PD Research Report for the 2015 year

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Research Theme Hyperspectral Raman image development for cancer tissue section study

Research Period 10, 2015 ~ 03, 2016

Research Results

Research Propose

The purpose of this study is to develop the spectral preprocessing and analytical methods for paraffin embedded cancer tissue. Traditionally, the gold standard for cancer/tumor histopathologic examination is through staining and observing by medical doctor/histologist. However, due to the lack of consistency and the arbitrary decision as the analysis based solely on experience of the observer, the result obtained can be improperly indicated and lead to faulty interpretation. This complication can be overcome by employing Raman spectroscopy and chemometrics technique. This project will contribute to the development of cancer diagnosis for medical application and provide an understanding of the cancer tissue characteristic.

Results

The cancer tissues were measured by using Raman imaging system. The obtained data were then analyzed by chemometrics technique called principal component analysis (PCA). The results showed that the paraffin component is totally overlapped with the information from cancer tissue. Moreover, PCA cannot separate between the tissue and paraffin component as shown in Fig.1 b-d) in comparison with pure paraffin Fig.1 a).

The reason behind this is due to the fact that the distribution of paraffin is not Gaussian, hence, it is required to use the other technique to solve. Independent component analysis (ICA) was employed to extract the non-gaussian component. The paraffin component was successfully extracted and quantify by using this technique Fig.1 e).

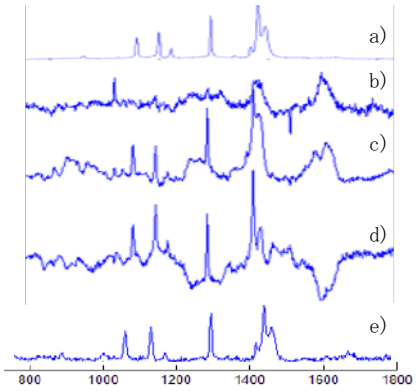

Fig.1 a) pure paraffin, b-d) PCA results and e) ICA result

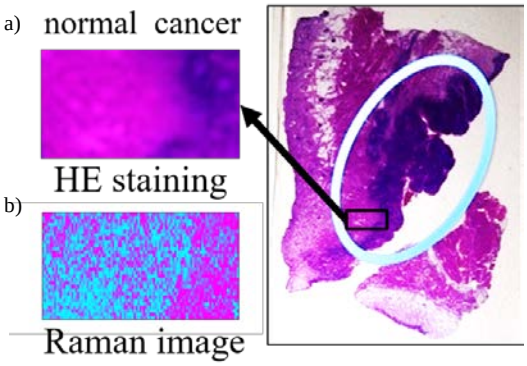

Fig.2 Raman imaging result

The cancer tissue section was successfully analyzed in the preliminary study using Raman imaging system and homemade data processing software. I was able to construct images that mimic HE staining and discriminate normal/cancer tissues. The malignant and normal tissues can be observed with dark and light purple colors in the HE staining section respectively, Fig 2 a). The picture in Fig 2 b) is a pseudo-color image. The advantage of Raman spectroscopy to provide in-depth detail for cancer diagnosis can be observed in Figure 1 b). The spreading of cancer cell into normal tissue can be observed as small purple dots spreading around in the blue area. This information cannot be achieved by staining.