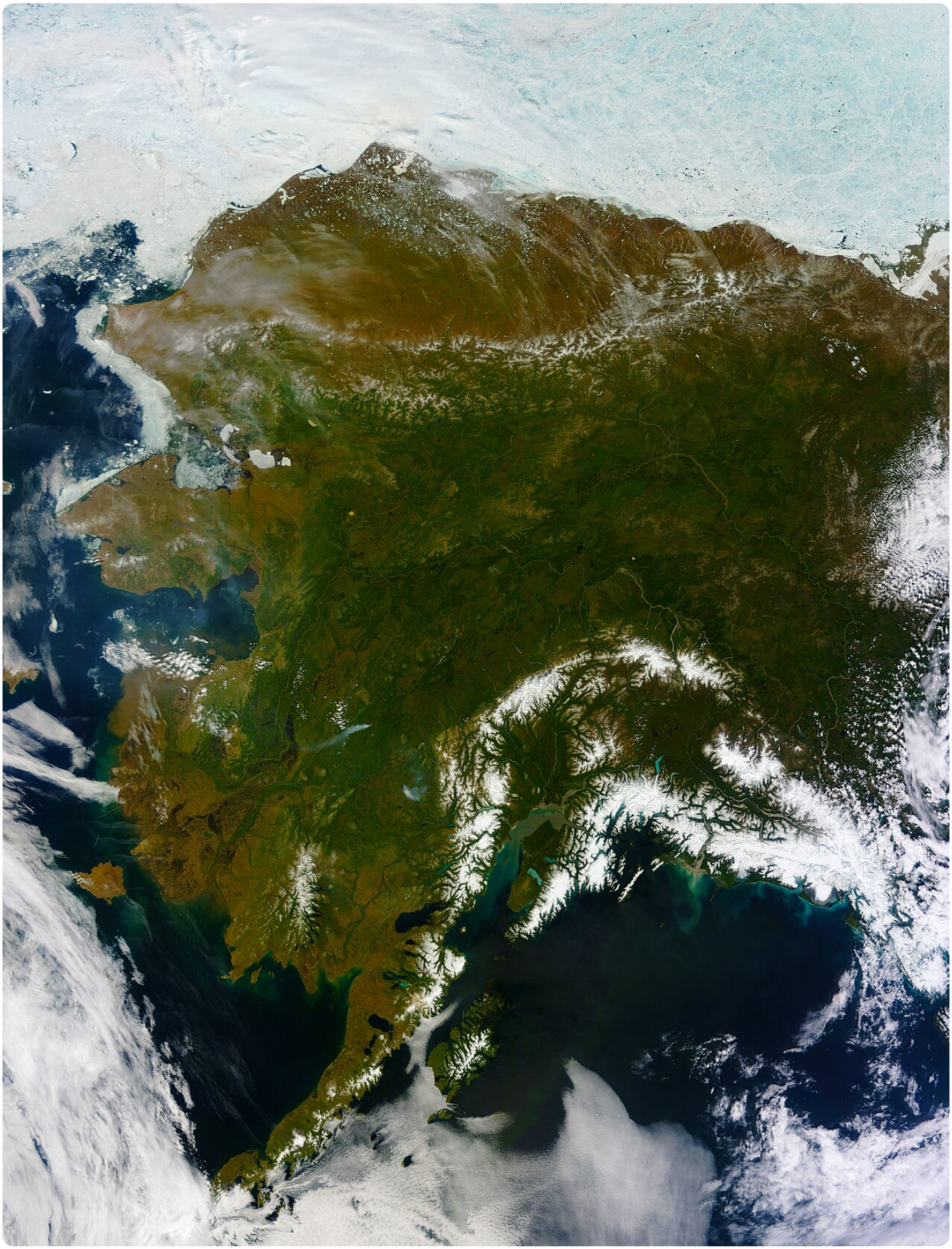
Water for Coffee: Chemistry, TDS, and Filtration



Coffee is more than 98 percent water by weight, and the chemistry of that water determines how much of the coffee actually ends up in the cup. Two brewers using the same beans, the same grinder, the same recipe, and the same technique will produce noticeably different cups if their water differs — and most of the time, water is the variable nobody is controlling.

