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2.2 RETARDERS

A retarder is an admixture that slows down the chemical process of hydration so that concrete remains plastic and workable for a longer time than concrete without the retarder. Retarders are used to overcome the accelerating effect of high temperature on setting properties of concrete in hot weather concreting.

The retarders are used in casting and consolidating large number of pours without the formation of cold joints. They are also used in grouting oil wells. Oil wells are sometimes taken upto a depth of about 6000 meter deep where the temperature may be about 200°C. The annular spacing between the steel tube and the wall of the well will have to be sealed with cement grout.

Retarding admixtures are sometimes used to obtain exposed aggregate look in concrete. The retarder sprayed to the surface of the formwork, prevents the hardening of matrix at the interface of concrete and formwork, whereas the rest of the concrete gets hardened.

The appropriate amount of gypsum to be used must be determined carefully for the given job. Use of gypsum for the purpose of retarding setting time is only recommended when adequate inspection and control is available, otherwise, addition of excess amount may cause undesirable expansion and indefinite delay in the setting of concrete.

In addition to gypsum there are number of other materials found to be suitable for this purpose. They are: starches, cellulose products, sugars, acids or salts of acids. These chemicals may have variable action on different types of cement when used in different quantities. Unless experience has been had with a retarder, its use as an admixture should not be attempted without technical advice. Any mistake made in this respect may have disastrous consequences.

Uses of Retarders

- Retarders are used to overcome the accelerating effect of high temperature on setting properties of concrete in hot weather concreting.
- Very useful when concrete has to be place in very difficult conditions and delay may occur in transporting and placing Retarders increase the setting time of the concrete mix and reduced the w/c ratio.
- Usually up to 10% water reduction can be achieved.
- A wide range of water-reducing and set-retarding admixtures are used in ready mixed concrete.
- **Used at**
- Casting and consolidating large number of pours without the formation of cold joints.
- Grouting oil wells, where temperature is about 200 °C, at a depth of 6000 meters.

Limitations of retarders

- Retarders should be used in proper amount. Access amount will cause indefinite setting time.
- At normal temperatures addition of sugar 0.05 to 0.10 per cent have little effect on the rate of hydration, but if the quantity is increased to 0.2 percent, hydration can be retarded to such an extent that final set may not take place for 72 hours or more

Retarding Agents

- Gypsum and Calcium Sulphate are well known retarders.
- Other examples are: starches, cellulose products, sugars, acids or salts of acids

Effect of retarding/water-reducing admixtures on setting time and strength build up

Admixture addition litres/50 kgs.	*Setting time hrs.*		*W : C ratio*	*Compressive Strength MPa*		
	Initial	*Final*		*3 days*	*7 days*	*28 days*
0	4.5	9	0.68	20	28	37
0.14	8.0	13	0.61	28	36	47
0.21	11.5	16	0.58	30	40	50
0.28	16.0	21	0.58	30	42	54

Retarding Effect.

It is mentioned earlier that plasticizer gets adsorbed on the surface of cement particles and form a thin sheath. This thin sheath inhibits the surface hydration reaction between water and cement as long as sufficient plasticizer molecules are available at the particle/solution interface.

The Quantity of available plasticizers will progressively decrease as the polymers become entrapped in hydration products.

Many research workers explained that one or more of the following mechanisms may take place simultaneously:

- Reduction in the surface tension of water.
- Induced electrostatic repulsion between particles of cement.
- Lubricating film between cement particles.
- Dispersionofcementgrains,releasingwatertrappedwithincementflocs.
- Inhibition of the surface hydration reaction of the cement particles, leaving more water to fluidify the mix.
- Change in the morphology of the hydration products.
- Induced steric hindrance preventing particle-to-particle contact.