Qualities of Water Used for Concrete Mixes

What is Mixing Water?

Water is an important constituent in concrete. It chemically reacts with cement (hydration) to produce the desired properties of concrete. Mixing water is the quantity of water that comes in contact with cement, impacts slump of concrete and is used to determine the water to cementitious materials ratio (w/cm) of the concrete mixture. Strength and durability of concrete is controlled to a large extent by its w/cm. Mixing water in concrete includes batch water measured and added to the mixer at the batch plant, ice, free moisture on aggregates, water included in any significant quantity with chemical admixtures, and water added after batching during delivery or at the jobsite.

What Source of Water Can be used in Concrete

In general, water that is fit for human consumption (potable) is acceptable for use as mixing water. However, non-potable sources of water can also be used provided the source does not negatively impact the properties of concrete. Most concrete plants have a source of municipal water that supplies potable water and this can be used as mixing water without any qualification testing. In rural areas, or for portable plants set up on project sites, the concrete producer may have to rely on non-potable sources such as wells, streams or other bodies of water. All concrete producers will also generate process water by cleaning mixers and plant components, also referred to as wash water. Additionally, precipitation on the site of the concrete plant generates storm water that may be collected at the plant. Environmental regulations typically require concrete plants to treat process and storm water to achieve certain characteristics like pH or solids content before it is discharged from the property

Qualities of Water Used for Concrete Mixes

- Water used for mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel.
- Any natural water that is potable and has no pronounced taste or odor is satisfactory as mixing water for making concrete.
- Water contaminated with industrial wastes, but free of suspended solids, is also suitable at low concentrations for making concrete.
- Much larger contents of the impurities, in natural water can be tolerated except for the alkali carbonates and bicarbonates which may have significant effects even less than or equal to 2000 ppm.
- Other inorganic impurities of possible industrial origin, that may be detrimental at moderate concentrations those are sulfides, iodides, phosphates, arsenates, borates, and

compounds of lead, zinc, copper, tin and manganese are adversely affect concrete properties.

Some General Precautions

- Avoid using wastewater from tanneries, from industrial, chemical and metals related plants (e.g. galvanizing plants, battery making plants); as some salts of manganese, tin, zinc, copper and lead can cause significant reductions in strength and large variations in the setting time of concrete.
- Avoid waters from abattoirs, chicken processing plants, etc. impurities in such waters may have severe effects on concrete.
- Avoid waters from swamps, marshes etc., which may contain organic impurities in amounts sufficient to interfere with the setting and hardening reactions of the cement.
- Avoid water containing algae; algae can cause excessive reductions in strength by influencing cement hydration or by causing a large amount of air to be entrained in the concrete mix. Algae may also be present on aggregate surfaces, in which case they reduce the bond between the aggregate particles and the cement paste and so will reduce concrete strengths. 5. Sugar. This is to be avoided at all costs

Effect on Concreting For Different Types of Contamination or Impurities

Suspended Solids:

Mixing water which contain high content of suspended solids should be allowed to stand in a setting basing before use as it is undesirable to introduce large quantities of clay and slit into the concrete.

Acidity and Alkalinity:

Natural water that is slightly acidic is harmless, but presence of humic or other organic acids may result adverse effect over the hardening of concrete. Water which are highly alkaline should also be tested.

Algae:

The presence of algae in mixing water causes air entrainments with a consequent loss of strength. The green or brown slime forming algae should be regarded with suspicion and such water should be tested carefully.

Sea Water:

Sea water contains a total salinity of about 3.5% (78% of the dissolved solids being NaCl and 15% $MgCl_2$ and $MgSO_4$), which produces a slightly higher early strength but a lower long-term

strength. The loss of strength is usually limited to 15% and can therefore be tolerated. Sea water reduces the initial setting time of cement but do not effect final setting time.

Chloride:

Water containing large amount of chlorides tends to cause persistent dampness and surface efflorescence. The presence of chlorides in concrete containing embedded steel can lead to its corrosion.

Moisture Content of Aggregate:

Aggregate usually contains some surface moisture. Coarse aggregate really contains more than 1% of surface moisture but fine aggregate can contain in excess of 10%. This water can represent a substantial proportion of the total mixing water indicating a significant importance in the quality of the water that contributes surface moisture in aggregate.