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mixing water for concrete

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Definition of mixing water for concrete

Mixing water for concrete refers to the water used in the process of preparing and mixing concrete components, typically consisting of cement, aggregates (such as sand and gravel), and water. This water is a crucial ingredient in the concrete mix, playing a key role in the hydration process of cement and influencing the workability, strength, and durability of the final concrete product.

Definition of mixing water for concrete

The quality of mixing water is essential for producing concrete with desired properties. It should meet specific standards and criteria to ensure the proper chemical reactions between cement and water, as well as to prevent adverse effects on the concrete's performance. The characteristics of suitable mixing water include cleanliness, absence of harmful impurities, appropriate chemical composition, and proper temperature.

Definition of mixing water for concrete

Using mixing water that meets established standards helps ensure the development of a strong and durable concrete structure. The choice of mixing water is a critical factor in concrete mix design, and careful consideration of its physical and chemical characteristics is necessary to achieve the desired properties in the finished concrete.

mixing water for concrete

2 - Role and function of mixing water

Role and function of mixing water

The water used in concrete, often referred to as mixing water, plays a critical role in the overall performance and durability of the concrete. Here are some key requirements for water to be suitable for use in concrete:

Potability:

Mixing water should be potable and safe for human consumption. It should meet the standards set by local health authorities to ensure that it does not introduce harmful contaminants or pathogens into the concrete.

Cleanliness:

The water used in concrete should be free from impurities such as oils, organic matter, debris, and excessive amounts of silt or clay. Clean water helps maintain the integrity of the concrete and ensures proper bonding between cement particles.

Role and function of mixing water

Chemical Composition:

The chemical composition of the water, particularly its ion content, should be within acceptable limits. Excessive amounts of certain ions, such as sulfates and chlorides, can lead to corrosion of reinforcing steel and affect the durability of the concrete.

pH Level:

The pH of the mixing water should be in the range specified by concrete mix design. Highly acidic or alkaline water can influence the setting time and strength development of the concrete.

Role and function of mixing water

Sulfate Content:

High sulfate content in water can lead to sulfate attack on concrete, causing expansion and cracking. The sulfate content in mixing water should be within acceptable limits to prevent this issue.

Chloride Content:

Excessive chloride content can contribute to the corrosion of reinforcing steel in concrete. The chloride content of the mixing water should be controlled to ensure the long-term durability of the concrete.

Role and function of mixing water

Temperature:

The temperature of the mixing water can affect the setting time and curing of concrete. Extremely hot or cold water may impact the workability and strength development of the concrete.

Consistency:

The water-cement ratio in the concrete mix should be controlled to achieve the desired consistency and workability. Proper water-cement ratio is crucial for achieving the desired strength and durability of the concrete.

Compatibility with Admixtures:

If admixtures are used in the concrete mix, the mixing water should be compatible with these admixtures. Incompatible water can reduce the effectiveness of admixtures and potentially lead to undesirable effects.

Role and function of mixing water

Testing and Quality Control:

Regular testing of the water, especially in large construction projects, is important to ensure that it meets the required standards. Quality control measures should be in place to monitor and adjust the properties of the mixing water as needed.

Adhering to these requirements helps ensure that the water used in concrete mixing contributes to the production of high-quality and durable concrete structures. It's important to follow local building codes and standards for concrete mix design and water quality.

mixing water for concrete

3 - Different types of mixing water

Different types of mixing water

The term "mixing water" can refer to water used in different contexts, and the type of mixing water can vary depending on the application. Here are a few types of mixing water in various contexts:

Potable Water:

This is drinking water that meets certain quality standards set by regulatory authorities. It is safe for human consumption and can be used in various applications, including cooking, mixing beverages, and other domestic purposes.

Deionized Water:

Deionized water has had ions removed, making it highly pure. It is often used in laboratories, manufacturing processes, and electronics to prevent the introduction of impurities into sensitive systems or reactions.

Different types of mixing water

Distilled Water:

Distilled water is produced by boiling water and then condensing the steam back into liquid form. This process removes impurities and minerals, resulting in relatively pure water. Distilled water is commonly used in laboratories, medical applications, and some industrial processes.

Tap Water:

Tap water refers to water supplied to households and businesses through a municipal water system. Its quality can vary depending on the location, and it is commonly used for various domestic purposes, including mixing in cooking and cleaning.

Different types of mixing water

Seawater:

Seawater is water from the ocean and contains a significant concentration of salts and other minerals. While not suitable for many industrial processes, it is sometimes used in specific applications, such as cooling systems in coastal power plants.

Groundwater:

Groundwater is water that comes from underground aquifers. It can vary in quality depending on the geological characteristics of the region. Groundwater is often used as a source of water for agriculture and some industrial processes.

