Application Note

No. 080DR0156-E

Determining Water Content Starch by Diffuse Feflectance using Optical Fiber

Because water content can be used identify a starch of unknown type, determining the water content of starch is very important in the quality control of processed food. Therefore, the following method was used in an attempt to determine the water content of several starches. First, NIR spectra were measured using a diffuse reflectance attachment equipped with optional fiber. The optional fiber simplified sample measurement. Next, the water content of each starch was approximated using the partial Least squares method(PLS), a multivariate analysis method.

Measurement equipment

Instrument: FT/IR
Optical Fiber: GALILEO Electro-optics Corporation
Light source: Halogen lamp
Detector: MCT

Figure 1 shows the diffuse reflection attachment equipped with optical fiber that was used in the present study. Power samples were mounted on the optical fiber and measured by relative diffuse reflectance. The obtained spectra were then compared to that of a standard white plate. Eighteen different starches, including samples produced by reagent companies and processed starches, were analyzed in the present study. The actual water contents of these starches were determined according to the following method :

(1) The mass of each of the starches was measured using an analytical balance.
(2) The starches were then dried at 115℃ for 15 hours.
(3) The mass of each of the starches was once again measured using an analytical balance.
(4) The water content of each starch was obtained as the difference in mass between.

Figure 2 shows the NIR spectra obtained in the present experiment. The OH group at the 5200 cm^{-1} absorption band reveals a strong dependence on water content. Figure 3 shows the correlation between the water contents obtained using the proposed method and actual value obtained through the conventional water content measurement method for the wavelength range of 4900 - 5200 cm^{-1}. Multivariate analysis is widely used in food analysis to determine the individual components of a sample. Moreover, Modifications such as arranging sample particle diameters or controlling temperature and moisture can be applied to obtain better correlation results. However, due to the preliminary nature of the present study, no such modifications were performed in the present method. The results of present study show that multivariate analysis is a very effective method for determining an individual component when no information is available concerning the other components.

Fig.1 Diffuse reflection attachment

Table 1

No.	Samples	Water content (%)
1	Amyropectin	10.496
2	Amylose	8.002
3	Processed starch 1	4.226
4	Processed starch 2	5.978
5	Processed starch 3	0.578
6	Processed starch 4	5.115
7	Processed starch 5	3.398
8	Processed starch 6	2.441
9	Processed starch 7	4.418
10	Corn	11.915
11	Potato	15.906
12	Rice	6.201
13	Sweet potato	11.780
14	Wheat	12.361
15	Processed starch 8	2.943
16	Processed starch 9	4.174
17	Processed starch 10	6.702
18	Processed starch 11	4.603

JASCO INTERNATIONAL CO., LTD.
4-21, Sennin-cho 2-chome, Hachioji, Tokyo 193-0835, Japan
Tel: +81-42-666-1322, Fax: +81-42-665-6512

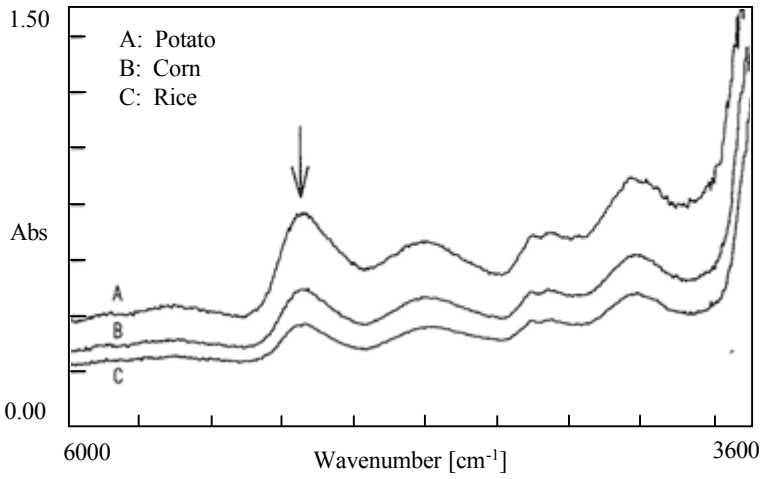

Fig.2 NIR Spectra

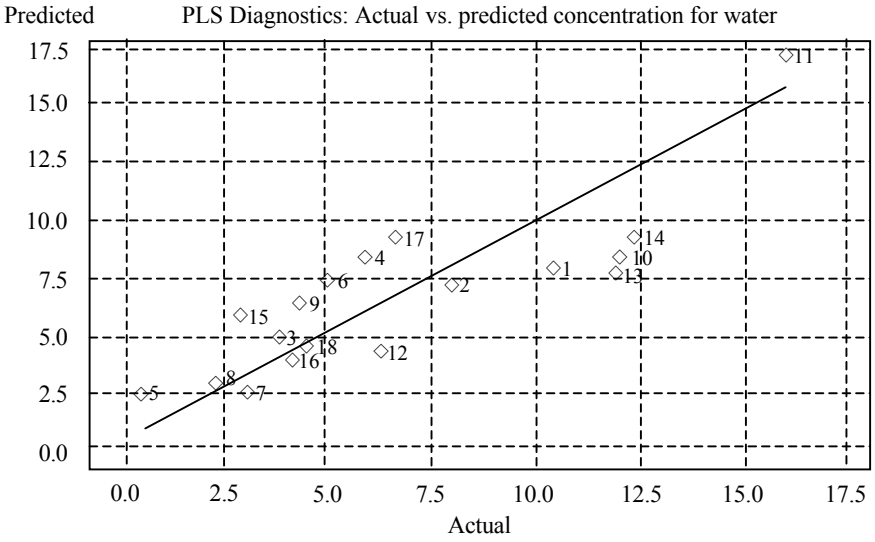

Fig.3 Multivariate analysis result (PLS method)