Raman Imaging of monkey brain tissue

Catalina David, HORIBA Scientific, 213 rue de Lille, 59650 Villeneuve d'Ascq, France

Abstract
Fast and non-invasive methods for clinical and non clinical investigations for biological tissue are more and more required. Raman imaging at micro scale can answer to crucial questions about the monkey brain tissue morphology and structural evolution.

Key words
Monkey brain tissue, Raman Imaging, Raman microscopy, Identification

Introduction

Nowadays, specific clinical studies in the field of cancer research, and in particular of hormone-sensitive cancer prevention and treatment are more and more required. These studies are based on the development of various hormonal therapies for different dysfunctions using steroids.
Naturally, the monkey brain tissue contains an important amount of steroids. Understanding the distribution and the behaviour of natural steroids in tissues can be of valuable help for the development of new and efficient synthetic steroids.
Raman Imaging can be employed to investigate the monkey brain tissue.

Basic analysis of a monkey brain tissue

Raman spectroscopy is a vibrational technique simple, reproducible, non-destructive to the tissue and requires small amounts of material with a minimum sample preparation. It provides useful information at molecular level, allowing investigation of functional groups, bonding types, and molecular conformations. Spectral bands in vibrational spectra are specific to each molecule and give direct information about the biochemical composition.
Biological tissues, including monkey brain tissues, are complex systems with a complex composition: several types of proteins and lipids, carbohydrates, sugars and sterols. All these molecules have their own spectral fingerprint which will allow us to distinguish between them. Based on the spectral differences, tissue investigation by Raman imaging is possible.
Below we are showing a basic analysis of a sample of monkey brain tissue. The sample was embedded in a matrix and then cut with a microtome. A section of about 20 µm thickness was analyzed.
The true confocal operation of the Raman system allows excellent spatial discrimination to be achieved.
The Figure 1 illustrates a Raman image of a region on the sample.

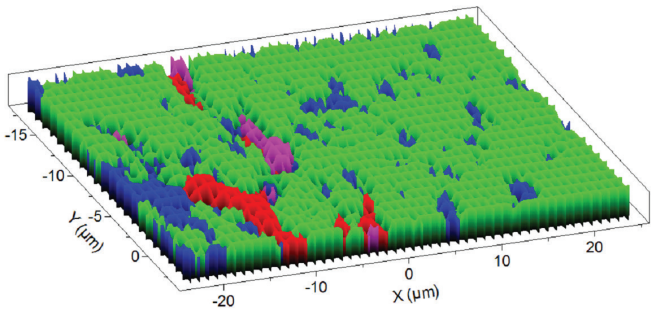

Fig. 1 Raman image of the tissue

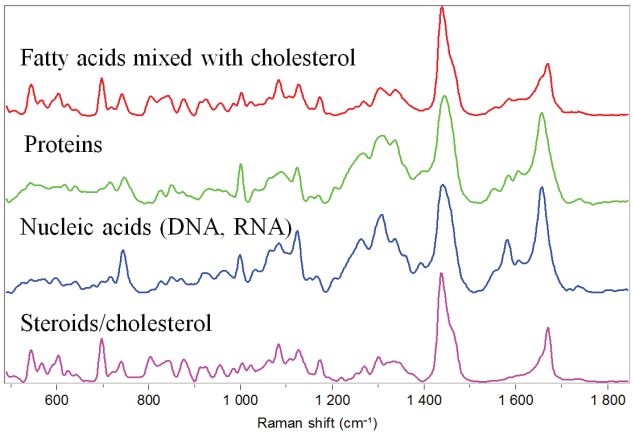

Figure 2. Raman spectra of the compounds found on the analyzed region.

These bands are sensitive to molecular structure, conformation, and environment and thanks to the high spectral resolution given by the instrument, they can be easily resolved.

However, often the signals are mixed and complex thus, the mapping data are usually treated by using multivariate techniques like Classical Least Square (CLS), principal component analysis (PCA) or Multivariate Curve Regression (MCR). In this example MCR method was used.

Conclusion

The combination of Raman and microscopy in a fully confocal instrument allows the discrete analysis of monkey brain tissue without chemical labelling. The Raman Microspectroscopy Imaging can be used to find the chemical and structural properties of natural tissues and, later on it can be an interesting tool for the early disease diagnosis and treatment.

Reference

Raman Spectroscopy of Biological Tissues, Z. Movasaghia, S. Rehman, I. U. Rehmana, Applied Spectroscopy Reviews, 42: 5, 493-541

Sample courtesy of Dr Arezki Azzi, Associate Professor, Dept Molecular Medicine, Laval University, Canada.

JOBIN YVON Technology

info.sci@horiba.com
www.horiba.com/scientific

HORIBA Scientific

USA: +1 732 494 8660
UK: +44 (0)20 8204 8142
China: +86 (0)21 6289 6060
France: +33 (0)1 69 74 72 00
Italy: +39 2 5760 3050
Brazil: +55 (0)11 2923 5400
Germany: +49 (0)89 4623 17-0
Japan: +81 (0)3 6206 4721
Other: +33 (0)1 69 74 72 00