Calculation of the Mixture Ratio of Turmeric Powder by 3D Fluorescence Spectrum (EEM)

INTRODUCTION

Turmeric is a kind of spice processed from ukon, a plant of the ginger family. Turmeric contains a yellow colored curcumin and widely used as a spice for curry, etc. and a colorant. Its anti-inflammatory and antioxidant effects are also expected recently and its use as a raw material for drinks and health food is drawing attention.
On the other hand, researches to assess the origin, freshness, and variety based on the fluorescence intensity distribution (fluorescence fingerprint) of the 3D fluorescence spectrum are being conducted.[1)] In this method, the analysis is conducted based on the fluorescence intensity ratios at multiple excitation and fluorescence wavelengths. This time, the 3D fluorescence spectra of autumn ukon (turmeric powder) and spring ukon (wild turmeric powder) were measured and the mixture ratio was estimated by applying the fluorescence wavelength specific to spring ukon. Hitachi F-7000 Fluorescence Spectrometer has the fastest throughput for 3D fluorescence spectrum analysis in the instrument class (about 4 minutes for the analytical conditions introduced this time) and is used in a wide application range from cutting edge researches to quality control.

1) "Estimation of the Mixture Ratio of Buckwheat Powder and Flour Based on the Excitation-fluorescence Matrix," *Journal of the Japanese Society for Food Science and Technology*, vol. 57. Issue no. 6, pp. 238-242 (2010)

SAMPLE	ACCESSORY
Sample: turmeric powder	Solid sample holder (P/N: 650-0161) 

ANALYTICAL CONDITIONS

Instrument	: F-7000				
Excitation wavelength range	: 250 - 800 nm	Scan speed	: 60000 nm	Filter	: L42
Fluorescence wavelength range	: 300 - 800 nm	Response	: Automatic	Full scale	: 2000
Slit on excitation side	: 5 nm	Detector	: R928F	Contour line interval	: 5
Slit on fluorescence side	: 5 nm	Photomultiplier Voltage	: 400 V		

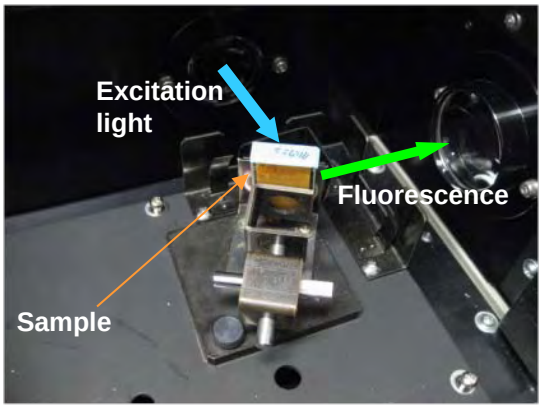

Figure 1: Appearance of Sample Setup

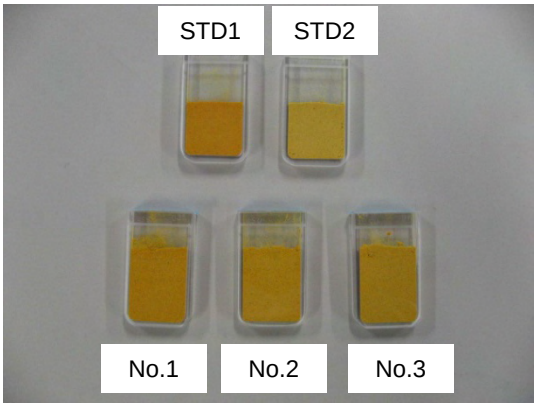

Figure 2: Sample Appearance

The auto-fluorescence of the sample powder was directly measured without any preparation such as component extraction/dissolution, fluorescence labeling, etc.

KEY WORDS
Bio/Medical Science/Food/Pharmaceutical, Food, Turmeric, Ukon, Fluorescence Fingerprint, Food Inspection, Determination of Origin, Mixture Ratio, 3D Fluorescence Spectrum, Excitation-Emission Matrix, EEM, FL, F-7000

Fluorophotometer (FL)

Sheet No. FL130001-01

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The fluorescence peak (fluorescence fingerprint) characteristic to spring ukon was confirmed at the excitation wavelength of 340 nm and the fluorescence wavelength of 440 nm (WL1). STD1 is 100% autumn ukon and STD2 is 100% spring ukon. The calibration curve was generated based on the STD1 and STD2 and the mixture ratio was calculated based on the fluorescence intensity of the powder mixture of spring ukon and autumn ukon. The powder mixtures were prepared at the compositions of 25%, 50%, and 75% spring ukon. The analysis results indicated that, while there are errors of a few %, the values close to the theoretical ratios of the powder mixtures were obtained. By using the fluorescence fingerprint characteristic to a sample, the mixture ratio of a powder mixture can be estimated.

