

I'm from Massachusetts, where we pride ourselves on having started the Revolution. Among the most prominent and colorful of Boston's escalating acts of disobedience was the Boston Tea Party. Like it is today, tea was huge deal back then. It was consumed on a daily basis by an overwhelming percentage of colonists. In Boston, a thriving port, the importation of tea was big business. So, when the King imposed a hefty new tax on tea, it not only disrupted the lives of everyday colonists, it threatened their livelihoods.

In revolt, Bostonians blockaded the harbor and refused to allow the unloading of tea. Dressed as natives, a group of patriots boarded three British ships and dumped around [92,000 pounds of tea](#) into the harbor. These actions energized Boston but angered the King. Tensions rose. Soon, in Lexington, a shot was fired that was heard around the world. The founding of our nation was steeped in tea.



No taxation without representation! Image Credit: Flickr User [Lee Wright](#) (CC BY 2.0)

Spectrophotometers Assess the Oxidation of Tea Leaves

In today's world, more than coffee, more than beer, more than Coca-Cola, tea is King (it sure isn't George III anymore). Having played a major role in global affairs for centuries, tea still thrives as the second most consumed¹ beverage in the world, behind water. The resulting enormous volume of tea grown, imported, and processed requires highly efficient processes. Fast, reliable quality control is essential for manufacturers, to keep deliveries on time and up to specification. That's why manufacturers often rely on spectrophotometers to quickly and accurately assess the color of their tea leaves.

Manufacturers measure the color of their leaves because color is indicative of the oxidation stage of a tea leaf. The oxidation of a tea leaf² indicates of the final properties of a cup of tea, including color, flavor, and caffeine content. This is because all tea is made from the leaves of the same plant, *Camellia sinensis*. Green tea, black tea, white tea, and red tea are only differentiated by the preparation of the leaf.

So, manufacturers can reliably distinguish types and batches of tea leaves by measuring their color. This ensures that their batches have been processed correctly. Finally, it guarantees consistency batch to batch over commodity-scale quantities and decades of production.

Without accurate, objective analysis, manufacturers will lose revenue. Batches of tea that fail to meet client standards for consistency and quality can be rejected. Repeated failures can cause clients to begin looking for other manufacturers. Likewise, failing to detect a processing error, such as a mistake in drying temperature or timing, can damage entire batches. It's unlikely any single error will be harmful to a manufacturer as losing 46 tons of tea, around \$1.7 million in today's dollars, was to the British East India Company. Over years, a manufacturer's small losses can easily add up to a greater total amount of lost tea than in the Boston Tea Party. To avoid this, manufacturers use spectrophotometric analysis to eliminate measurement errors. It's easier than going to war.



Different levels of oxidation result in different types of tea. Image Credit: Flickr User [H.C.](#) (CC BY 2.0)

Instruments Improve on the Human Eye in Tea Leaf Color Quality Control

These crucial color assessments are most often performed by instrumental analysis. More ably than the human eye, spectrophotometers assess color by measuring the light reflected from objects. Tea color quality control requires discerning slight differences in color for extended periods of time. Unlike the human eye, whose objectivity is variable, spectrophotometers perform objective, repeatable measurements based on controllable instrumental variables. As a result, they are more reliable than human observers. For accurate color measurements of tea, we recommend using directional [45°/0° reflectance geometry](#).

Instead of relying on comparisons to printed scales, spectrophotometers allow manufacturers to compare tea leaves to digital tolerance standards. These standards can be programmed into the machine itself. Portable instruments can take many readings each minute, and rapidly determine whether the tea meets standards. These readings can be assessed separately or averaged together. The speed and ease of this method have allowed manufacturers to easily incorporate it into their processes without sacrificing efficiency.

HunterLab has been building spectrophotometers for over 65 years. In that time, they have worked extensively with the tea industry, and have developed measurement devices ideally suited to the needs of tea manufacturers. To find the perfect solution or upgrade for your manufacturing process, [contact the experts at HunterLab](#).

1. "Tea Fact Sheet," 2017, <http://www.teausa.com/14655/tea-fact-sheet>
2. "What Is Oxidation?" 2012, <https://www.worldoftea.org/tea-leaves-oxidation/>