Early Detection of Cancer by using Wax Physisorption Kinetics and FTIR imaging

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Altered glycosylation of glycoprotein is a common phenotypic change during the development of cancer and inflammation cells [1−2], and the chain length of oligosaccharide residues (glycan chain) of glycoprotein is dependent on the processes of exogenous and endogenous glycosylation during cell proliferation. An innovative method of wax physisorption kinetics (WPK) has developed for estimating the strength of van der Waals force between oligosaccharide residue (glycan chain) of glycoprotein anchored on the surface of cancer tissue section sample and n-alkane (n-$C_nH_{2n+2,}$ n=20-34) waxes as glycan adsorbents. In this study, Wax-physisorption-kinetics-based FTIR (WPK-FTIR) imaging can be employed to estimate the aberrant glycosylation level of malignant sample compared to normal tissue, measuring the glycan adsorbents residue adhering onto sample surface to correlate the strength of physisorption between glycan chains of glycoprotein and glycan adsorbents. The result of WPK-FTIR imaging for malignant cells exhibited that a stronger physisorption was found with long-chain n-alkane waxes ($28 \leq n \leq 34$) than those of short-chain ones ($20 \leq n < 28$); nevertheless, normal cells showed a more preference with short-chain n-alkane waxes than those of malignant tissue[3−5]. A malignancy index can be utilized to indicate the aberrant glycosylation level for benign, precancerous or cancer tissue by using infrared absorbance ratio ($A_{Beeswax}$/ $A_{Paraplast}$) of beeswax ($C_{30}H_{61}CO_2C_{15}H_{31}$) to Paraplast (or using n-pentacosane) residue adhering onto sample surface in the mid-infrared range of 3000-2800 cm^{-1}. So far, we have examined several cancers including oral cavity cancer, colon cancer, gastric cancer, breast cancer, prostate cancer, cervical cancer, ovary cancer, brain cancer, neuroendocrine tumor and skin cancer by WPK-FTIR imaging.

References

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