

ATR: a tool for botanical and ecological analysis

Plant samples are easily analyzed using ATR-FTIR spectroscopy.

THE DIFFERENT CHEMICAL MAKEUP of leaves, petals and even pollen may be detected using infrared spectroscopy.

Traditionally, wet bio-samples like leaves had to be dried and ground with KBr to make pellets. These would then be pressed and placed in a spectrometer.

This is a very slow and outdated method of analysis and requires a lot of sample preparation.

Conversely, attenuated total reflectance (ATR) requires no sample preparation and is a fast way of analyzing multiple samples. Moreover, modern ATR accessories like the Quest™ can handle wet samples like plants easily.

This note describes the simple analysis of Winter Rose buds of different ages.

Experiment

Plants draw upon various nutrients to produce organic molecules, which give rise to complex absorption features in the infrared spectrum.

In addition, plant matter shows strong water absorbances. The relative quantities of these substances can be seen to change as the bud develops into a flower.



Figure 1 shows 4 example ATR spectra of *Rosa Meilandina* buds. All of them show a broad feature at 3300 cm^{-1} .

This is the strong water absorption band and is a common feature in IR spectra of wet samples. As the bud gets older, it appears to contain less water.

Also present in Figure 1 are two sharp features at 2914 and 2846 cm^{-1} , which are characteristic of CH_2 stretches of long chain aliphatic compounds.

These bands seem to increase in intensity as the bud matures.

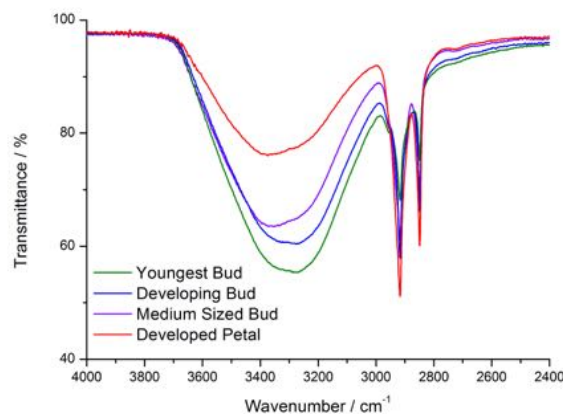


Figure 1: ATR spectra of winter rose plant at different stages of maturity

The change in intensity of the sharp peak at 2914 cm^{-1} and the broad water peak are plotted in Figure 2. Clearly, there is a relationship between the water and hydrocarbon sugars.

Conclusion

The analysis showed that as the rose buds aged, there was less water and more sugar in the petals. This is likely to be a result of greater photosynthesis in mature roses.

Recording IR spectra of several plant samples was done easily and quickly using the Quest™ ATR. Similar analysis on wet bio-mass samples is also possible. More in depth analysis can be made to check the effect of environmental conditions on plants.

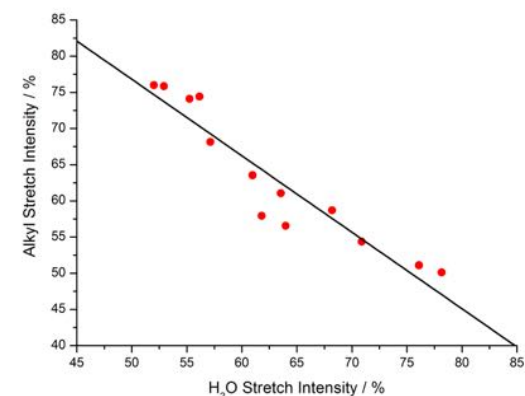


Figure 2: Alkyl vs H₂O stretch intensity

For more information about ATR and the Quest™ accessory, contact Specac. Also, why not read our application note on the analysis of heated soil using the Heated Golden Gate ATR accessory?

References

B. Zimmermann, A. Kohler, PLoS ONE 9(4): e945417 (2014)

B.r. de Luz, New Phytologist, (2006) **172**: 305–318