The Specialty Coffee Association publishes a water quality standard, mineral content recommendations, and pH targets, but the underlying truth is simpler than the chemistry suggests. Water with too few minerals tastes flat and extracts poorly. Water with too many minerals tastes harsh and over-extracts certain compounds while under-extracting others. The window of "right" water is wider than purists claim, but it is not infinite, and the difference between water in the window and water outside it is the difference between coffee that sings and coffee that mumbles.

Coffee is 98.75% Water — and Most People Ignore It

A standard 250-gram cup of brewed filter coffee contains roughly 247 grams of water and just 3 grams of dissolved coffee solids. The cup is, by mass, almost entirely water. Anything dissolved in that water — minerals, chlorine, dissolved organics, off-flavors from old plumbing — sits in the cup alongside the coffee and contributes to what you taste. This is not a metaphor. If your tap water tastes faintly of chlorine, your coffee will taste faintly of chlorine. If your water is hard enough to leave deposits in a kettle, your coffee will taste subtly mineral and slightly bitter.


600ml
KIMAX
NO. 14000
APPROXIMATE VOLUMES
500ml
400
300
200
100

The flip side is that water with the right minerals does not just disappear into the background — it actively pulls flavor compounds out of the coffee grounds during extraction. Magnesium ions bind to certain flavor compounds and lift them into solution. Calcium ions do similar work with different compounds. Bicarbonate ions buffer acidity, smoothing the cup at the cost of some brightness. Get the balance right and the same coffee will reveal flavors that taste, in poor water, like they were not even there.

The SCA Water Quality Standards

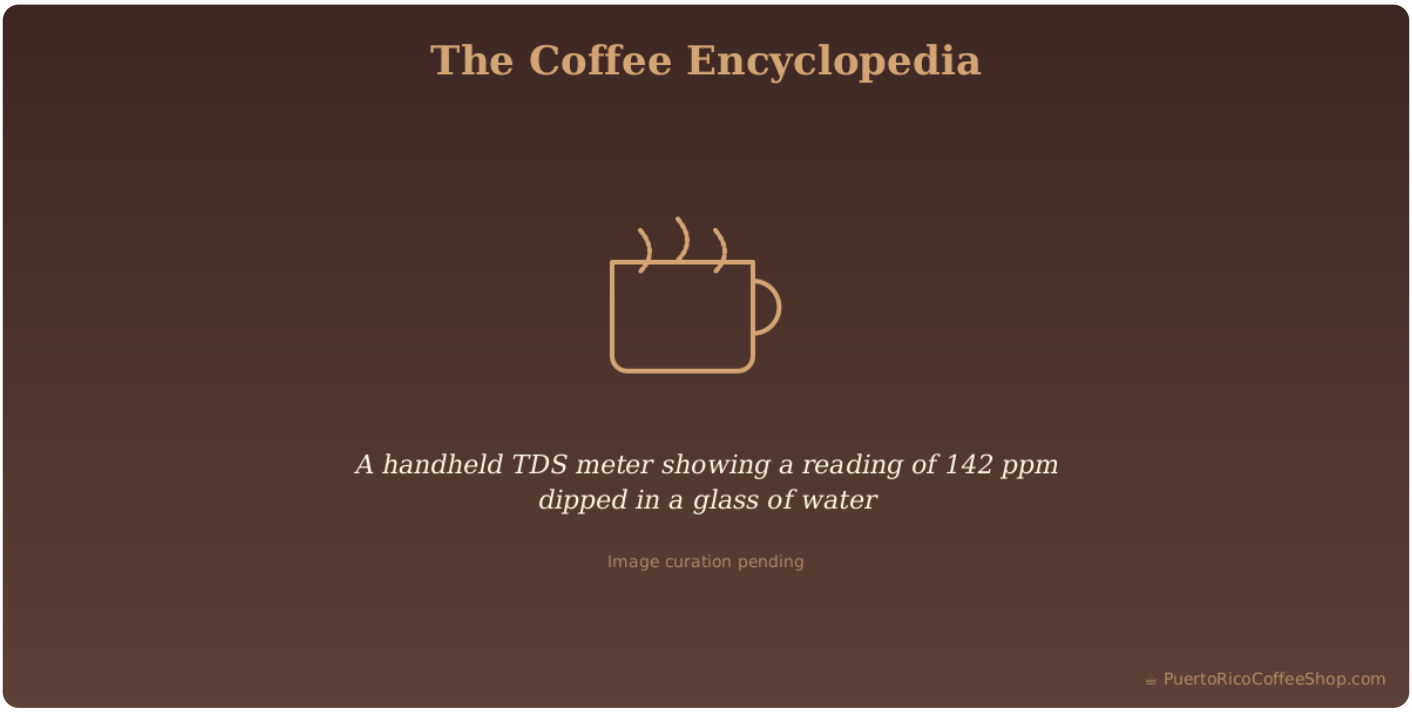
The Specialty Coffee Association published water quality standards in 2009 that remain the most widely cited reference for coffee water. The headline numbers are: total dissolved solids (TDS) of 75 to 250 parts per million, target around 150 ppm; total hardness of 17 to 85 ppm as calcium carbonate, target around 68 ppm; alkalinity of 40 ppm as calcium carbonate; pH of 6.5 to 7.5, target 7.0; chlorine 0 ppm; and zero noticeable odor.

