Determination of monosodium glutamate of potato snacks by near infrared spectroscopy

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Introduction

Potato snacks are considered as one of the most important products among all the snack industry, and that industry has impacted on Thai economics, based on a report of Kasikorn research. Moreover in 2009, the potato snacks market share was 45% of the total snack industry. In addition, trends among consumers show that they are becoming more aware of the type and quality of food they are consuming, as well as the health aspects of it. One common parameter used to monitor the quality of samples is mono-sodium glutamate (MSG) content. Food regulations limit the levels of MSG to 1% in many foodstuffs, especially for snack foods. The official analytical method for MSG content is HPLC. However, concerns with this method include the amount of time, that could be as much as 2 days per sample, the expense, and the requirement of hazardous organic solvents.

Studies on red paprika have successfully determined aflatoxin B1, ochratoxin A and total aflatoxins in red paprika with NIR.[1] The multiple correlation coefficients (*RSQ*) and *SEP* were respectively 0.955 and 0.2 $\mu g kg^{-1}$, 0.853 and 2.3 $\mu g kg^{-1}$, and 0.938 and 0.3 $\mu g kg^{-1}$. The efficiency of prediction of these three substances measured as *RPD*[2] were 5.2 for aflatoxin B1, 2.8 for ochratoxin A, and 4.4 for total aflatoxins.

The aim of the research to be described was to assess the performance of NIRS, combined with chemometrics, in determining MSG content in potato snacks.

Materials and methods

Samples

A total of 110 samples obtained from Useful Food Co., Ltd., local market, were fried and MSG mixed into the snacks ranging from 0%–5%. The samples were then packed in resealable

polyethylene bags before measuring. The samples were ground with a blender for 5 seconds before scanning.

Spectral acquisition

The ground samples were placed in a rotating cup that was directly placed onto the NIR instrument. An NIR spectrophotometer, model InfraAlyzer 500 (Company BRAN+LUEBBE, Norderstedt, Germany), was used for spectral acquisition. The NIR spectra were measured in reflectance mode