Recycled Water:

Recycled water, also known as reclaimed water, is wastewater that has been treated and purified for reuse. It is used in non-potable applications like irrigation, industrial processes, and some environmental restoration projects.

Different types of mixing water

Process Water:

Process water is water used in various industrial processes. It may undergo specific treatments to meet the requirements of the particular manufacturing or production process.

These are just a few examples, and the type of mixing water chosen for a specific application depends on factors such as purity requirements, regulations, cost, and the nature of the process or activity. Water treatment processes may also be applied to modify the characteristics of the water to meet specific needs.

mixing water for concrete

4 - Physical and chemical characteristics of concrete mixing water

Physical and chemical characteristics of concrete mixing water

The physical and chemical characteristics of concrete mixing water play a significant role in determining the performance, durability, and overall quality of the concrete. Here are some key physical and chemical characteristics to consider:

Physical Characteristics:

Temperature:

The temperature of the mixing water can influence the setting time and curing of concrete. Extreme temperatures, either too hot or too cold, can affect the workability and strength development.

Physical and chemical characteristics of concrete mixing water

Color and Clarity:

Clear and colorless water is generally preferred to avoid introducing impurities that may affect the appearance of the concrete.

Turbidity:

Turbidity refers to the cloudiness or haziness of water caused by the presence of suspended particles. Excessive turbidity can affect the workability of concrete and its appearance.

Odor:

Odorous water may indicate the presence of contaminants or organic matter, which could potentially affect the properties of the concrete.

Physical and chemical characteristics of concrete mixing water

Chemical Characteristics:

pH Level:

The pH of the mixing water should be within the recommended range for concrete mixing, typically between 6 and 8. An excessively acidic or alkaline pH can impact the setting time and strength development of the concrete.

Total Dissolved Solids (TDS):

TDS is a measure of the total concentration of dissolved substances in water. High TDS values may indicate the presence of salts, minerals, or other impurities that can affect the properties of concrete.

Physical and chemical characteristics of concrete mixing water

Chloride Content:

Excessive chloride content in water can lead to the corrosion of reinforcing steel within the concrete. The chloride content should be within acceptable limits to ensure the durability of the structure.

Sulfate Content:

Elevated sulfate levels in water can contribute to sulfate attack on concrete, causing expansion and cracking. Sulfate content should be controlled to prevent this issue.

Alkalinity:

The alkalinity of mixing water can influence the potential for alkali-aggregate reactions (AAR) in concrete. High alkalinity may mitigate the risk of certain types of AAR.

Physical and chemical characteristics of concrete mixing water

Bicarbonate Content:

Elevated bicarbonate levels in water can influence the setting time and may require adjustments in the mix design.

Regular testing and analysis of the physical and chemical characteristics of mixing water are essential to ensure that it meets the specified standards and is suitable for producing durable and high-quality concrete.

Adjustments to the mix design or water treatment may be necessary to address any issues identified during testing.

Physical and chemical characteristics of concrete mixing water

Hardness:

Hard water, which contains high levels of calcium and magnesium ions, can impact the setting time and workability of concrete. Water softening may be required in regions with very hard water.

Organic and Inorganic Impurities:

Presence of organic matter, oils, or other contaminants in water can negatively affect the performance of concrete. Water should be free from such impurities.

Conductivity:

Electrical conductivity is a measure of the ability of water to conduct an electric current. High conductivity may indicate the presence of dissolved ions, which can impact concrete properties.

mixing water for concrete

5 - Action of impurities in the mixing water on concrete

Action of impurities in the mixing water on concrete

The presence of impurities in mixing water used for concrete can have several adverse effects on the properties and performance of the concrete.

The impurities in mixing water can come from various sources, including natural sources, groundwater, surface water, or even the water used in the concrete mixing process. Here are some potential actions of impurities in mixing water on concrete:

Reduced Strength:

Certain impurities, such as excessive amounts of dissolved salts or chlorides, can adversely affect the strength of concrete. Chlorides, for example, can lead to the corrosion of reinforcing steel within the concrete, compromising its structural integrity.

Action of impurities in the mixing water on concrete

Delayed Setting Time:

Some impurities may cause delays in the setting time of concrete. This can be problematic, especially in construction projects where a specific timeline for curing and setting is crucial.

Increased Permeability:

Impurities in water can contribute to increased permeability of concrete. This can result in a higher likelihood of water and aggressive substances penetrating the concrete, leading to deterioration over time.

Action of impurities in the mixing water on concrete

Alkali-Aggregate Reaction (AAR):

Impurities in the mixing water may contribute to alkali-aggregate reactions, a chemical reaction between alkalies in the cement and reactive minerals in aggregates. This can result in the formation of a gel, causing expansion and cracking in the concrete.