These numbers describe a water profile that is mineral-rich enough to extract flavor effectively but soft enough to avoid scaling equipment or muting acidity. Most municipal tap water in the United States falls outside this range — usually too hard, sometimes too soft, and almost always with measurable chlorine. The standard is a target, not a law, and excellent coffee can be made with water that drifts somewhat outside these bounds, but using the standard as a north star will produce cleaner, more consistent results than ignoring water entirely.

Total Dissolved Solids (TDS) Explained

TDS is the total mass of all dissolved substances in a sample of water, measured in parts per million (milligrams per liter). It includes minerals (calcium, magnesium, sodium, potassium), bicarbonate ions, sulfates, chlorides, dissolved silica, and trace organics. A TDS meter is a small handheld device that measures electrical conductivity and converts it to a TDS estimate; it is not perfectly accurate (different ions conduct

differently), but it gives a useful single number for comparing water sources.



TDS below 50 ppm — distilled water, deionized water, water from extreme reverse osmosis — extracts coffee poorly because there are not enough mineral ions in solution to bind and lift flavor compounds. The cup tastes thin, hollow, and lacking body. TDS above 300 ppm — heavily mineralized municipal water, well water from limestone aquifers — over-extracts the wrong compounds, mutes acidity, and leaves a slightly bitter or chalky finish. The 75 to 250 ppm sweet spot is wide enough to accommodate most filtered municipal water and most quality bottled waters, which is why the SCA published the range it did.

General Hardness vs. Carbonate Hardness (GH vs. KH)

Total hardness is the sum of two related but distinct measurements. General hardness (GH) measures the calcium and magnesium ion concentration. These are the "permanent" hardness minerals that cannot be removed by boiling. Carbonate hardness (KH), also called alkalinity or buffering capacity, measures the bicarbonate ion concentration. Bicarbonate is what neutralizes acidity in the cup, which is why high-KH

water mutes the bright fruity notes of light-roasted single-origin coffee.

