

# Development of a prototype instrument for minced meat

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## Introduction

There are many cases where a different type of meat is intentionally or accidentally mixed into a ground meat product. Recently, false labeling of minced meat has become an important problem in Japan. To address this a prototype near infrared (NIR) instrument for identification of minced meat has been developed. The prototype instrument is small, has a high-performance, and is inexpensive, and could be used at the site of a meat processing factory. The performance of the prototype instrument was evaluated.

## Materials and methods

The hardware specifications of the NIR spectrometer to measure minced meat, including the wavelength region (from 700 nm to 1050 nm) and wavelength resolution (10 nm), were decided according to previous research and experience. An interactance probe as shown in Figure 1 was used for spectral acquisition.

For the spectrometer optics, a Fastie Ebert mount with a linear array detector was used in order to avoid stray light. The performance of the prototype instrument developed was evaluated by comparing it to a high grade commercially-available, but expensive NIR spectrometer. Using both instruments, spectra of minced meat samples with chemical values that had been analysed by standard chemical methods were scanned by the instrument, and PLS regression was carried out to develop a calibration. Each frozen sample was defrosted under 5°C and the defrosted sample packed in a polyethylene bag. Spectra were acquired below 15°C on five locations on the samples, as shown in Figure 2.

The PLS regression was performed using the averaged spectra from the 5 locations on the samples, and fat content values measured by a chemical method.

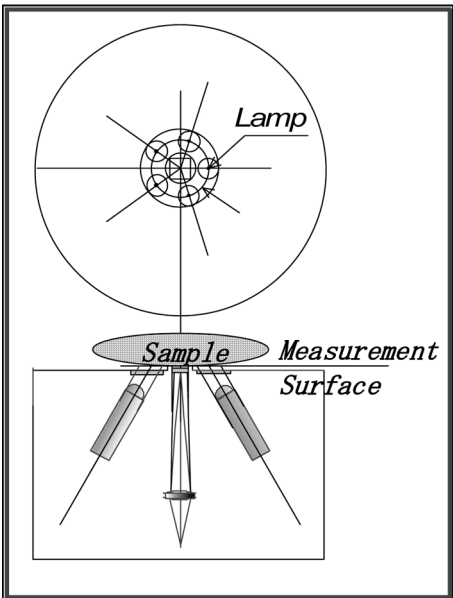


Figure 1. Optical probe.

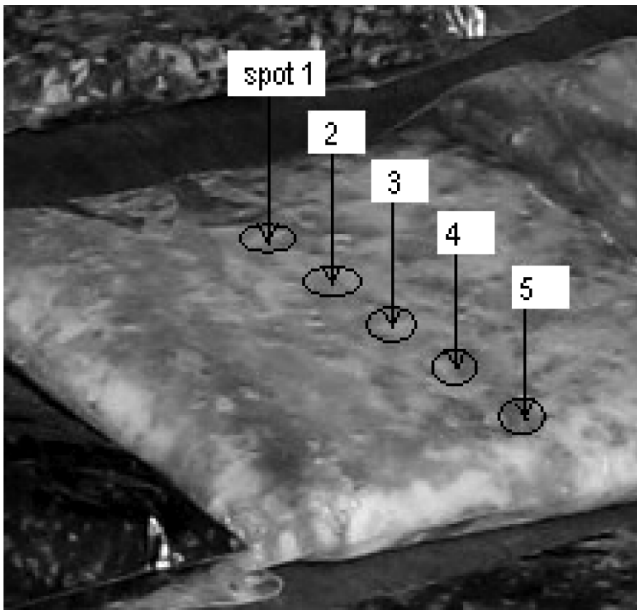


Figure 2. Meat sampling positions.

**Table 1.** Comparison of the performance between high grade and prototype ones for determining fat content of minced meat.

	<i>F</i>	<i>R</i>	<i>SEC</i> (%)	<i>SECV</i> (%)	Bias (%)
High Grade Instrument	6	0.96	2.0	2.1	−0.0
Prototype Instrument	2	0.96	1.9	2.0	0.0

*F*: The number of factors used for the PLS calibration model developed.

## Results and discussion

The prototype instrument is shown in Figure 3.

It is a desktop type instrument. All the functions (i.e. sample box, illumination optics, spectrometer and data processing unit) were built in one unit to give a compact configuration. The SN ratio of the instrument is around 65 ABSu. Prediction of the fat content, using a calibration model developed by PLS regression resulted in a SEP of the prototype of 2.0%, which was lower than that of the high grade NIR instrument (2.1%) (Table 1). The spectrometer specification and performance of the high grade NIR instrument is probably superior to that of the prototype instrument, but the performance of the prototype instrument for this application showed the better actual performance. Further work is in process to “fine-tune” the prototype instrument, including the automatic spectral averaging function.

## Conclusion

The prototype instrument developed and described in this paper was small, compact and inexpensive and showed higher performance than the high grade NIR instrument, as far as the application



**Figure 3.** Prototype instrument.

described for fat content prediction in minced meat is concerned. From this work we conclude that the instrument would be applicable for the evaluation of minced meat at the site of a meat-processing factory. Further work will focus on improving the evaluation method.

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