

What's Causing Those Awful Tea Stains?

Don Mercer
Associate Professor, Food Science
Kemptville Campus University of Guelph

Sometimes the idea for an article can be literally right under your nose. This is what happened while pondering the question a few weeks ago as I was drinking a mug of tea in the living room with my wife.

I've always noticed how my mug gets ugly brown stains on the inside of it, whereas there are no such stains from my wife's tea. Both are poured from the same pot, and the only difference is that I drink my tea black, but Jane prefers to add a small amount of milk.

Tea tannins are the real culprit here, but their positive attributes tend to outweigh the bad.

Tea tannins belong to a group of chemical compounds called "polyphenols" which are considered as beneficial due to their anti-oxidant properties. By reacting with various compounds produced within the body, they have been found to reduce damage at the cellular level, and also strengthen the body's immune system. For this reason, tea is considered to be a healthy beverage when consumed in moderation.

Getting back to the staining caused by tea – it really boils down (pun intended) to the water that is used in preparing the tea. Water that is "hard" has a high concentration of dissolved calcium carbonate, or limestone as it is commonly known. The calcium in the water can form chemical bonds easily, and it readily links up with the tannins in the tea to form an insoluble material that becomes deposited on the insides of mugs, cups, and teapots. With "soft" water, there is much less calcium available to react with the tannins, so there is less staining.

Since our well water is quite hard, this explains why my tea mugs get stained. Even using a small water treatment unit does not eliminate the problem completely.

However, the question still remains as to why the addition of milk in my wife's tea seems to prevent the problem from occurring. The answer lies with the proteins in the milk (such as casein), which can react to form tight bonds that effectively tie up the tannins. This prevents the tannins from bonding with the calcium in the water, and thereby avoids the tea-stains on the cups.

The next logical question concerns how to get rid of the stains once they occur. For our mugs, I tend to use dish detergent, paper towels, and good old-fashioned elbow-grease. Some people recommend making a paste from baking soda and rubbing the stains with

it. Unfortunately, the paste can act as an abrasive on fine china, creating a rough surface which may actually enhance the formation of stain deposits.

One of my favourite chemical reactions has always been mixing vinegar and baking soda – good old sodium bicarbonate (or sodium bicarbonate, as we have called it ever since our daughter mispronounced it when she was learning to read). Cleaning the teapot seemed like a really good excuse to get things foaming and frothing in the kitchen sink – don't do this on the countertop!

After emptying the teapot and rinsing it with hot water, I filled it about half-full with room-temperature vinegar, or acetic acid in chemical terms. Swishing the vinegar around got all the surfaces wet. I did this a number of times, and allowed the teapot to soak for a few minutes. Then, with the teapot of vinegar now in the sink, the *coup de grâce* was delivered. About two tablespoons or so of baking soda were dumped into the teapot which erupted in foam from the spout and through the top. Along with the foam came flakes of deposits from the inside of the teapot. When the foaming subsided, a bit more baking soda renewed the reaction before the pot was emptied. Hot tap water and a quick gentle scrub with a soft brush freed up most of the remaining deposits. Although the brush was slightly brown, the colour washed off easily. A final rinse with boiling water completed the task. Just as a warning: don't use a good cloth towel to wipe the inside of the teapot.

Some weekend if you find yourself with time on your hands and boredom setting in, this may be just what you need to stir things up a bit. You'll even have a clean teapot to show for your efforts.



A clean mug can soon become stained after a few cups of tea.