The interaction between GH and KH determines how a water "behaves" in coffee. High-GH, low-KH water gives an extracting punch from the calcium and magnesium without buffering away the acidity — this is bright, lively water that flatters African and Latin American coffees. High-GH, high-KH water — typical of municipal water in much of the United States — extracts well but mutes acidity, which can flatter dark roasts and Sumatra-style profiles but suppresses brightness in lighter coffees. Low-GH, low-KH water (soft mountain spring water, distilled water) under-extracts and produces thin cups regardless of the bean.

pH and Why It Matters Less Than You Think

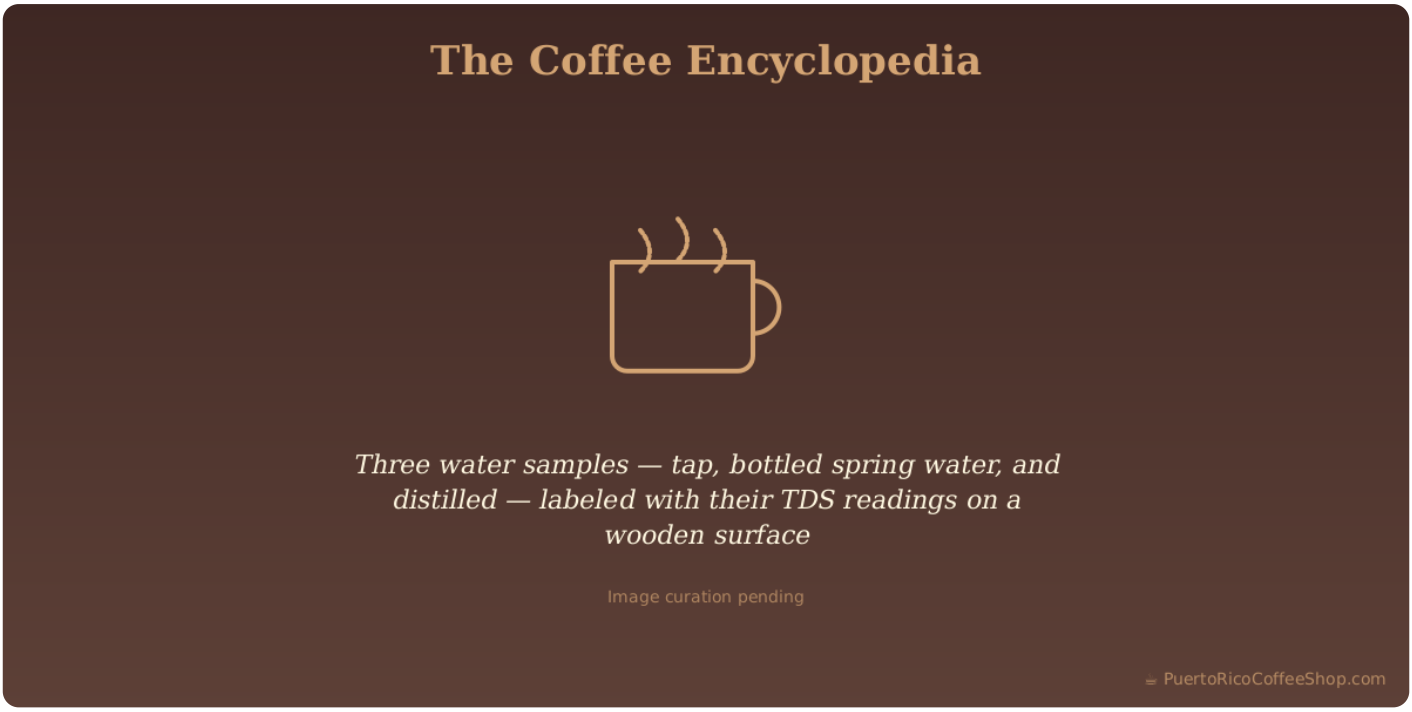
Coffee water pH gets discussed more than it deserves. The actual pH of brewing water has minimal direct impact on extraction, because the moment water meets coffee grounds, the dissolved acids in the coffee dominate the resulting solution and the original water pH becomes irrelevant. A water with a pH of 6.8 versus 7.2 will produce indistinguishable cups if the other variables — TDS, hardness, alkalinity — are similar.

