Wax Physisorption Kinetic Study of Diagnosis of Cervical Cancer by Using Focal-plane-array Infrared Microspectroscopy

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IR spectroscopic images were recorded using a Bruker IFS66/S FT-IR spectrometer coupled to a Hyperion 3000 which was equipped with a 64×64 infrared focal plane array (FPA) detector (Bruker Optic, Germany) and a 15× cassegrain objective. The microscope was enclosed in a plastic box which was purged with dry nitrogen. Images of 4096 IR spectra at a spectral resolution of 8 cm^{-1} were acquired by the OPUS software (Bruker) and operated the FPA in continuous-scan mode by coadding 64 interferograms. Representative spectra in the mid-IR region of normal and cancer cervical tissues and nevi and melanoma are shown in Fig. 1. Furthermore, normal cervical tissue showed a higher absorbance in the region 900–1185 cm^{-1} and lower peak height ratio of $\nu_{as}CH_2/\nu_{as}CH_3$ compared with cervical cancer tissues. The results of infrared kinetics of wax physisorption revealed that waxed cervical cancer tissue(carcinoma in situ, cis) showed a much stronger tendency for adsorbing beeswax ($C_{46}H_{92}O_2$) than that of paraffin ($C_{25}H_{52}$) after xylene washing of 5 s showen as Fig 2. On the contrary, waxed normal cervical tissue showed a strong adsorption with the paraffin but relatively weak with beeswax shown as Fig. 3. We proposed that the phenomenon of specific physisorption for aliphatic wax is induced by polarity variation of the membrane proteins between normal and cancerous tissues. Infrared kinetic study of wax physisorption will be one of potential methods to screen and detect cancer.

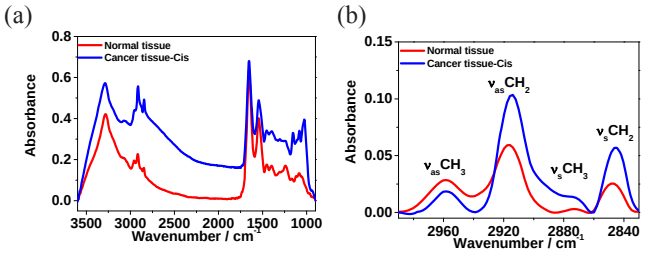

Fig. 1: Representative mid-IR absorbance spectra of normal and malignant cervical tissue in the range (a) 3600-900 cm^{-1} and (b) 3000-2800 cm^{-1}.

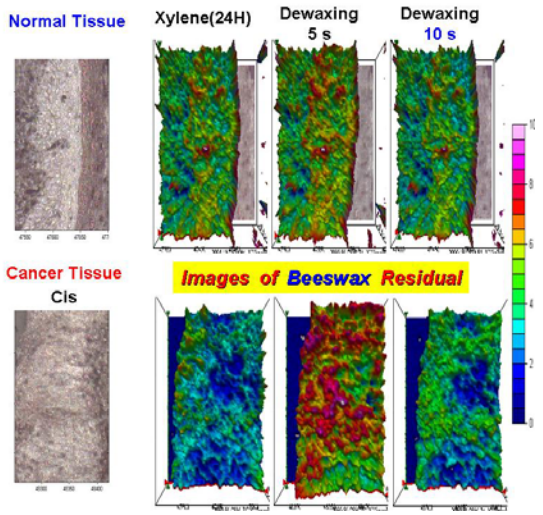

Fig 2: IR spectral images of absorbance between 2800-3000 cm^{-1} of infrared kinetics of beeswax physisorption of cervical normal and cancer tissue(cis).

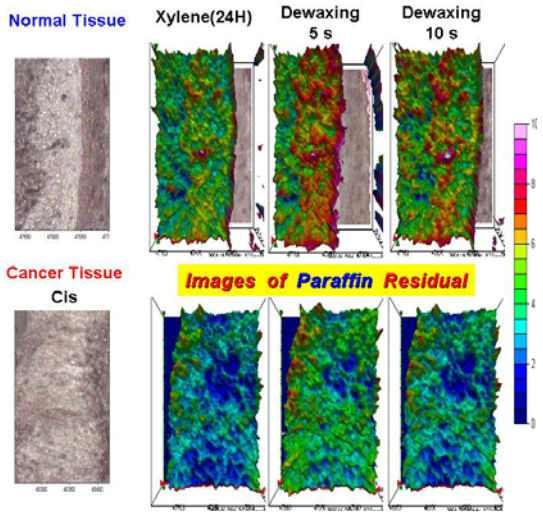

Fig 3: IR spectral images of absorbance between 3000-2800 cm^{-1} of infrared kinetics of paraffin physisorption of normal and cancer cervical tissue(cis).

References

[1] R K Sahu and S. Mordechai, Future Oncology **1(5)** 635 (2005).
[2] A. Podshyvalov *et.al*, Applied Optics **44**, 18 (2005).
[3] Bayden *et.al*, Biospectroscopy **4**, 75 (1998).