

Determination of Isoflavone Contents in Soybean Seed, Using Near Infrared Reflectance Spectroscopy

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Objectives :

The objectives of this study were to determine the potential use of near infrared reflectance spectroscopy(NIRS) for isoflavone analysis in soybean seed, and to provide the efficient large scale screening technique for selection of high quality soybean.

Materials and Methods :

Materials : 298 accessions (ground soybean seed samples)

Isoflavone analysis : RP-HPLC(Column: YMC-ODS AM 303, Hydrolysis: 1N-HCl) method

Scanning of NIRS spectra : NIRSystem 6500 monochrometer(400 - 2500nm)

Calibration and Validation : Using the WinISI program(ver. 1.52)

Results and Discussion :

Soybean contains isoflavone, which is well known as a phytoestrogen. During the past several years, there has been much interest among clinicians and researchers in the potential role of isoflavones in preventing and treating chronic diseases. Considerable research has centered around soybean quality and its relationship with isoflavones contents. However, little research has looked at using NIRS for isoflavone analysis in soybean seed.

The NIRS isoflavone equations had low standard error of calibration (SEC) values for total and each isoflavone, and moderate R^2 values for three of the four isoflavone contents. Additionally, the predicted means for total and each isoflavon were similar to the means based on the HPLC analysis. These data suggest that the total isoflavone, genistein, and daidzein NIRS equation have potential use as a crude screening method for isoflavone analysis in soybean seed. The glycitein equation had moderate SEC values, but much lower R^2 value than the other isoflavone equations, which may be due to the low standard deviation.

Based on the bias, standard error of prediction(SEP), and R^2 statistics, the NIRS isoflavone equations good predicted total isoflavone, genistein, and daidzein of the validation set. These statistics indicate that total isoflavone, genistein, and daidzein content can be estimated in soybean samples using NIRS technique.

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Table 1. HPLC laboratory reference value statistics for isoflavone based on 127 soybean calibration sample set.

Isoflavone	Low	High	Mean	SD
	$\mu\text{g/g}$			
Total	289.09	2494.46	1184.18	474.27
Genistein	143.33	1239.10	597.89	239.63
Daidzein	50.87	1326.22	500.07	240.50
Glycitein	1.68	217.55	83.87	36.42

Table 2. HPLC laboratory reference value statistics for isoflavone based on 97 soybean validation sample set.

Isoflavone	Low	High	Mean	SD
	$\mu\text{g/g}$			
Total	361.31	2184.23	1144.76	406.96
Genistein	143.75	1212.42	589.00	219.07
Daidzein	157.36	916.74	467.83	188.34
Glycitein	24.86	195.24	87.93	36.59

Table 3. Near infrared spectroscopy(NIRS) calibration equation statistics for isoflavone.

Isoflavone	Math	Regression/Wavelength	Scatter	Mean	R^2	SEC
Total	1,4,4,1	MPLS/1108 - 2492	None	1184.13	0.900	150.28
Genistein	1,4,4,1	MPLS/1108 - 2492	SNV	600.19	0.814	103.43
Daidzein	1,4,4,1	MPLS/1108 - 2492	SNV-D	500.06	0.843	95.14
Glycitein	2,8,6,1	MPLS/ 400 - 2492	None	84.26	0.093	37.37

Table 4. The performance of the initial isoflavone calibrations based on validation statistics from a new set of 97 soybean samples.

Isoflavone	Mean	SEP	R^2	Bias	R. SD(%)	SEP/M(%)
Total	1146.61	162.28	0.840	-1.85	163.11	0.14
Genistein	584.54	117.28	0.711	4.46	117.80	0.20
Daidzein	473.59	100.01	0.745	-5.76	100.36	0.21
Glycitein	83.88	35.25	0.076	4.06	35.20	0.42