Where pH does matter is as a proxy for other things. Very low pH water (5.5 or below) usually indicates dissolved CO2 and may be associated with corrosive behavior in espresso machines. Very high pH water (8.5 or above) usually indicates high alkalinity, which mutes acidity in the cup and contributes to scaling. Treat pH as a screening number — anything in the 6.5 to 7.5 range is fine — and spend your attention on TDS and hardness instead, which are the actual levers that move flavor.

Tap Water, Bottled Water, Distilled Water — A Comparison

Tap water varies enormously by region. Soft-water cities — Seattle, Portland, much of New England — have low-mineral water that often falls below the SCA range and

benefits from mineral addition. Hard-water cities — much of the Midwest, Texas, Florida — have high-mineral water that frequently exceeds the SCA range and benefits from filtration or dilution. Coastal cities sometimes have brackish water with elevated sodium that produces a faintly salty cup. The only way to know your tap water is to test it (TDS meter, hardness test strips) or to look up your municipal water report, which is published annually.



Bottled water varies by brand. Some natural spring waters fall almost perfectly within the SCA range and make excellent brewing water without modification. Others are far too soft (Fiji, Acqua Panna in many regions) or too hard (Evian, Vittel) for ideal coffee. Read the label — most quality bottled waters publish their mineral content, and you can pick the brand that lands closest to 150 ppm TDS with calcium and magnesium dominant.

Distilled water and deionized water have effectively zero dissolved solids. They are not suitable for direct brewing because they cannot extract coffee well, but they are the perfect blank canvas for building custom brewing water. The DIY brewing water approach starts with distilled and adds a measured mineral concentrate to hit a chosen

target — typically 80 to 100 ppm magnesium-and-calcium hardness with 40 ppm alkalinity, which produces a clean, bright, flexible water suitable for almost any coffee style.

Filtration Systems: Pitcher, Inline, Reverse Osmosis

Filtration covers a wide range of capabilities. Pitcher filters (Brita, Pur, similar) use activated carbon to remove chlorine and some organics, and ion-exchange resin to slightly soften hard water. They improve taste noticeably and are cheap, but they do not produce SCA-spec water from severely hard sources, and the filter capacity is limited — most pitcher filters need replacing every 40 to 60 gallons.

Inline carbon filters, installed under the sink or attached to a faucet, do similar work to a pitcher filter at higher capacity and without the daily refilling. They are the right answer for households where filtered water from the tap is preferable to a separate pitcher. Their limitations are the same: chlorine and organics out, but limited softening and no ability to add minerals.

Reverse osmosis (RO) systems use a semi-permeable membrane to remove almost everything from the water — chlorine, organics, minerals, dissolved gases. The output is essentially distilled-quality water at TDS readings of 5 to 20 ppm. For coffee, RO water needs remineralization to be drinkable as brewing water; the simplest solutions are blending a small amount of unfiltered tap back in, using a remineralization cartridge, or dosing with a mineral concentrate. RO systems are the gold standard for serious home setups in hard-water regions and for almost all commercial cafes, where they protect espresso machines from scaling damage worth tens of thousands of dollars over a machine's lifetime.

Building Your Own Brewing Water (Recipes)

The DIY brewing water approach takes distilled or RO water and adds measured minerals to hit a chosen profile. The simplest recipe uses two stock solutions: a hardness solution (Epsom salts and calcium chloride dissolved in distilled water) and a buffer solution (sodium bicarbonate dissolved in distilled water). A typical recipe is the "Rao-Perger water" approach, which targets approximately 80 ppm magnesium-and-calcium hardness with 40 ppm bicarbonate alkalinity by adding small measured volumes of each stock to a gallon of distilled water.

