Rapid measurement of sample in container using macro measurement unit

Introduction

Laser Raman spectroscopy is a method which enables to obtain the information on molecular structure as well as IR spectroscopy, but by adopting a confocal optical system, it is possible to selectively acquire information on only the part where the laser was focused. With this system, non-destructive and non-contact measurement without sample pretreatment can be performed, and imaging measurement in the depth direction in a minute area becomes possible. The confocal optical system is also effective in macroscopic measurements. It is also applied for measuring bulk sample in a container such as a bottle without taking it out. We developed a macro measurement unit (figure 1) as an accessory for such measurements. The macro measurement unit has an L-shaped structure with a condenser lens at the tip of the lateral direction. In measurement, users can use the unit easily by just attaching the unit to the revolver in the same procedure as the objective lens.

In this application note, rapid measurement of the liquid/solid samples in the bottle without opening the bottle were performed by using the macro measurement unit.

Comparison with the conventional method

In liquid measurement, a method which requires to remove a sample from a container such as dropping a sample onto a plate or introducing it into a capillary tube has been widely used. Therefore, it was difficult to measure volatile samples and anaerobic samples. Meanwhile, since the macro measuring unit emits the laser beam in the sideways direction, the sample can be measured as with the container in an upright position and without opening. In addition, since the unit has condenser lens at the tip of the L-shaped lateral direction, even a powdery solid sample in a bottle can be measured by focusing on the surface.

As mentioned above, by using the macro measurement unit, it is possible to analyze solid and liquid sample in a non-open, non-contact and rapid manner. Additionally, because the unit is installed in the sample chamber of Raman spectrometer compatible with laser safety standard Class 1, anyone can use this system with confidence without taking countermeasures such as laser exposure.
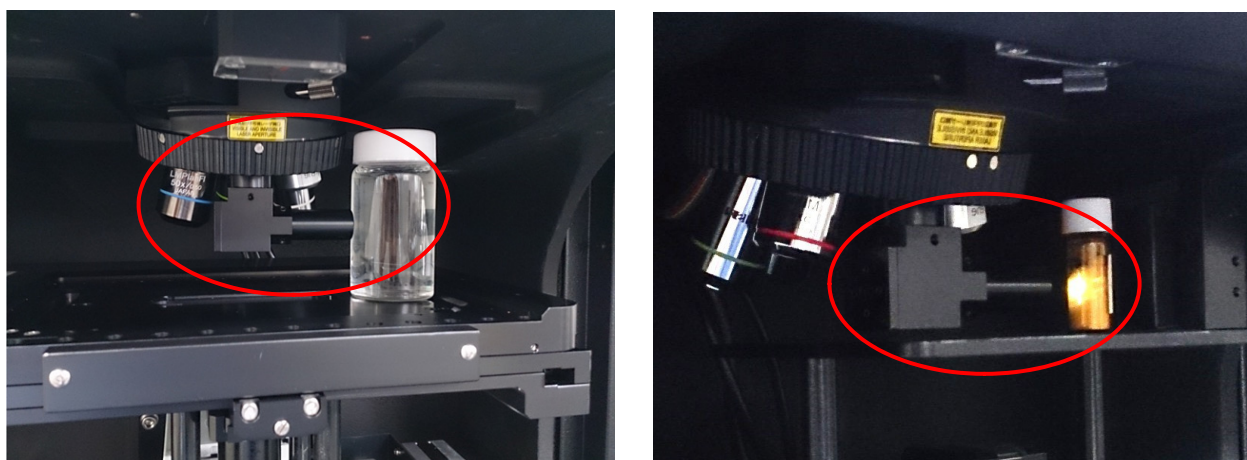

Fig. 1 Macro measurement unit and sample installation image (Left: Liquid, Right: Solid)

Sample measurement

The colorless transparent liquid in a commercially available sample bottle and the white solid in a brown bottle were measured without taking out from the bottle as shown in figure 1. The database search results of the obtained spectra were shown in figures 2 and 3.

The liquid was identified as ethanol (figure 2). The solid sample was able to measure over the bottle without opening the lid, just by set the sample bottle close to the unit. In addition, high quality spectrum was acquired with only two seconds of the exposure time.
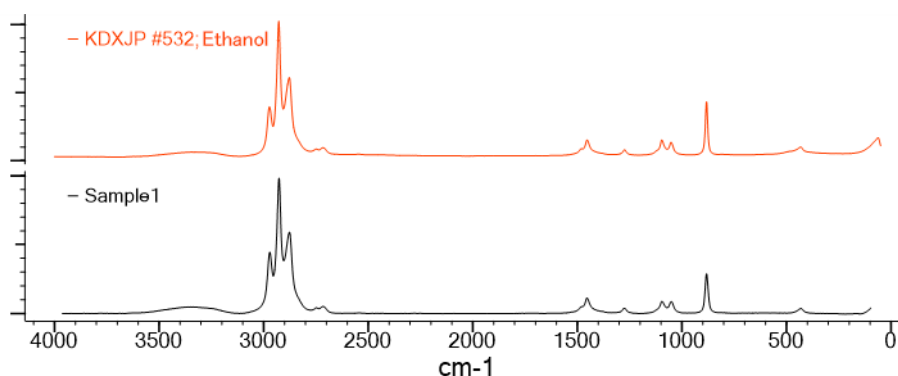

Fig. 2 The result of non-opening measurement of liquid sample by using macro measurement unit
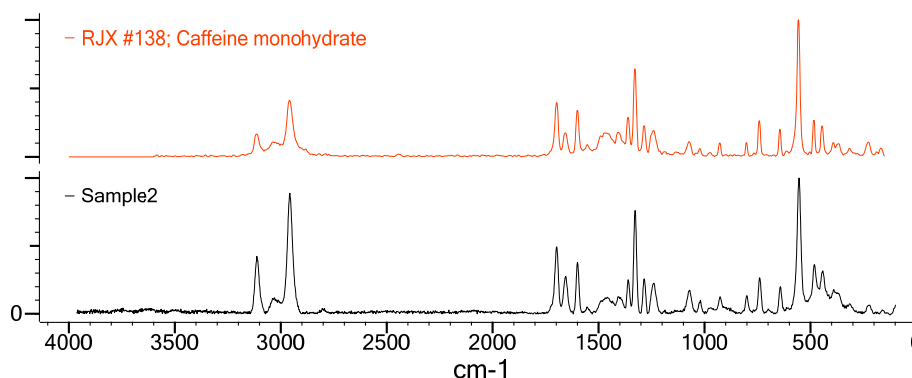(Top: Database, Bottom: Measurement result)

Fig. 3 The result of non-opening measurement of solid sample in a brown bottle by using macro measurement unit (Top: Database, Bottom: Measurement result)

Conclusion

As described above, using the revolver-installed macro measurement unit, it is possible to measure the bulk sample quickly and easily. In addition, it is considered that this system is useful for the measurement of samples that can not be measured in open system such as hazardous materials, and for analysis of solution components.

Moreover, our software is equipped with easy-to-use functions for routine measurements like quality control, such as a function to support measurement condition setting in wizard format (see more detail: Raman application data 260-AN-0011) and a function to compare the degree of coincidence with already measured spectrum in real time. A synergistic effect of software and hardware will enable more efficient analysis.