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SHIMADZU

Application News

Spectrophotometric Analysis No.A414

Analysis of Contaminants in Foods

Concern for food is rising these days due to events of contamination with toxins and deceptive labeling of origin, etc., and one concern related to food safety is contamination with foreign substances. When foreign matter contaminates a food product, even if, for example, it consists of dirt from the exterior food wrapping which has no direct effect on the human body, the image of that commercial product and its manufacturer as well as vendor, can be very adversely affected, requiring that the matter be urgently addressed.

Identification and qualitative characterization of a foreign material is essential for defining the cause of contamination, and use of the Fourier transform infrared spectrophotometer (FTIR) is one of the quickest and the easiest means of accomplishing this. Here, we introduce actual cases in which FTIR was used to analyze contaminants that were found in food products.

■ Measurement Method

Since foreign matter in food is often large enough to be seen with the naked eye, here we conducted analysis using a single reflection ATR accessory (DuraSamplIR II), capable of measurement up to about 100 μm.
Fig. 1 shows a photograph of the DuraSamplIR II used for the analysis. The analytical conditions are shown in Table 1.

Fig.1 DuraSamplIR II

Table 1 Analytical Conditions

Resolution : 4 cm^{-1}	Detector : DLATGS
Accumulation : 20	

■ Contaminant Analysis (Case 1) -Contaminant in Riceball-

Fig. 2 shows a photograph of a contaminant found in a riceball that was in a plastic container.

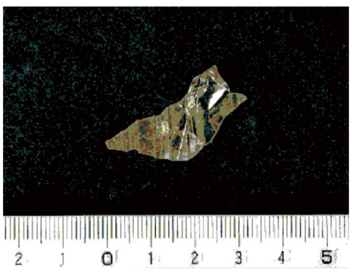

Fig.2 Photograph of Contaminant in Riceball

The size of the contaminant is about 30 mm, and there appear to be parts that are transparent and parts that are brown in color. We conducted analysis at 2 sites that were different in color. The spectra obtained from these sites are shown in overlaid fashion in Fig. 3.

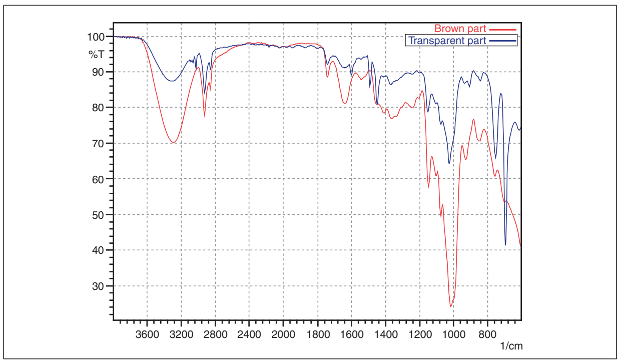

Fig.3 Spectra of Contaminant in Riceball

Since this contaminant was found in a riceball, there is a possibility of it being an ingredient of the riceball that was adhering to its surface. The measurement result in Fig. 3 from the especially brown-colored site shows a large peak in the vicinity of 1200 - 900 cm^{-1}, suggesting that this is due to starch. Therefore, this peak is thought to be due to the influence of a piece of a rice grain adhering to the surface of the contaminant. A peak also believed to be due to starch was found in the measurement result of the transparent site, but due to its small intensity, it is believed that just a small amount is adhering at this site. Then, to eliminate this influence and obtain only the spectrum of the contaminant, the difference spectrum of both the spectra (transparent part - brown part) was obtained. Fig.4 shows the obtained difference spectrum.

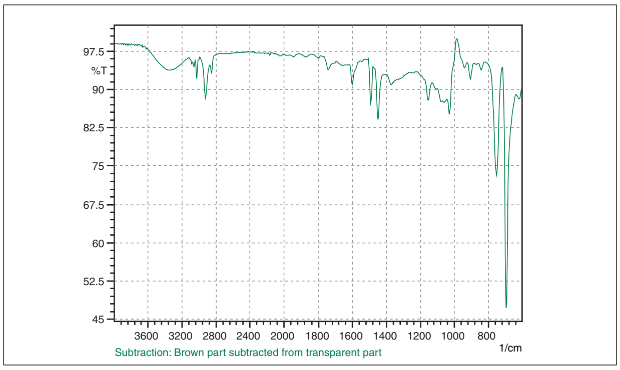

Fig.4 Difference Spectrum

The difference spectrum shown in Fig.4 is thought to be, from its shape, a spectrum of polystyrene. Polystyrene is a transparent, hard plastic that is widely used for daily miscellaneous goods and as a food packaging material, etc. Then, considering the shape and color of this contaminant, we conducted analysis of a plastic container used to package riceballs. A photograph of such a container and the obtained spectrum are shown in Fig. 5.

