The requirements of mixing water for concrete

Almost any natural water that is drinkable and has no pronounced taste or odor can be used as mixing water for making concrete.

Drinkable Water is good for making concrete

- **Some waters that are not fit for drinking may be suitable for concrete making provided that they satisfy the acceptance criteria laid by ASTM C 94 (Tables 3.1)**

Table 3.1 Acceptance Criteria for Questionable Water Supplies (ASTM C 94)

	Limits	Test method
Compressive Strength, minimum percentage of control at 7 days	90	ASTM C 109 or T 106
Time of set, deviation from control, hr:min	From 1:00 earlier to 1:30 later	ASTM C 191 or T 131

Effects of Impurities in Mixing Water

Excessive impurities in mixing water affect setting time and concrete strength and also cause efflorescence (deposits of white salts on the surface of concrete), staining, corrosion of reinforcement, volume changes, and reduced durability

Impurity	Effects
1. Alkali carbonate and bicarbonate	Acceleration or retardation of setting time. Reduction in strength
2. Chloride	Corrosion of steel in concrete
3. Sulfate	Expansive reactions and deterioration of concrete. Mild effect on corrosion of steel in concrete
4. Iron salts	Reduction in strength
5. Miscellaneous inorganic salts (zinc, copper, lead, etc)	Reduction in strength and large variations in setting time
6. Organic substances	Reduction in strength and large variations in setting time
7. Sugar	Severely retards the setting of cement
8. Silt or suspended particles	Reduction in strength
9. Oils	Reduction in strength

Use of Questionable Waters as Mixing Water

Sea Water

- Seawater containing up to 35,000 ppm of dissolved salts is generally suitable as mixing water for plain concrete
- Seawater is not suitable for use in making steel reinforced concrete and prestressed concrete due to high risk of steel corrosion

Acid Waters

- Acid waters may be accepted as mixing water on the basis of their pH values.
- Use of acid waters with pH values less than 3.0 should be avoided.
- Organic acids, such as tannic acid can have significant effect on strength at higher concentrations.

Alkaline Waters

- Waters with sodium hydroxide concentrations up to 0.5 % and potassium hydroxide in concentrations up to 1.2 % by weight of cement has no significant effect on strength.

- The possibility for increased alkali-aggregate reactivity should be considered before using the alkaline water as mixing water.
- Tannic acid can have significant effect on strength at higher concentrations.

Wash Waters

- Wash waters may be reused as mixing water in concrete if they satisfy the limits in Tables 3.1 and 3.2

Table 3.2 Chemical Limits for Wash Water used as Mixing water (ASTM C 94)

Chemical or type of construction	Maximum concentration, ppm	Test Method
Chloride, as Cl		ASTM D 512
Prestressed concrete or concrete in bridge decks	500	
Other reinforced concrete	1000	
Sulfate, SO4	**3,000**	**ASTM D 516**
Alkalies, as (Na2O+0.658 K2O)	**600**	
Total solids	**50,000**	**AASHTO T 26**

Industrial Wastewaters

- Industrial wastewaters may be used as mixing water in concrete as long as they only cause a very small reduction in compressive strength, generally not greater than 10 % to 15 %.
- Wastewaters from paint factories, coke plants, and chemical and galvanizing plants may contain harmful impurities. Thus such wastewaters should not be used as mixing water without testing.

Sanitary Sewage

- The sanitary sewage may be safely used as mixing water after treatment or dilution of the organic matter.