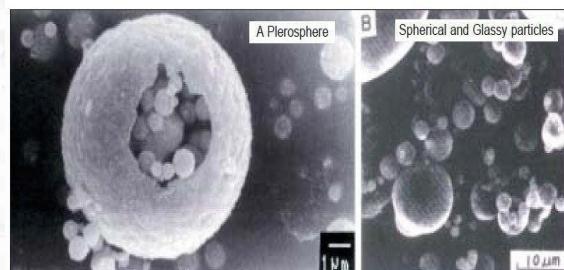
- ▶ Contributes to the strength of concrete due to its pozzolanic reactivity.
- ▶ Continued pozzolanic reactivity concrete develops greater strength at later age not at initial stage.
- ▶ Resulting in decrease of water permeability and gas permeability.

Application:

- ▶ Many high-rise buildings
- ▶ Industrial structures
- ▶ Water front structures
- ▶ Concrete roads, Roller compacted concrete dams.

Effect on Heat of Hydration:

Replacement of cement by fly ash results in a reduction in the temperature rise in fresh Concrete. This is particular importance in mass concrete where cooling, following a large temperature rise, can lead to cracking.



Scanning electron micrograph of Class F Fly Ash.

Pozzolanic action

The pozzolanic reaction is the chemical reaction that occurs in Portland cement upon the addition of pozzolans. The pozzolanic reaction converts a silica-rich precursor with no cementing properties, to a calcium silicate, with good cementing properties.