

Simple Identification of Illegal Drug using NIR (Identification of MDMA Tablet)

<Introduction>

Since light in the Near-Infrared region has the characteristic of penetrating into the substance, it is useful in the non-destructive analysis of certain area or an overall volume in average. In recent years, utilizing this characteristic, NIR spectroscopy has been widely used in the observation of biological samples and quality control/analysis of food and medical products. A sample holder for NIR diffuse reflection system is so designed for the extremely easy sample handling. In addition simple identification of illegal drugs, such as MDMA can be done by combining the system of search data library created by NIR diffuse reflection system.

<Experimental>

A diffuse reflection measurement accessory (VIR-NRF-N) is placed in a portable Fourier Transform Near-Infrared Spectrometer (VIR-9650) and then by simply placing a tablet, such as MDMA directly on the sample holder, the measurement can be done. An InGaAs detector is used. Firstly, grouping was performed by means of Principal Components Analysis (PCA) in order to identify the MDMA tablet. Since as the result, the possible grouping was confirmed, the library was tried to be established. For establishing the data library, 40 types of tablets were used, namely 25 types of over-the-counter pharmaceuticals, such as gastrointestinal drugs, one type of amphetamine (AP), eight types of MDMA (street name: ecstasy), three types of methamphetamine (MA), and three types of MDA (street name: the love drug). The optimal value of simple identification system was examined by the investigation of algorithm, calculation parameters and threshold from comparison of search results of tablets selected in random. Figure 1 shows a photo of the diffuse reflection system installed in the VIR-9650. The tablets were placed on the sample holder directly, as shown in Figure 2. In case of extremely small tablet unable to be placed on the holder, the sample was placed in a test tube like the one shown in Figure 3, and measured.



Figure 1. VIR-9650 & Diffusive reflection accessory



Figure 2. Measurement of tablet



Figure 3. Measurement of crushed sample & powder sample

<Measurement example>

Figure 4 shows the PCA analysis results for tablet such as MDMA. Figure 5 shows their Near-Infrared spectra. Simple identification is possible by using the region (indicated by the arrow) where the spectra shape varies depending on the type of each tablet. The NIR diffuse reflection system is a simple method by only placing the tablet on holder, and the main unit is simply the expanded system of conventional FT-IR, so that the single measurement time required is only 10 seconds. It will be more powerful as a simple identification system by enhancing the library and further increasing the number of standard samples.

Figure 6 shows a calibration model that indicates the correlation between tablets containing MDMA and the quantitative results by their GC. With a correlation coefficient of $R=0.966$, it shows a sufficient value for performing simple identification. It is also possible to analyze the amount of MDMA in the tablets by linking the search results of the identification program with the calibration model.

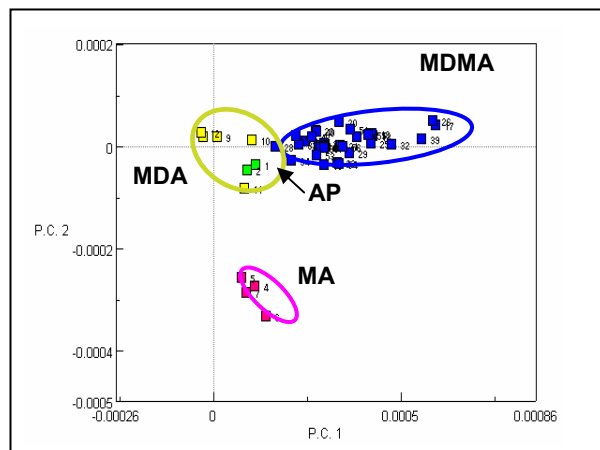


Figure 4. PCA analysis results for tablet

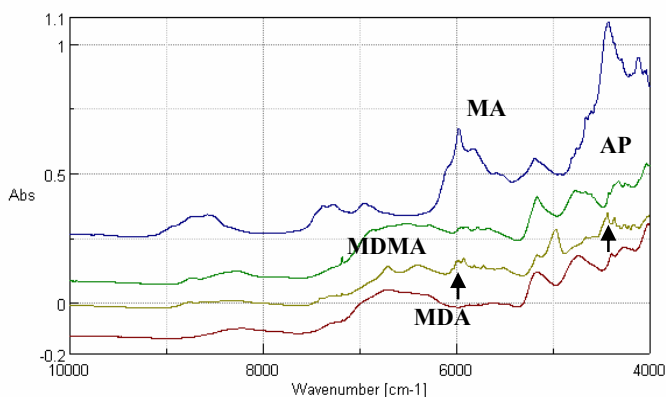


Figure 5. Diffuse reflectance spectra of tablet

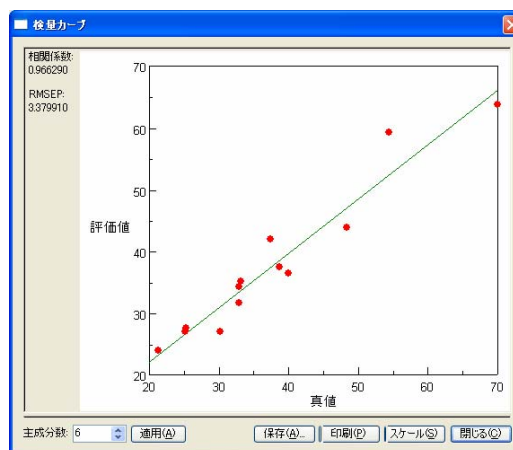


Figure 6. Calibration curve of MDMA



Figure 7. Illegal drug identification program

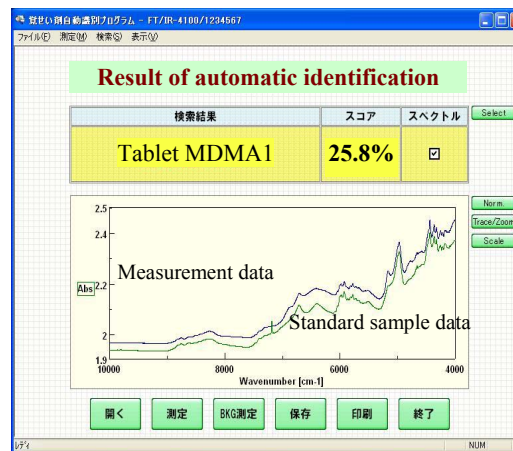


Figure 8. Confirmation test and quantitation results