A Kinetic Study of Capability of Wax Physisorption for Colorectal Cancer Diagnosis by Infrared Microspectroscopy

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Human colorectal cancer tissues showed higher intensity ratio of $vasCH_2$/ $vasCH_3$ than that of normal colorectal tissues[2]. According to the variation of intensity ratio of $vasCH_2$/ $vasCH_3$ during carcinogenesis, we developed an innovative infrared kinetic imaging method for screening colorectal cancer using infrared microspectroscopy, which employed the intensity of residual paraffin in the spectral range of 3000-2800 cm^{-1} to be the signpost for the capability of wax physisorption with tissue and cells. The kinetic residual paraffin images of sample revealed that there is obviously amount of paraffin residual ($C_{25}H_{52}$) adhering to normal human colonic fibroblast cell, CCD-18Co, than that of colorectal cancer cells, SW-480 and SW-403 after xylene washing. On the contrary, there is relative more amount of residual of beeswax ($C_{46}H_{92}O_2$) adhering to cells of SW-480 and SW-403 after xylene washing than that of CCD-18Co. Based on this finding, we inferred that colorectal carcinogenesis accompanied with polarization variation causing malignant colorectal cells or cancer tissues which were higher level of polarization than normal colorectal cell. Therefore, paraffin and beeswax showed a stronger capability of physisorption with normal cells and cancer cells, respectively and could be the adsorbent for differentiating malignancy from colorectal tissues or cells. This innovative infrared kinetic method of wax physisorption could be a potential way for diagnosing human colorectal cancer in the future.

The infrared kinetics of waxing adsorption employing paraffin and beeswax as the markers can differentiate the normal cells from malignant colorectal cancer cells. Therefore, we proposed that paraffin and beeswax could be the marker for screening cancer and infrared kinetics of wax physisorption be a potential method for early detection of cancer.

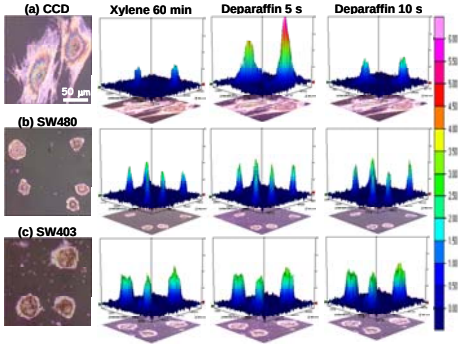

Fig. 1: Maps of peak area between 2800 to 3000 cm^{-1} of colon cells. (a) CCD-18Co, (b) SW480, and (c) SW403. The spectrum of colorectal cells after xylene washing for 20 min as reference and the others were the spectra of paraffined colorectal cells treated by xylene washing for 5 s, 10 s, and 15 s.

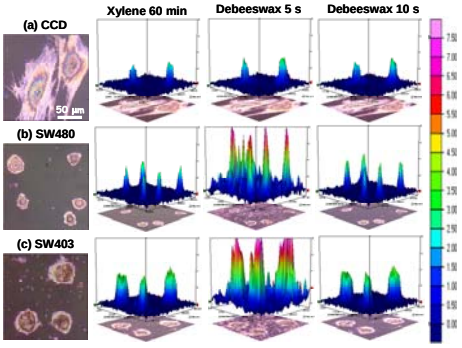

Fig. 2: Maps of peak area between 2800 to 3000 cm^{-1} of colon cells. (a) CCD-18Co, (b) SW480, and (c) SW403. The spectrum of colorectal cells after xylene washing for 20 min as reference and the others were the spectra of beeswaxed colorectal cells treated by xylene washing for 5 s, 10 s, and 15 s.

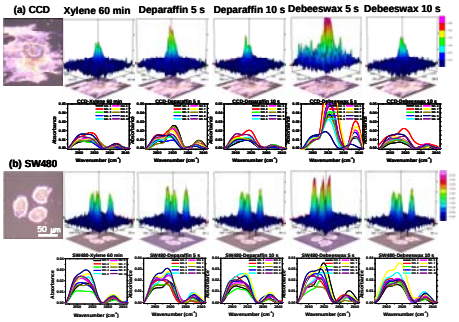

Fig. 3: IR spectral images and spectra of absorbance in the range 2800-3000 cm^{-1} of co-culture of (a) CCD-18Co, (b) SW480.

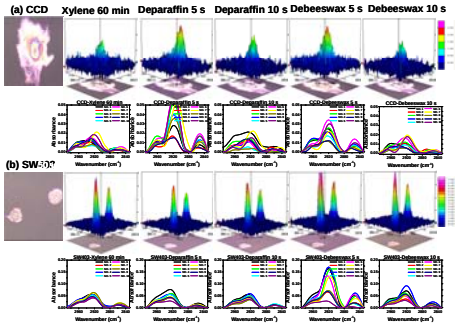

Fig. 4: IR spectral images and spectra of absorbance in the range 2800-3000 cm^{-1} of co-culture of (a) CCD-18Co, (b) SW403.

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