Temperature, humidity affect health benefits of green tea powders

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The beneficial compounds in green tea powders aren't as stable as once thought, according to a Purdue University study that will give industry guidelines on how to better store those powders.

"People drink green tea for health benefits, so they want the catechins to be present," said Lisa Mauer, a professor of food science. "The instant powder beverages are becoming more popular for consumers, and it's important to know how storage can influence nutrition of your products."

Catechins are the source of antioxidants thought to fight heart disease, cancer, diabetes and other health problems. Green tea powders are often used as ingredients in products that are flavored like green tea or tout the health benefits of the tea. U.S. imports of green tea increased more than 600 percent from 1998 to 2007, according to the U.S. Department of Agriculture.

Mauer found that increased temperature ⏫ and humidity, to a smaller degree ⏫ speed catechin degradation. She said it had been believed that the powders were stable below the glass transition temperature, the temperature at which an amorphous solid changes from a rigid, glassy state to a rubbery, viscous state. In that rubbery state, compounds may start reacting with each other faster due to increased molecular mobility, leading to significant chemical degradation.

But Mauer's findings, reported in the early online version of the *Journal*

of Agricultural and Food Chemistry, showed that green tea powder degrades at lower temperatures, even below the glass transition temperature.

"Tea powders are not infinitely stable below their glass transition temperature. They degrade more slowly below that temperature, but they can still degrade," Mauer said.

Catechin concentrations were tracked using high-performance liquid chromatography. The method involved dissolving the green tea powder into a solution, which then passed through a column. Compounds moved at different rates and could be measured.

More than 1,800 powder samples were stored at varying temperature and humidity combinations for up to 16 weeks and then measured for catechin loss. Those at the highest temperatures and humidities lost the most catechins.

From those results, models were built to predict the rates at which catechins would be lost at different storage conditions. Mauer said those in the food industry could use the models to predict the amount of catechins and the likely health benefits in green tea powder at the time it is used.

"Knowing what's happening to the ingredients is extremely important for understanding the quality of a food or beverage product," she said.

Mauer said she would next look at what the catechins become once they degrade and how those new compounds affect nutritional qualities.

More information: Degradation Kinetics of Catechins in Green Tea Powder: Effects of Temperature and Relative Humidity, by Na Li, Lynne S. Taylor and Lisa J. Mauer

ABSTRACT

The stability of catechins in green tea powders is important for product shelf life and delivering health benefits. Most published kinetic studies of catechin degradation have been conducted with dilute solutions and, therefore, are limited in applicability to powder systems. In this study, spray-dried green tea extract powders were stored under various relative humidity (RH) (43–97%) and temperature (25–60 °C) conditions for up to 16 weeks. High-performance liquid chromatography (HPLC) was used to determine catechin contents. Catechin degradation kinetics were affected by RH and temperature, but temperature was the dominant factor. Kinetic models as functions of RH and temperature for the individual 2,3-cis-configured catechins (EGCG, EGC, ECG, and EC) were established. The reaction rate constants of catechin degradation also followed the Williams–Landel–Ferry (WLF) relationship. This study provides a powerful prediction approach for the shelf life of green tea powder and highlights the importance of glass transition in solid-state kinetics studies.

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