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Application News

No.A515

Spectrophotometric Analysis

Introducing the Automatic Contaminant Recognition System

Introduction

With the recent growing interest in the safety of many products, including foods, pharmaceuticals, electronic goods, and cars, there is an increasing demand for contaminant analysis. When performing contaminant analysis work, measured positions and aperture sizes (measured area size) can vary between analysts, which introduces variations or errors in the results.
Shimadzu's automatic failure analysis system (IRTracer-100 infrared spectrophotometer and AIM-9000 infrared microscope) comes with an automatic contaminant recognition system as standard, which automatically recognizes contaminants and automatically sets the optimum aperture size and angle in just one second. We describe an example analysis performed using the automatic contaminant recognition system.

Automatic Recognition

The automatic contaminant recognition system is enabled by clicking the [Automatic Registration] button shown in the red box in Fig. 1.
Then, image processing is performed on the current microscopic image to automatically recognize candidate measurement points, set the optimum aperture size as shown in Fig. 2, and register this information.
The automatic contaminant registration function is available in two types. There is a standard type that generally selects measurement positions of a relatively large size, and a micro type that generally selects measurement positions that are microscopic in size (around 10 µm). Either type can be selected according to the sample to be measured. Up to a maximum of 20 measurement positions can be configured automatically, and positions can be added or removed as needed. After measurement, the image showing measurement positions and aperture information is saved automatically together with the spectra.

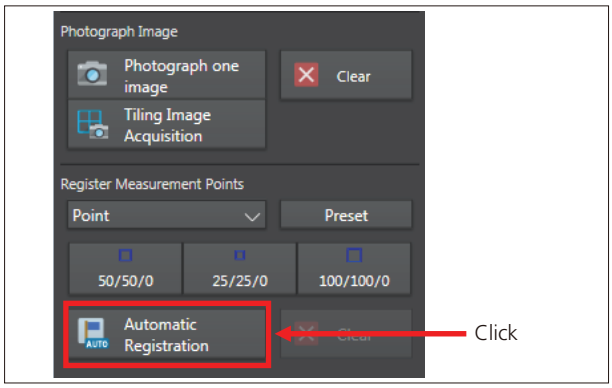

Fig. 1 AIMsolution Window

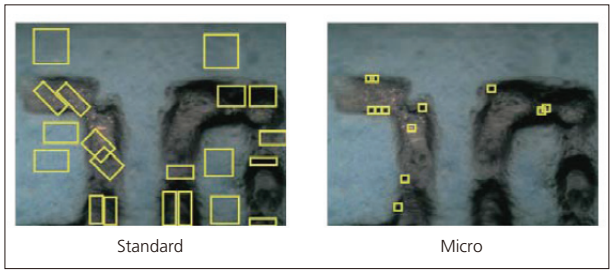

Fig. 2 Automatic Recognition

Measurement Procedure

Fig. 3 shows a flowchart of the measurement sequence. The measurement procedure is very simple, with configuration performed in order of sections A to D of the measurement parameter configuration area. Analysis time is reduced since measurement points and aperture sizes can be configured automatically in Step A.

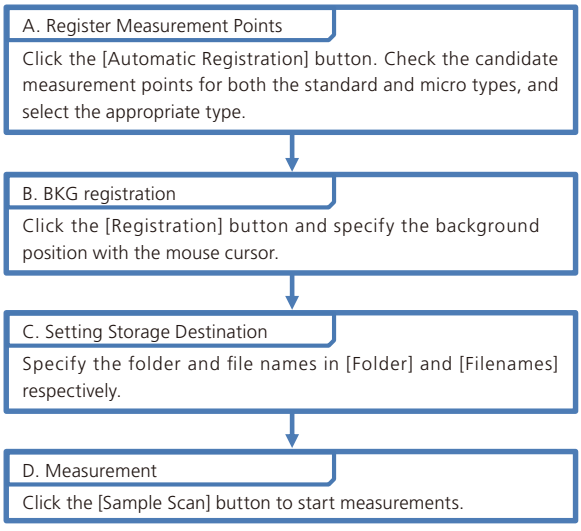

Fig. 3 Measurement Procedure Flowchart

Contaminant Analysis Example

Fig. 4 Contaminants on a Frozen Pizza

We analyzed the black contaminant on the surface of a frozen pizza as shown in Fig. 4. Contaminant was collected, compressed in a diamond cell, and analyzed with an infrared microscope. Fig. 5 is the images shown by the automatic contaminant recognition system after automatic registration. The measurement positions on the left are standard type, and the positions on the right are micro type. For this analysis, standard type measurement positions were chosen.
Looking at Fig. 5, there are black areas and transparent areas in the compressed contaminant. Normal (transparent) parts of the pizza were probably collected together with black contaminant during sample collection. Both the black and transparent areas were analyzed. Fig. 6 shows infrared spectra for representative black areas and transparent areas.

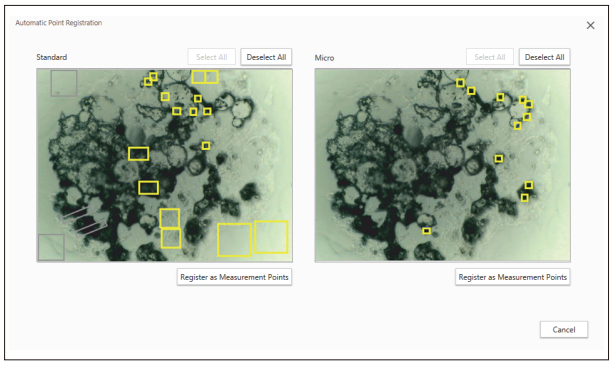

Fig. 5 Automatic Contaminant Recognition System

Table 1 Measurement Conditions

Resolution	: 8 cm^{-1}
Accumulation	: 40
Apodization	: Happ-Genzel
Detector	: MCT

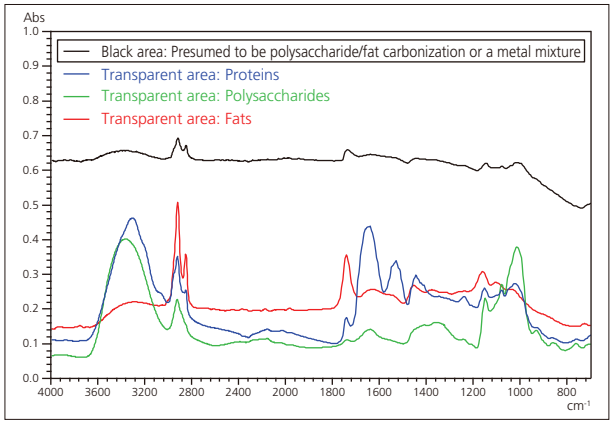

Fig. 6 Infrared Spectra and Qualitative Results

Proteins, polysaccharides, and fats were detected in each position on the collected contaminant that was analyzed, and are all presumed to be normal components of the pizza dough. The baseline of the infrared spectrum of the black area is noticeably elevated, and is presumed to be caused by carbonized fats/polysaccharides or a metal mixture.

X-ray fluorescence spectrometry examination of the black area was performed separately, and Fe, Cr, and Ni were detected, which identifies the black area as stainless steel.

Conclusion

There will probably be a demand for quicker and more accurate methods of contaminant analysis in the future. Shimadzu's automatic contaminant recognition system can automatically configure measurement positions and aperture sizes optimized for the sample, and perform highly accurate contaminant analysis in a short period of time.

Fig. 7 IRTracer-100 Infrared Spectrophotometer and AIM-9000 Infrared Microscope

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