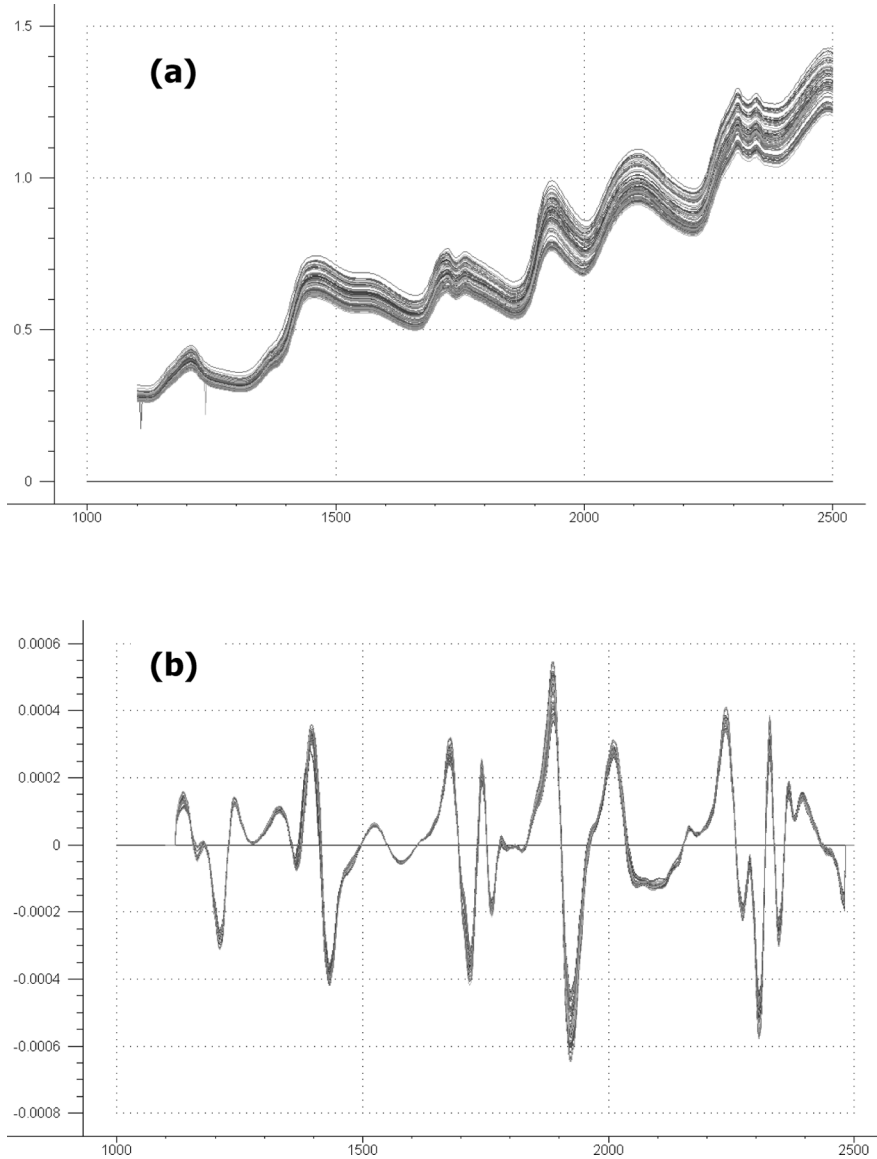

Figure 1. (a) The original log 1/*R* spectra and **(b)** 2nd derivative spectra of 110 potato snack samples.

Table 1. Composition characteristics of the calibration and the validation sample sets.

Items	Calibration set (n = 88)			Validation set (n = 22)		
	Mean	*SD*	Range	Mean	*SD*	Range
MSG (g/100g)	1.69	1.48	0–4.9	1.69	1.50	0–4.64

in the wavelength region of 1100–2500 nm with 2 nm intervals. The spectral data were transferred into JCAMP.DX format and imported into the Unscrambler (version 8.0 : CAMO AS, Trondheim, Norway) for data processing.

Reference analysis

Reference MSG values were measured with HPLC. The MSG analysis was performed three times for each sample.

Data analysis

Data analysis were performed with Unscrambler software. First, spectral pretreatment of second derivative was applied. Then the calibration equation was developed using PLS regression, moving window partials least squares (MWPLS) and CMWPLS, with the window size of 30 spectral points by MATLAB software (version 6.5 : The MathWorks, USA). Validation was performed using a separate test set of 22 samples. Composition characteristics of the calibration and validation sample sets are shown in Table 1. Figure 1 shows the log 1/R and second derivative spectra of the potato snacks.

Results and discussion

NIR spectra were collected from samples obtained from useful food Co., Ltd. and local markets. Pretreatment of the raw spectra using second derivative enhanced spectral features. The pretreatment

Table 2. PLS, MWPLS calibration results for predicting MSG content of potato snacks.

Regression	Spectra region (nm)	Pretreatment	*F*	*R*	*SEC*	*SEP*	Bias	*RPD*
PLS	1100–2500	2nd derivative	10	0.97	0.41	0.45	–0.02	3.33
MWPLS	1130–1160	2nd derivative	4	0.83	0.82	0.67	0.27	2.24
MWPLS	1600–1630		3	0.57	1.22	1.24	0.12	1.21
MWPLS	1640–1730		8	0.92	0.58	0.60	–0.09	2.50
MWPLS	1900–2000		8	0.93	0.53	0.64	–0.08	2.34
CMWPLS	1130–1160, 1600–1630, 1640–1730, 1900–2000		10	0.98	0.39	0.40	–0.08	3.75

of PLS , MWPLS and CMWPLS model that gave the best performance was second derivative (Table 2 and Figure 2).