Reduced Workability:

Certain impurities, such as excessive amounts of organic matter or certain minerals, can affect the workability of concrete, making it more challenging to place and finish during construction.

Action of impurities in the mixing water on concrete

To mitigate the impact of impurities in mixing water, it is essential to use water that meets the recommended quality standards for concrete mixing. Water testing and treatment may be necessary in some cases to ensure that the water used in the concrete mix is free from harmful impurities. Adhering to proper construction practices and specifications can also help minimize the potential negative effects of impurities on concrete performance.

mixing water for concrete

6- Requirements for use in concrete

Requirements for use in concrete

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Mixing water should be potable and safe for human consumption. It should meet the standards set by local health authorities to ensure that it does not introduce harmful contaminants or pathogens into the concrete.

Cleanliness:

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Requirements for use in concrete

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Requirements for use in concrete

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Temperature:

The temperature of the mixing water can affect the setting time and curing of concrete. Extremely hot or cold water may impact the workability and strength development of the concrete.

Consistency:

The water-cement ratio in the concrete mix should be controlled to achieve the desired consistency and workability. Proper water-cement ratio is crucial for achieving the desired strength and durability of the concrete.

Requirements for use in concrete

Compatibility with Admixtures:

If admixtures are used in the concrete mix, the mixing water should be compatible with these admixtures. Incompatible water can reduce the effectiveness of admixtures and potentially lead to undesirable effects.

Testing and Quality Control:

Regular testing of the water, especially in large construction projects, is important to ensure that it meets the required standards. Quality control measures should be in place to monitor and adjust the properties of the mixing water as needed.

Requirements for use in concrete

Adhering to these requirements helps ensure that the water used in concrete mixing contributes to the production of high-quality and durable concrete structures. It's important to follow local building codes and standards for concrete mix design and water quality.

mixing water for concrete

7 - Consequences of excess and insufficient mixing water

Consequences of excess and insufficient mixing water

The amount of mixing water used in concrete plays a critical role in determining the properties and performance of the final product. Both excess and insufficient mixing water can lead to various consequences that affect the quality and durability of concrete. Here are the consequences of excess and insufficient mixing water:

Consequences of Excess Mixing Water:

1-Reduced Strength:

Excessive water can weaken the concrete by diluting the cement paste. This leads to lower compressive strength, making the concrete more susceptible to cracking and structural failure.

Consequences of excess and insufficient mixing water

Consequences of Excess Mixing Water:

2-Increased Permeability:

Excess water can increase the porosity of concrete, making it more permeable. This heightened permeability allows water and aggressive substances to penetrate the concrete more easily, leading to durability issues.

3-Workability Issues:

While excess water can improve short-term workability, it can also lead to segregation and bleeding, negatively impacting the finishing and overall quality of the concrete surface.

Consequences of excess and insufficient mixing water

Consequences of Excess Mixing Water:

4-Cracking:

Shrinkage cracking is more likely to occur in concrete with excess water. As the concrete dries and cures, excessive water can result in higher levels of shrinkage, leading to cracking.

5-Delayed Setting Time:

Excess water can extend the setting time of concrete, causing delays in construction schedules and potentially affecting the quality of the finished product.

Consequences of excess and insufficient mixing water

Consequences of Excess Mixing Water:

6-Efflorescence:

Increased water content can contribute to efflorescence, the formation of white, powdery deposits on the concrete surface due to the leaching of soluble salts.

Consequences of Insufficient Mixing Water:

1-Poor Workability:

Insufficient water can lead to a lack of workability, making it challenging to mix, place, and finish the concrete. This can result in a mix that is difficult to handle and properly compact.

Consequences of Insufficient Mixing Water

2-Incomplete Hydration:

Inadequate water can hinder the complete hydration of cement particles, leading to insufficient strength development and a less durable concrete structure.

3-Honeycombing:

Insufficient water may prevent proper consolidation and compaction of the concrete mix, resulting in voids or gaps within the structure known as honeycombing. This compromises the structural integrity and aesthetics of the concrete.

Consequences of Insufficient Mixing Water

4-Increased Shrinkage:

Lack of sufficient water can contribute to higher shrinkage in the concrete as it cures, leading to an increased risk of cracking.

5-Difficulty in Placement:

Insufficient water makes it challenging to properly place and consolidate the concrete, particularly in areas with complex formwork or reinforcement.

Consequences of Insufficient Mixing Water

6 - Reduced Durability:

Inadequate water can lead to a less dense and more porous concrete, reducing its resistance to freeze-thaw cycles, chemical attacks, and other environmental factors.

Balancing the water-cement ratio is crucial to achieving the desired properties in concrete. Proper mix design and control of water content during the construction process are essential to avoid the negative consequences associated with both excess and insufficient mixing water.