

Does water boil faster if you put salt in the water?

Yes and no. If you look at how fast water boils when you add a small amount of salt to it, such as when cooking your noodles, the change is insignificant between pure water and the salted water. However, if you take two identical pots and add one gallon of pure water to one pot and one gallon of 20 percent salt water to the other and heat the two pots on identical stoves, the pot containing the salt water will come to a boil first. Surprised?

To truly answer the question, one must look at what it takes to boil a container of water.

The time it takes a bucket of liquid to boil is controlled by essentially three things. The first is how much heat or energy you put into the bucket. The second is how fast the temperature rises in response to the heat input (the liquid's heat capacity), and the third is the boiling point of the liquid. Assuming that we can control our stoves and add the same amount of energy to each pot, this variable becomes insignificant.

The boiling point of water does rise if you add salt to it, but only by about 2°C (4°F) to 102°C (216°F). Remember, water boils at 100°C (212°F). This is an insignificant change for adding such a large amount of salt. For you science nerds out there, the boiling point increase is calculated using the "ebullioscopic" constant of water. This leads us to the important variable, how fast water or salt water heats up, or the solution's heat capacity.

The heat capacity of water is very high. What this means is that it takes a lot of energy to raise the temperature of water 1°C; in fact, the calorie is defined as the amount of energy that it takes to heat one gram of water to 1°C. Not to digress, but the high heat capacity of water is good, especially if you live on a planet where two-thirds of the surface is covered by water - it helps regulate the global temperature.

Now back to the question. If you look at the heat capacity of salt water, you will find that it is *less* than pure water. In other words, it takes less energy to raise the temperature of the salt water 1°C than pure water. This means that the salt water heats up faster and eventually gets to its boiling point first.

Why does salt water have a lower heat capacity? If you look at 100 grams of pure water, it contains 100 grams of water, but 100 grams of 20 percent salt water only contains 80 grams of water. The other 20 grams is the dissolved salt. The heat capacity of dissolved salt is almost zero when compared to the high heat capacity of water. This means that the heat capacity of a 20-percent salt solution is 80 percent that of pure water. Twenty percent salt water will heat up almost 25 percent faster than pure water and will win the speed race to the boiling point.

Please note that this will not hold true if you take two identical pots containing one gallon of water each and *add* the salt to one pot because then the volume of liquid in the salted pot will be greater than the one gallon starting point.

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