Development of quality certification system of domestic sesame oil using near infrared spectroscopy

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Introduction

Sesame seed oil is one of the traditional edible oils in Korea. Korean sesame seeds are usually sold in a market at a higher price compared to those of other origins, such as China and India. Due to the difference in cost, Chinese and Indian sesame seeds are sometimes offered in place of Korean sesame seeds.[1] Therefore, Korean consumer's demands for sesame seeds and their products, that are truly certified as to their origin, are increasing. Development of an on-line monitor system for origin identification would satisfy consumer's demands and also would give benefits to farmers. In this study, classification of sesame seeds was conducted using near-infrared (NIR) spectroscopy to identify their origins. The ultimate goal of this study is to develop an effective NIR system that could be used for determining sesame seed origin.

Materials and methods

Sesame seed samples were provided by the Chengatti Company in Korea. The samples included two geographical origins of Korea and China, which were grown in each country in 2008. A total of 120 samples (Korea = 60, China = 60) were used in this study. Four different types of sesame samples were prepared, which included raw sesame seeds, roasted sesame seeds, sesame oil and oil cake (Figure 1).

The sesame oil was obtained by extraction, using an extruder (Oil Love, National ENG Co., LTD, Korea).

Transflectance NIR spectra were collected over a range of 1300 nm to 2500 nm in 2 nm increments using a SNIR instrument (designed by our group and manufactured by Soma Optic). The solid samples, raw sesame seeds, roasted sesame seeds and oil cake were placed in a sample cup

Figure 1. Sample preparation for raw sesame seeds, roasted sesame seeds, sesame oil and oil cake.

and the sesame oil was placed on a liquid cell for the NIR measurement. All data analysis was performed in Unscrambler software (CAMO ASA, Oslo, Norway). Smoothing was used as a pre-processing of the spectral data. Soft independent modeling of class analogy (SIMCA) was used to classify the sesame samples according to their origins.

Results and discussion

Figure 2 shows the mean NIR spectra of sesame samples used in this study.

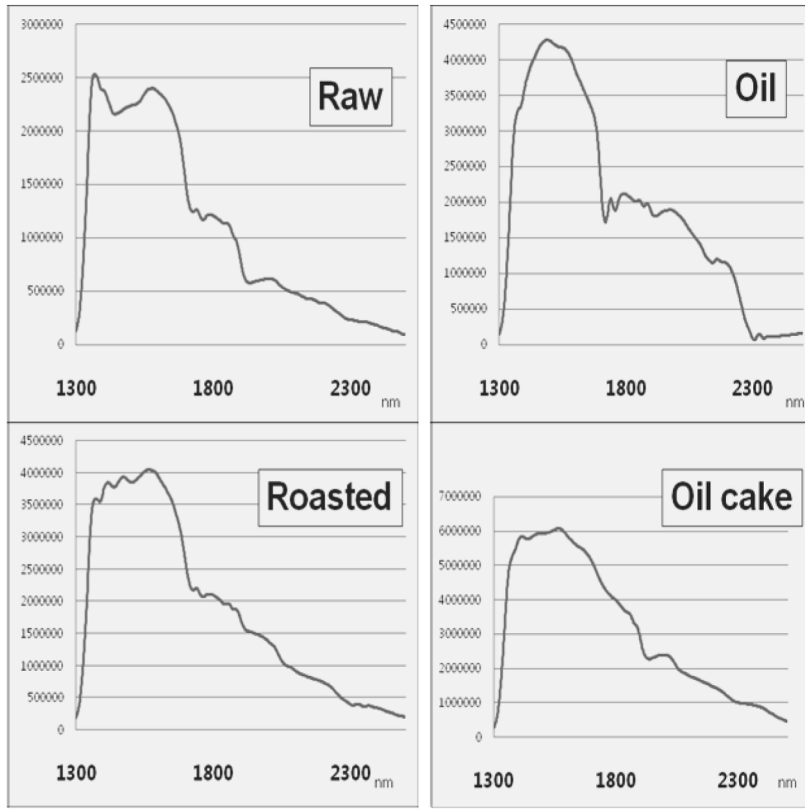

Figure 2. Mean NIR spectra of 4 types of sesame samples used in this study.

Differences in absorption peaks were observed between the samples. A SIMCA model was built using the Korean sesame set and China sesame set, and the model was applied to the unknown test set (Korean). Four SIMCA models were developed from four sample types, and the classification results were compared. The classification result was affected by the sample type used. The best result was obtained by using the raw sesame seed samples, giving an accuracy of 95%. Figure 3 shows the classification of the sesame samples by the SIMCA model developed, using the raw sesame seeds.

The two groups of Korean and Chinese sesame were clearly separated from each other. The unknown test samples (Korean) were successfully located in the Korean group. The classification results by using other sample types were not as good as the result using the raw sesame seeds, giving the accuracy of 85% for roasted seeds, 50% for sesame oil and only 15% for oil cake. This indicates that raw sesame seeds contain important information for the classification of sesame origin. The most highly related wavelengths for the classification were 2160 nm, 1980 nm and, 2030 nm, which are assigned to CONH and NH fraction of protein and peptide.[2] This result is supported by the study, in which Chinese sesame and Korean sesame differed in their protein content.[3] On the basis of the results obtained, a quality certification system for domestic sesame oil is being developed.

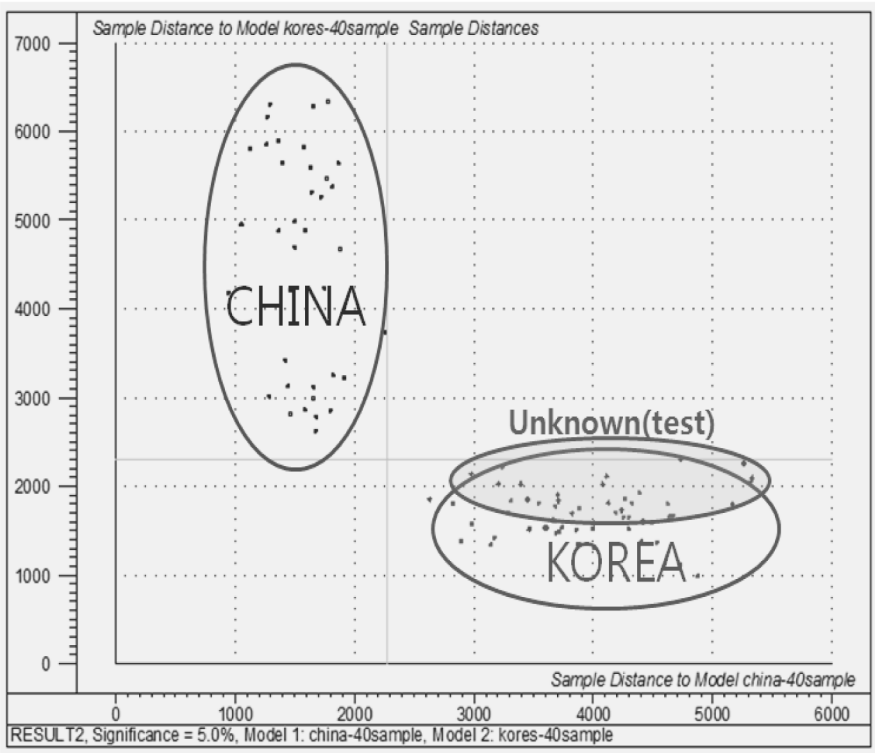

Figure 3. Classification of raw sesame seeds according to their origins.

Acknowledgement

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