

Fumecrete 90 (Microsilica)

Fumecrete90 is designed to give a big Qualitative boost to Concrete. It is wellrecognized that Concrete Mix for High Strength cannot be achieved withoutsome extra cementitious material beyond Cement & Fly ash.

Here **Fumecrete90** plays a vital role in

- ✓ Increasing Compressive, Flexural and bond strengths in concrete.
- ✓ Improves the Life of Concrete by acting as *Corrosion Inhibitor* for Reinforcement.
- ✓ Improves the Life of Concrete by reducing *Alkali-Silica Reaction (ASR) or Concrete Cancer*.

Fumecrete90 is a mineral admixture comprising of very fine solid glassy spheres of silicon dioxide (SiO₂). **Fumecrete90** is fine amorphous silica with particle size around 100 times smaller than average particle size of cement and fly ash.

Higher Compressive, Flexural & Bond Strength with Fumecrete90

- ✓ The silica present in Fumecrete90, reacts with the weaker calcium hydroxide released during the hydration of cement and forms additionalcalcium silicate hydrate (C – S – H). The concrete derives greater strength from higher concentration of strong Calcium Silicate Hydratereplacing weak and easily soluble calcium hydroxide.
- ✓ **Fumecrete90** is like a pozzolanic material which provides more uniformdistribution and a greater volume of hydration in concrete structures. Thischanges the Rheology of concrete and reduces the water-binder ratio.This in turn results in higher compressive strength.

Reinforcement Corrosion Inhibitor role of Fumecrete90

- ✓ With particle size of $1/100^{\text{th}}$ of cement & fly ash, **Fumecrete90** drastically reduces the average size of pores in the concrete. This drastically reduces water permeability in concrete.
- ✓ The lower water-binder ratio achieved by adding **Fumecrete90** ensure that the concrete does not lose water during setting and no pin holes are created.
- ✓ It reduces the rate of carbonation, decreases permeability to chloride ions and imparts high electrical resistivity. Hence it protects the reinforcement steel and embedment.
- ✓ As an additional functional benefit, this reduces the instances of damp and water leakage troubles.

Resistant to Concrete Cancer (Alkali-Aggregate Reaction)

Cement Hydration process produces Calcium Hydroxide along with Sodium and Potassium oxides which has the following impact on concrete at a later stage:

With age the porosity of concrete gathers sufficient moisture to aid a swelling reaction between highly alkaline cement paste and the reactive non-crystalline silica found in many aggregates. This forms a hygroscopic gel of Sodium Silicate which swells absorbing further moisture weakening the concrete and creating cracks. These cracks lead to increased porosity which in turn exponentially propagates the process of disintegration. That is the reason it is termed **Concrete Cancer**.

In case of Sulfate attack, free calcium hydroxide reacts to produce calcium sulphate. This brings acidity in concrete and weakens the structure.

Fumecrete90 acts with the policy of “fight Fire with Fire” to combat ASRreaction. It initiates a prompt reaction at the early stage of concrete hardening. Thus, it binds these troublemakers, i.e., Calcium Hydroxide along with Sodium and Potassium oxides. Thus, they are arrested and quarantined, not allowing them to create much trouble at later stage. Add to this the fact that Fumecrete90 has already reduced the porosity and hence curtailing the availability of moisture, the other key requirement for this process.

Recommendation

Fumecrete90 can be mixed between 5-10% of cement used in Concrete Mix for excellent performance.

Results

The Concrete trial mix was conducted for M-70 grade. **Fumecrete90** was added in concrete mixture in the ratio of 1:10 of cement; the following results were achieved for cube test.

Trial Date: 9/11/2022 to 7/12/2022 Result 1

Date	Age (days)	Weight (kg)	Comp. Strength (N/mm ²)	Average
12/11/2022	3	8.650	61.51	55.64 N/mm ²
12/11/2022	3	8.790	49.82	
12/11/2022	3	8.820	55.60	
16/11/2022	7	8.790	71.24	71.59 N/mm ²
16/11/2022	7	8.690	73.15	
16/11/2022	7	8.960	70.40	
7/12/2022	28	8.590	100.92	95.26 N/mm ²
7/12/2022	28	8.730	97.22	
7/12/2022	28	8.710	87.63	

Trial Date: 13/11/2022 to 8/12/2022 Result 2

Date	Age (days)	Weight (kg)	Comp. Strength (N/mm ²)	Average
13/11/2022	3	8.890	54.48	58.29 N/mm ²
13/11/2022	3	8.860	59.11	
13/11/2022	3	8.830	61.28	
17/11/2022	7	8.860	75.91	73.77 N/mm ²
17/11/2022	7	8.790	74.75	
17/11/2022	7	8.970	70.60	
8/12/2022	28	8.910	102.83	97.16 N/mm ²
8/12/2022	28	8.690	98.11	
8/12/2022	28	8.880	90.52	

Conclusion

M70 grade mixture was expected to give a compressive strength of 80-82 N/mm² after 28 days. With addition of **Fumecrete90** @10% of cement weight in the mixture, the average strength achieved was 18% better.

