Distinction of Turmeric Powder by 3D Fluorescence Spectrum

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 type of a food 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 several commercially available turmeric powders and curcumin, a major component of turmeric powder, were measured and the types were classified by applying this method. Hitachi F-7000 fluorescence spectrophotometer 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 mixing 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, p-238-242 (2010)

Sample	Accessory
Sample: Turmeric powder Curcumin (Wako, Osaka, Japan)	Solid sample holder (P/N: 650-0161)

Analytical Conditions

Instrument : F-7000	Scan speed : 60000 nm	Filter : L42
Excitation wavelength range	Response : Automatic	Full scale : 2000
: 250 - 800 nm	Detector : R928F	Contour line interval : 5
Fluorescence wavelength range	Photomultiplier Vol. : 400 V	
: 300 - 800 nm		
Slit on excitation side : 5 nm		
Slit on fluorescence side		
: 5 nm		
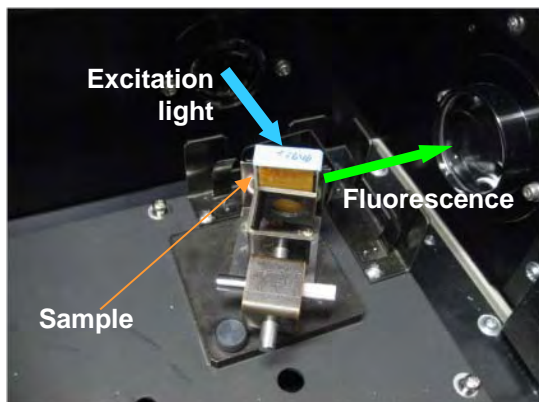
Figure 1 Appearance of Sample Setup

Figure 2 Sample Appearance

Fluorophotometer FL

Sheet No. FL120007-01

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Distinction of Turmeric Powder by 3D Fluorescence Spectrum

The 3D fluorescence spectra of 6 samples, including 4 kinds of turmeric powder of which raw material is autumn ukon, 1 kind of turmeric powder of which raw material is spring ukon, and curcumin powder, were measured. The 3D fluorescence spectra were studied by focusing on 4 sets of excitation and fluorescence wavelengths. The wavelength 1 (WL1) is the fluorescence fingerprint which was confirmed in sample E and the wavelength 2 (WL2) and wavelength 3 (WL3) are the fluorescence fingerprints originating from curcumin. The wavelength 4 (WL4) was extracted as all the samples showed fluorescence at that wavelength.

When the spectra were studied focusing on the fluorescence intensity, it was confirmed that sample E showed the most intense fluorescence at WL1.

Sample C was found to have the most intense fluorescence at WL2 and WL3, suggesting a high curcumin content.

On the other hand, sample D showed the most intense fluorescence at WL4, suggesting the possible fluorescence caused by a component other than curcumin.

The fluorescence intensity ratio at each wavelength was calculated by using the intensity at WL1 as the base. The fluorescence intensity ratio was found to be specifically low only for sample E. It is difficult to judge based on the sample appearance shown in Figure 2. However, by obtaining the 3D fluorescence spectra, turmeric powders can be classified into the powders from autumn ukon and those from spring ukon.

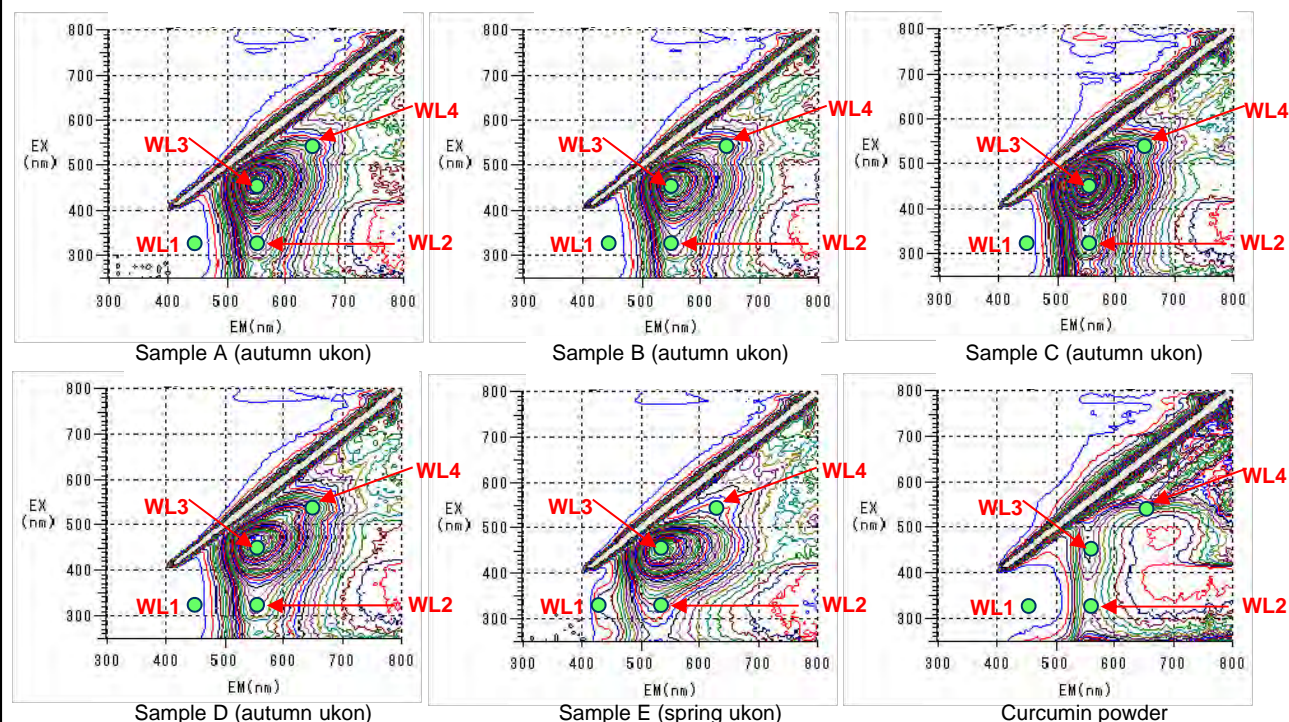* Turmeric powder prepared from spring ukon as the raw material is sometimes called wild turmeric.

Figure 3 3D Fluorescence Spectrum of Each Sample

Table 1 Fluorescence Intensity and Fluorescence Intensity Ratio of Each Sample

		A	B	C	D	E	F
WL1	340-440	3.341	2.675	4.309	3.928	**37.22**	1.244
WL2	340-550	215.2	200.1	**300.2**	190.1	131.8	39.23
WL3	455-550	446.1	396.2	**583.9**	402.1	371.2	51.21
WL4	550-640	143.8	157.8	173.5	**193.4**	116.4	46.59

* The number in red indicates the highest fluorescence intensity at the wavelength.

Ratio1	WL2:WL1	64	75	70	48	4	32
Ratio2	WL3:WL1	134	148	136	102	10	41
Ratio3	WL4:WL1	43	59	40	49	3	37

KEY WORDS
Bio/Medical Science/Food/Pharmaceutical, Food, Turmeric, Curcumin, Ukon, Fluorescence Fingerprint, Food Inspection, Determination of Origin, 3D Fluorescence Spectrum, FL, F-7000

Fluorophotometer FL

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