The MSG value in the samples ranged from 0%–5%. The models generated using the second derivative by PLS, using MWPLS and CMWPLS provided similar performance statistics for MSG, with respective standard errors of calibration (*SEC*) of 0.41, and 0.39, and correlation coefficients (*R*) of 0.97 and 0.98. *R* values of 0.97 are usable in most applications, including quality assurance.[2] The RPD values for prediction of MSG using the models developed using PLS and MWPLS were respectively 3.33 and 3.75, which verified that NIRS can be useful in screening potato snacks for MSG. Overall, the most accurate models were obtained using the second derivative pretreatment.

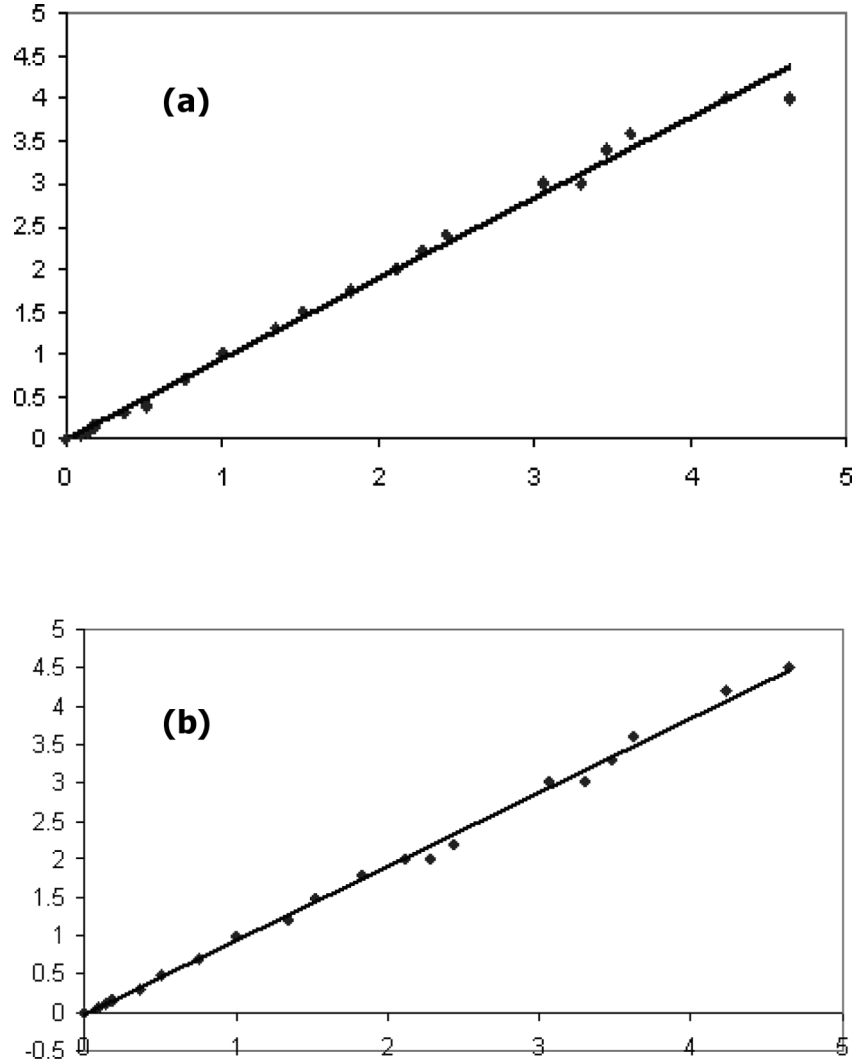

Figure 2. (a) Scatter plots of PLS and **(b)** CMWPLS prediction of MSG content.

Conclusion

A fast, simple and accurate method for prediction of MSG content in samples of potato snacks was demonstrated, using NIR spectroscopy. The total time required for sample preparation and analysis was 10 minutes, compared to the 2 days required for MSG determination by the reference method. NIRS can effectively provide the snacks food industry with a simple, cost-effective method to monitor the quality of their products by measuring MSG content.

Acknowledgements

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