The advantages of building your own water are total control, perfect repeatability, and the ability to tune the profile to a specific coffee. A bright Ethiopian benefits from slightly higher hardness and lower alkalinity; a chocolatey Brazil benefits from slightly higher alkalinity. The disadvantages are the kitchen chemistry overhead and the modest cost of distilled water for daily use. For most home brewers, a quality bottled water in the SCA range is a more practical answer; for competitive brewers, cafe owners, and dedicated enthusiasts, DIY water is the level of control no other approach can match.

Water for Espresso vs. Filter Coffee

Espresso and filter coffee place different demands on water. Espresso brewing happens at high pressure and temperature in a closed system, which means scaling is a real and expensive risk — limescale buildup destroys boilers, group heads, and steam wands over time. For espresso, lower hardness is preferred, typically 50 to 100 ppm total hardness, with the alkalinity tuned to neutralize the very high acidity of pressurized extraction. Many commercial cafes run their espresso machines on RO water with carefully controlled remineralization for exactly this reason.

Filter coffee is more forgiving on equipment because no high-pressure heated boiler is involved, but it is less forgiving on flavor because the flavor compounds released by gentler extraction are more delicate. Filter brewing benefits from slightly higher hardness — the SCA target of around 150 ppm TDS sits right in the filter sweet spot — and from balanced alkalinity that does not mute acidity entirely. The same household

can absolutely use one water for both, but baristas chasing the last 5 percent of either machine longevity or flavor clarity often run separate water supplies.

https://www.youtube.com/embed/jfElZfrmlRs

Frequently Asked Questions

Can I just use my tap water?

Sometimes yes, often no. If your tap water is in the SCA TDS range (75 to 250 ppm), low in chlorine, and low in off-flavors, it is fine for coffee. If it tastes strongly of chlorine, has visible scale buildup in a kettle, or your municipal water report shows TDS above 300 ppm, you will get noticeably better coffee with filtered or bottled water.

Does brand of bottled water matter?

A lot. Read the label and pick water with TDS around 150 ppm, calcium plus magnesium hardness around 70 ppm, and alkalinity around 40 ppm. Many spring waters fall in this range; many do not. Distilled water and zero-mineral waters are not suitable for direct brewing.

Will a Brita filter give me SCA-spec water?

A pitcher filter removes chlorine and some organics and slightly softens hard water. It does not transform severely hard water into SCA-spec water, and it cannot add minerals to soft water. It is a meaningful improvement for most municipal tap water but not a complete solution if your starting water is far from the target range.

Do I need a TDS meter?

Helpful but not essential. A TDS meter costs little and tells you whether your water is in the right ballpark. Hardness test strips give similar information for less precision. If your coffee already tastes great, you do not need to measure; if it tastes off and you have ruled out grind, dose, and beans, water is the next variable to check.

Is bottled water for coffee wasteful?

For daily use at home, refilling a large jug from an in-home filtration system is more economical and ecological than buying single-use bottles. RO systems with remineralization or pitcher filters with the right starting water cover most needs. Single-use bottled water is best reserved for travel or as a diagnostic tool when troubleshooting a tough water situation.

Key Facts

- **Coffee is over 98 percent water by weight** in a brewed cup, making water chemistry the dominant variable after the bean itself.
- **SCA TDS target:** 75 to 250 ppm, ideal around 150 ppm.
- **SCA hardness target:** 17 to 85 ppm as calcium carbonate, ideal around 68 ppm.
- **SCA alkalinity target:** 40 ppm as calcium carbonate.
- **SCA pH target:** 6.5 to 7.5; pH alone has minimal direct effect on extraction.
- **Distilled water alone extracts poorly** — it lacks the minerals that bind and lift flavor compounds.

- **Reverse osmosis output** typically 5 to 20 ppm TDS; needs remineralization for brewing.
- **Espresso machines** prefer lower hardness (50 to 100 ppm) to prevent scaling.
- **Magnesium ions** are particularly effective at extracting flavor compounds from coffee.
- **Chlorine in water** carries directly into the cup and produces a faintly chemical, dulled flavor.

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