

Analysis of Chlorogenic Acid in Coffee

Chlorogenic acid (3-caffeoylquinic acid) is one of the polyphenol compounds widely distributed in higher plants. Coffee, potatoes, and sweet potatoes contain a large amount of chlorogenic acid. It is one of the flavor components in coffee and is responsible for the discoloration of peeled potatoes. The antioxidant effects of chlorogenic acid have attracted recent

attention and a variety of research has been conducted into its efficacy.

This Application News introduces analysis examples of three components in processed coffee using the Photodiode Array UV-VIS Detector SPD-M10AVP. The analyzed components are chlorogenic acid, caffeine, and caffeic acid (3,4-dihydroxycinnamic acid).

■ Simultaneous Analysis of Chlorogenic Acid, Caffeine, and Caffeic Acid

Chlorogenic acid is a polyphenol compound comprised of caffeic acid and quinic acid. While many isomers and analogs exist, this analysis was conducted on 3-caffeoylquinic acid*, which is commonly dubbed "chlorogenic acid." Fig. 1 shows the structure of 3-caffeoylquinic acid.

Fig. 2 shows the chromatograms for a standard mixture of chlorogenic acid, caffeine and caffeic acid. The standard mixture was prepared by dissolving each component to 50mg/L in a phosphate buffer (A in Table 1) with a small amount of added acetonitrile. 10 μ L of the standard was injected. 270nm is near the maximum absorption wavelength of caffeine and 325 nm is that of chlorogenic acid and caffeic acid. Table 1 shows the analytical conditions. Actual samples require gradient elution because chlorogenic acid and caffeic acid must be separated from impurity components in the samples.

* While chlorogenic acid is occasionally called "5-caffeoylquinic acid," here it is denoted "3-caffeoylquinic acid" in accordance with "Merck Index 13th Ed".

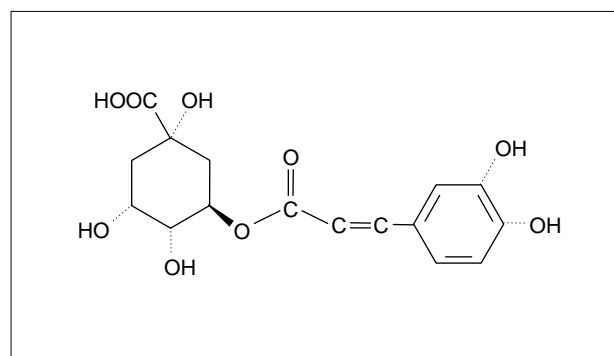


Fig.1 Structure of Chlorogenic Acid

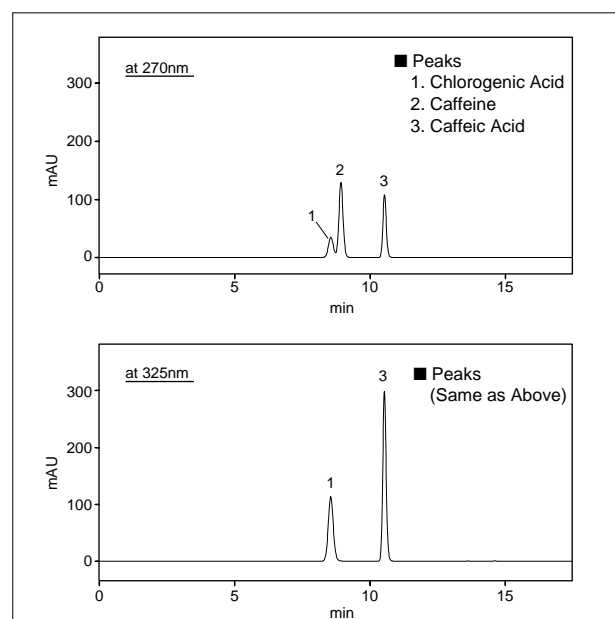


Fig.2 Chromatogram of a Standard Mixture of Chlorogenic Acid, Caffeine and Caffeic Acid (50mg/L each, 10 μ L Inj.)

Table 1 Analytical Condit

| | |
|--------------|---|
| Column | : Shim-pack VP-ODS (150mmL. \times 4.6mmI.D.) |
| Mobile Phase | : A : 10mM (Sodium) phosphate buffer (pH 2.6) B : Acetonitrile |
| | (Time Program of Low Pressure Gradient) |
| Time (min) | B Conc. (%) |
| 0 | 10 |
| 5 | 10 |
| 15 | 30 |
| 15.01 | 70 |
| 18 | 70 |
| 18.01 | 10 |
| 25 | stop |
| Flow Rate | : 1.0 mL/min |
| Column Temp. | : 40 $^{\circ}$ C |
| Detection | : SPD-M10AVP at 270nm and 325nm |

■ Analysis of Coffee Beans and Coffee Beverages

Fig.4 shows the analysis of a canned coffee beverage. Fig. 5 shows spectra of a chlorogenic acid standard and that in the coffee beverage. Figs. 6 and 7 are the chromatograms of instant coffee granules and coffee beans. 10 μ L of each sample was injected after preparation according to the procedure in Fig. 3.