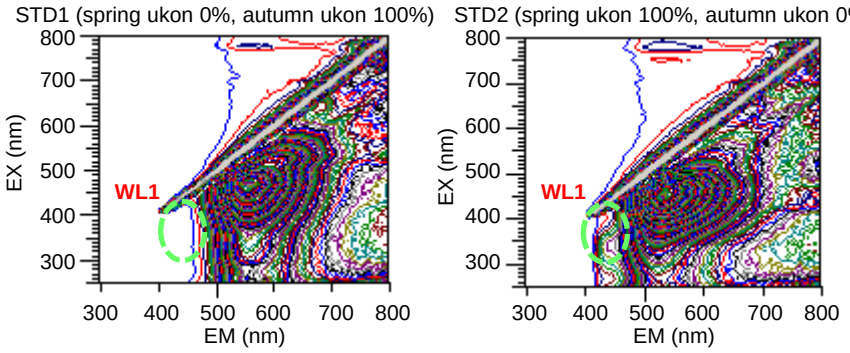

Figure 3: 3D Fluorescence Spectrum of Turmeric Powder

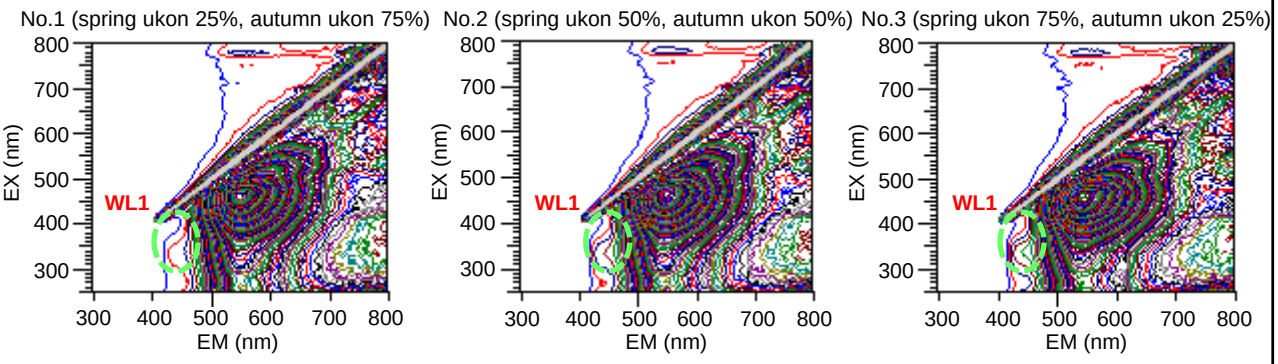

Figure 4: 3D Fluorescence Spectrum of Turmeric Powder Mixture

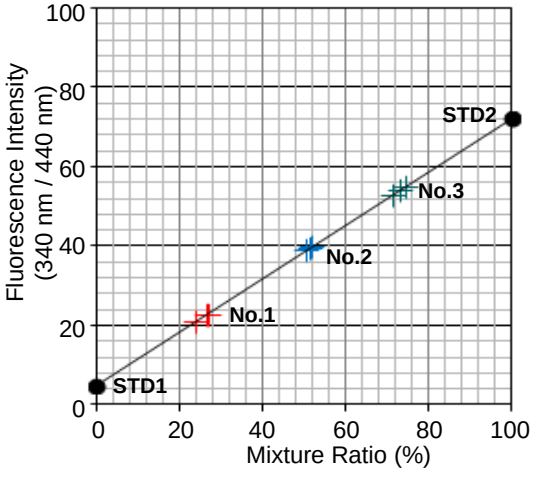

Figure 5: Calculation of Mixture Ratio by Calibration Curve

Table 1: Fluorescence Intensity of Each Sample
(WL1: Ex 340 nm / Em 440 nm)

	STD1	STD2	No.1	No.2	No.3
1	5.51	72.58	22.90	39.86	54.10
2	4.68	72.76	20.96	39.51	55.15
3	4.91	71.29	22.98	38.94	53.05
Mean	5.04	72.21	22.28	39.44	54.10

Table 2: Calculation Results of Mixture Ratio
(Spring Ukon Mixture Ratio)

	No.1	No.2	No.3
1	26.6	51.8	73.0
2	23.7	51.3	74.6
3	26.7	50.5	71.5
Calculated value of mixture ratio	25.7	51.2	73.0
Theoretical mixture ratio	25.0	50.0	75.0

KEY WORDS
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Fluorophotometer (FL)

Sheet No. FL130001-02