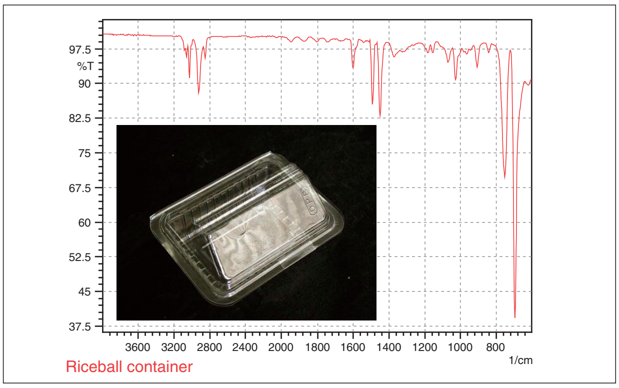

Fig.5 Spectrum of Riceball Container

A comparison of the container spectrum with that of the difference spectrum reveals that they closely match. From the above results, it is assumed that this contaminant is a fragment from the container which contaminated the riceball during the packaging process.

■ Contaminant Analysis (Case 2) -Contaminant in Sushi-

Fig. 6 shows a photograph of a fiber-shaped contaminant adhering to the surface of a piece of sushi. Fig. 7 shows the results of analysis of this contaminant.

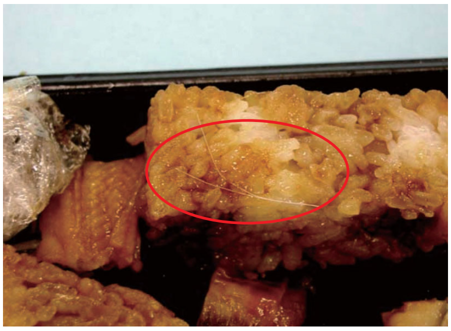

Fig.6 Photograph of Contaminant in Sushi

From these results, it is believed that the fiber-shaped contaminant is polypropylene which, like polystyrene, is used in a wide variety of applications. Then, we conducted analysis of a brush typically used to apply sauce to sushi when it is prepared, noting that its

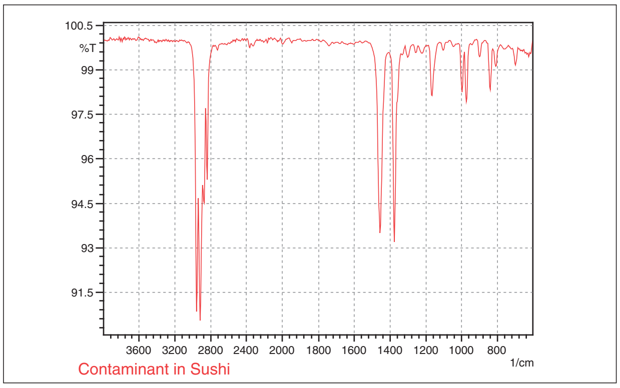

Fig.7 Spectra of Contaminant (red trace) and Brush (green trace)

fibers resembled the contaminant. The overlaid spectra of the contaminant and brush fibers are shown in Fig. 8 along with a photograph of the brush.

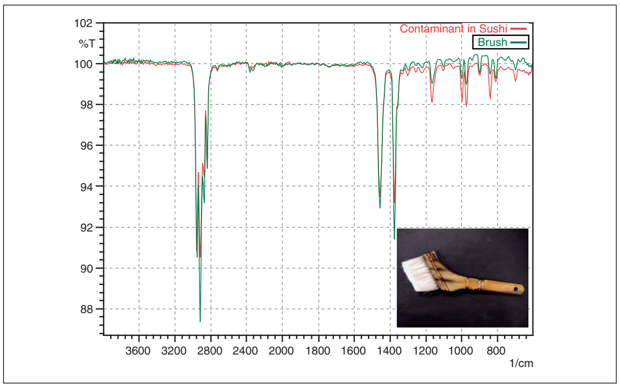

Fig.8 Spectra of Contaminant (red trace) and Brush (green trace)

As can be seen in Fig. 8, both spectra closely match each other. Therefore, it is presumed that the contaminant adhering to the sushi is a fiber that became detached from the brush during the process of applying sauce to the sushi.

As described above, FTIR is a very effective analytical technique for analysis of contaminants in food. In addition, rather than determining the substance name in actual contaminant analysis, it is most important to identify and clarify the cause of contamination. Thus, as described in the cases introduced here, analyzing foreign substances which could possibly be the source of contamination, and matching those spectra with the spectrum of the contaminant is an important key in identifying the contaminant.

The contaminants discovered in these cases were organic substances, however, contamination with inorganic substances also occurs quite frequently. In those situations, contaminant identification and characterization are possible using an energy dispersive X-ray fluorescence spectrometer (EDX) or an electron probe microanalyzer (EPMA).

SHIMADZU

SHIMADZU CORPORATION. International Marketing Division
3. Kanda-Nishikicho 1-chome, Chiyoda-ku, Tokyo 101-8448, Japan Phone: 81(3)3219-5641 Fax. 81(3)3219-5710
Cable Add.:SHIMADZU TOKYO

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