

Is Water More Than Just H₂O?

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Chemists call it H₂O, or dihydrogen monoxide if they want to impress their friends. But to the layperson, it's simply water. What do we know about water? Well, it is wet, it makes up about 60-70% of our body mass, and it covers approximately 70% of the Earth.



But did you know that water, in all its various forms, is an important factor in obtaining accurate test results? Many common test procedures require special kinds of water, such as tap, distilled, deionized, or deaired. What are the differences among these types of water? Why is it so important to make sure we are using the correct type of water for the correct test?

Tap Water

Tap water is the least expensive type of water, and is as easy to obtain as turning on the faucet. Tap water, as well as bottled water, has usually been treated to remove dirt, pollutants, and bacteria. However, even after treatment, dissolved minerals and gases remain. While the substances found in potable tap water are harmless for human consumption (and sometimes even beneficial), they may have adverse effects on laboratory testing. Tap water may cause unwanted chemical reactions through dissolved minerals, affect density and mass calculations, or change the way materials behave.

Deaired Water

Deaired water is tap water that is boiled or subjected to vacuum to remove dissolved gases. It is important to store deaired water in a sealed container, as gases will slowly be absorbed back in if exposed to the air. One of the most common atmospheric gases, carbon dioxide or CO₂, will form carbonic acid as it dissolves into deaired water. Carbonic acid can significantly lower the pH of water and could affect some test results.

Distilled Water

Distilled water is produced by boiling tap water, and the steam is captured and condensed to create water in its simplest form. The distillation process removes metal ions and many non-ionic organic compounds- leaving essentially pure, deaired water behind.

Deionized Water

Also known as demineralized water, it is produced most commonly through an ion exchange system. During this process, chemically reactive ions that are dissolved in tap water (such as calcium, magnesium, and iron) are exchanged for hydrogen and hydroxide ions, which combine to produce water. The process only removes charged ions, and neutral gases and nonionic compounds will still be present.

Selecting the Correct Type of Water

Very few test methods do not specify the type of water to be used during testing. However in these circumstances it is safe to assume that regular tap water is acceptable. It is important to remember that for methods that specify the use of deaired, distilled, or deionized water, tap water is never an acceptable alternative.

Also, many common soil, aggregate, and asphalt tests will throw you some curves. For example, AASHTO T 304, Uncompacted Void Content of Fine Aggregate, calls for the use of freshly boiled, deionized water. In this instance, the obvious choice would be to deair previously deionized water. What if your laboratory does not own a fancy ion exchange system? Distilled water is always an acceptable alternative for replacing deionized water. However, the reverse is never true, as the neutral particles and organic compounds that still remain in deionized water could affect the test results.

So far tap water has taken a bad rap. Nevertheless, in some instances tap water may actually be preferred. For example, many test methods will require replication of the in-situ environment from which the test samples were obtained. In this case, the material's interaction with the local ground water may play an important role in the test. Of course ground water can be difficult to obtain, but tap water is often an acceptable replacement. In most circumstances, tap water will replicate many of the same mineral, pH, and organic properties found in the local groundwater, as they both have been subjected to the same underground hydraulic system.

So now it should be as clear as distilled water how important it is to pay attention to the specific type of water required for each test we run. Do not let your test data be all washed up and confidence in your results go down the drain just because your H₂O has the wrong M.O. Now you are well-equipped with the water knowledge you need to complete many common test procedures...So water you waiting for?