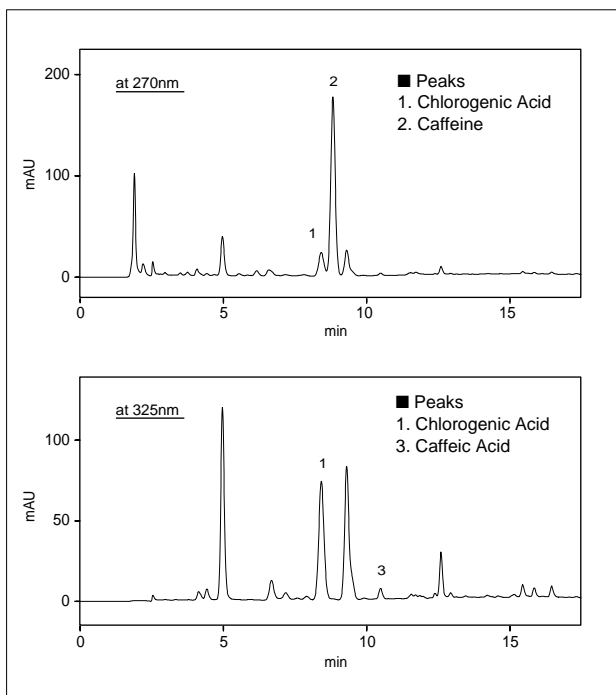


Fig.4 Chromatograms of Canned Coffee

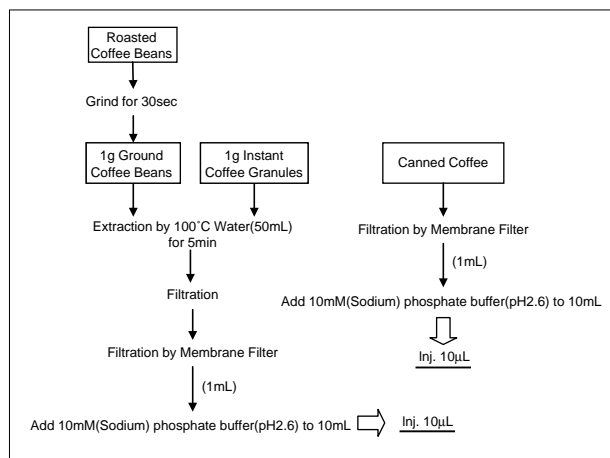


Fig.3 Sample Preparation

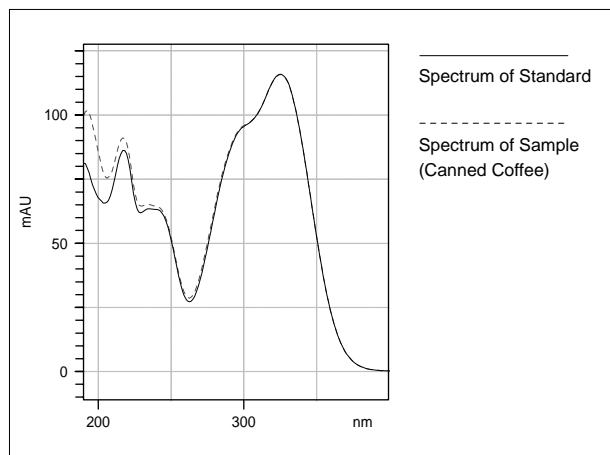


Fig.5 Spectra of Chlorogenic Acid

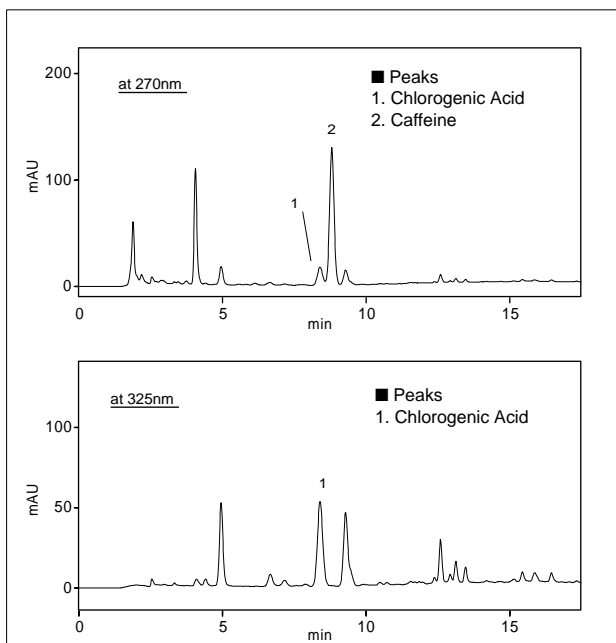


Fig.6 Chromatograms of Instant Coffee Granules

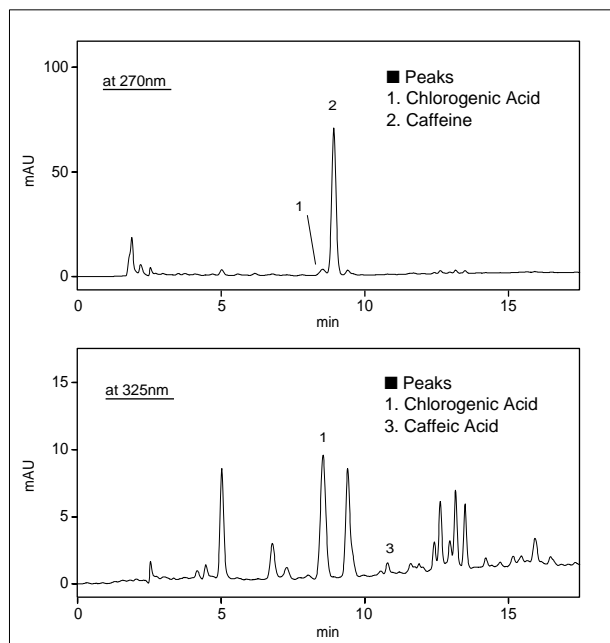


Fig.7 Chromatograms of Coffee Beans