Diagnostic Application of SRFTIR Spectroscopy: Human Liver Cancer Case Study

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Morphologic examination of tissue specimens usually uses optical light microscopy to detect and grade the most human cancers. However, the morphology information is limited to a spatial variation and requires extensive human observations to recognize both the constitutive histological entities and the pathologic state. In this study, investigation of the chemical insight between cancerous and noncancerous human liver tissue was studied by SRFTIT with high spatial resolution and higher signal to noise ratio realized by coherence and ultra-high brilliance synchrotron radiation source. The information content of intrinsic chemical composition provides a potential route to obtain the diagnostic markers between normal and tumor tissue. With this approach, the spatial resolution can be down to under 10 μm. This facility has been widely used in various biological studies including investigation of cell membranes, proteins and nucleic acids, as well as tissues engineering.

5 tissue liver samples were obtained from biopsy of liver tumor (from Macky Memorial Hospital) specimens. FTIR spectra of tissue specimens, were collected by using SR-FTIR (Thermo Nicolet, Magna-IR spectrometer) on BL14A, NSRRC. Every 5μm step takes one spectrum and scans at the same thickness to ensure individual discrepancy on the sample.

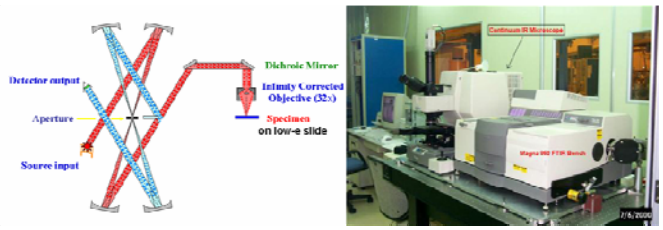

Figure 1. Ray diagram of reflectance IR confocal microscope

Our result demonstrated that Amide I peak in normal region exhibits a red shift compared to that in cancerous region. In addition, a small vibrational peak at 1150 cm^{-1} only appears in the spectra of the normal area. Since the spectra of 5 liver tissues show almost the same absorption peaks (energy and intensity), indicating that the SRFTIR shows high reliability in this study. As the result, these information prove that FTIR might act as a diagnostic tool to distinguish normal and cancerous human tissue which provides as an index of disease progression,

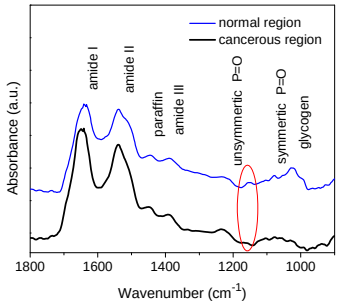

Figure 2. Infrared spectra in the range from 1800-1000 of human normal and cancerous tissues. Peak shift between normal and cancerous regions can be seen and a small vibrational peak at 1150 cm-1 only appears in the spectra of the normal area.

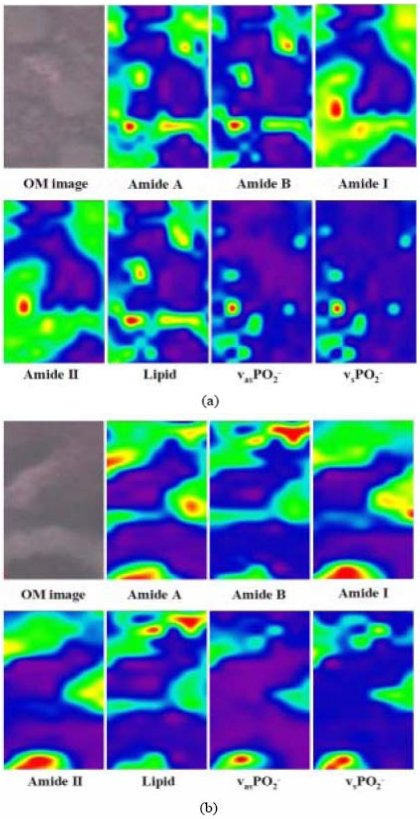

Figure3. The functional group map of (a) normal, and (b) cancerous live section of characteristic bands of PO_2-, amide I, amide II, lipid, amide B, amide A.