



Color And Volatile Changes Due To Excessive Heating Of Tea Concentrate

Sensus Technical Note (SEN-TN-0009)

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ABSTRACT

A 45°C tea concentrate was heated for 1 hour at 85°C in order to observe any color or volatile changes. There was a significant increase in color, but little volatile changes. Of particular interest is if any caramelization products are formed. Evidence indicates that little to no such compounds are formed. This is due to the very low carbohydrate content of tea.

INTRODUCTION

Tea color is one of the primary quality factors people use to judge tea. Dark tea is better than light tea for most consumers. In an ongoing effort to learn more about what affects tea color, tea concentrate was heated to see if there was an increase in darkness. If so, were the color changes due to caramelization or some other chemical reaction.

MATERIALS AND METHODS

Tea concentrate (45°B) was heated for 1 hour at 85°C. Volatiles were measured using the company GC-MS system. A Gerstel MultiPurposeSampler (MPS-2) (Baltimore, MD) was used with a 1-cm 3-phase (divinylbenene, Carboxen, Polydimethylsiloxane) for sample preparation. A 10-min incubation followed by a 40-min exposure was used to capture the volatiles on the fiber for injection into the GC. The sample was stirred using a 3x12mm stirbar in the 20mL vial. The fiber was desorbed for 5-min in the GC injector for 5 min. An Agilent 7890A gas chromatograph (Palo Alto, CA) was used for the analysis. Analysis was performed in the splitless mode with a helium flow rate of 1.25mL/min through a 60mx0.25mmx0.25µm RTX-5ms column. The initial oven temperature was 50°C immediately followed by a 4°C/min temperature ramp to 170°C which was followed by a 100°C/min ramp to 250°C and held for 5min in order to ensure no sample to sample contamination. The transfer line to the Leco TruTOF MS (St. Joseph, MN) was held at 240°C. Data was collected for 30-250 *m/z* at an acquisition rate of 10 spectra per sec. Identification was based on a combination of MS library matching along with reported retention indices.

Color changes were determined by measuring the absorbance at 460 nm using a ThermoElectron Genesys 6 UV-VIS Spectrophotometer (Minneapolis, MN) and determine the Hue. Hue is:
Hue=10*log(A510/A610)

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RESULTS AND DISCUSSION

Figure 1 is an overlay of the cooked and un-cooked tea concentrate showing very minor differences in the volatile profile after 1 hour of heating. One of the questions is if any caramelization occurs by heating the tea concentrate. As there are little to no carbohydrates in tea concentrate, the color change was determined to not be caramelization.

Figures 1. Cooked (green) and uncooked (red) tea concentrate "fingerprints"

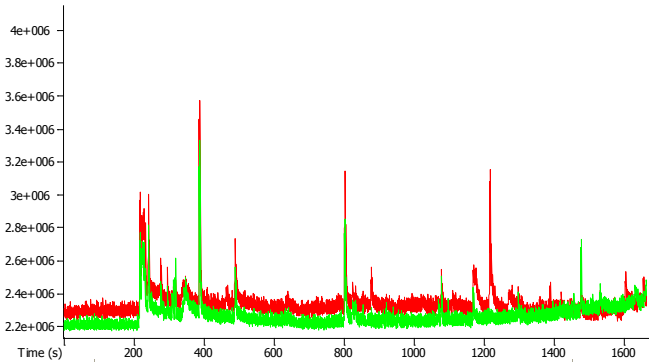


Figure 2. Furfural (525s) and 2-acetylfuran (670s) for cooked (green), uncooked (red) tea concentrate, and caramel color chromatograms

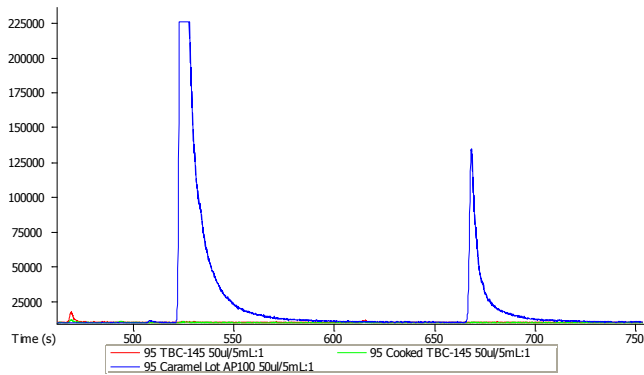
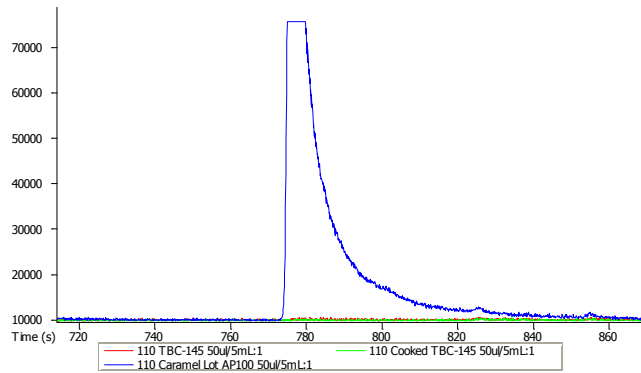


Figure 3. 5-methylfurfural (780s) for cooked (green), uncooked (red) tea concentrate, and caramel color chromatograms



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Figure 4. 5-Methyl-2(5H)-furanone (728s) for cooked (green), uncooked (red) tea concentrate, and caramel color chromatograms

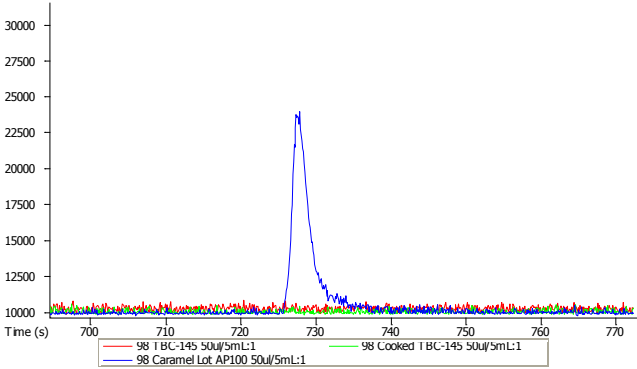


Figure 5. 5-HMF (1350s) for cooked (green), uncooked (red) tea concentrate, and caramel color chromatograms

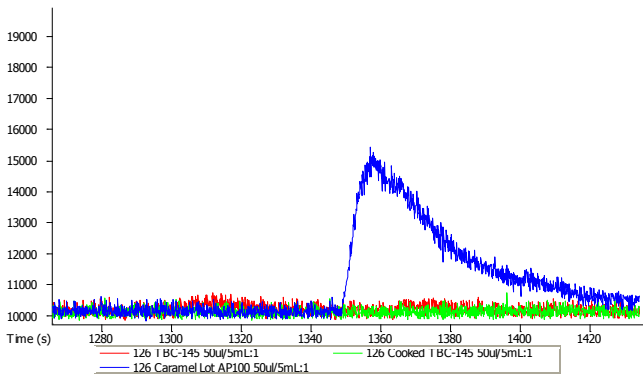


Table 1. Color changes of TBC-145 due to cooking.

Product	Color	Hue
Uncooked tea concentrate	9.43	2.82
Cooked tea concentrate	11.26	2.67

REFERENCE CITED

Goodner, K.L.; Wampler, B.D . Measuring Tea Color Using A Simple Spectrometric Assay. 2008. SEN-TN-0002.