The Investigation of Rat Liver Tissue after Exposure of LED illumination using Wax Kinetics Physisorption and Fourier Transform Infrared (WPK-FTIR) imaging

Chin-Wei Kuo (郭晉維)[1], Pei-Yu Huang(黃佩瑜)[1], Hui-Ying Jheng(鄭惠霙)[2],
Chee-Yin Chai(蔡志仁)[2,3], Hsin-Su Yu(余幸司)[2,4*], Yao-Chang Lee(李耀昌) [1,5*]

[1]National Synchrotron Radiation Research Center, Hsinchu 30076, Taiwan
[2] Graduate Institute of Clinical Medicine, College of Medicine, Kaohsiung Medical University,Kaohsiung 80708, Taiwan
[3]Department of Pathology, Faculty of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung 80708, Taiwan
[4]Department of Dermatology, Kaohsiung Medical University, Kaohsiung 80708, Taiwan
[5]Department of Optics and Photonics, National Central University, Chung-Li 32001, Taiwan
* yclee@nsrrc.org.tw

Abstract

Solar radiation is an essential component of nature making intricate interactions with the living organisms and providing both beneficial and harmful health effects. Previous studies focused on UV radiation[1-3] ; however, the effects of visible and NIR radiation on human health is rarely understood. Herein two LED Illuminators were set up, blue light LED (460 ± 20 nm) and visible white light LED (380~900 nm), for studying the pathological effects after long term illumination by visible light radiation in rat model. In this study, wax physisorption kinetics coupled with FTIR imaging was utilized to profile the alteration of glycan structure on the surface of tissue sections of rat liver after rat receiving illumination at a given exposure. The altered glycan structure of glycoprotein was demonstrated to be strongly correlated with carbon number (CN) of n-alkanes employed as glycan adsorbent using wax physisorption kinetics coupled with FTIR (WPK-FTIR) imaging, and greater physisorption was found between the glycans of glycoprotein on the malignant sample and higher CN n-alkanes than those of lower CN n-alkanes using wax physisorption kinetics coupled with FTIR (WPK-FTIR) imaging [4-6]. In this study, the profile of glycan structure alteration of glycoprotein was probed using WPK-FTIR imaging and n-$C_{22}H_{46}$ and n-$C_{28}H_{58}$ utilized as glycan adsorbents to investigate the strength of physisorption capability with the surface of liver tissue section of rat after treatment of LED illumination at 3.6 J/ day and 7.2 J/ day. The result of WPK-FTIR imaging revealed that the increasing level of carbohydrate of liver tissues in the spectral range of 1200-980 cm^{-1} and liver inflammation, presenting a higher ratio of absorption of n-$C_{28}H_{58}$ residue to that of n-$C_{22}H_{46}$ residue in the spectral range of 3000-2800 cm^{-1}, A_{28R}/ A_{22R}, were positively related to the power of LED illumination onto those rats. Furthermore, the population of kupffer cells was dramatically decreased after visible light illumination using white and blue LED. Based on these findings, we proposed that the population density of altered glycans structure of glycoprotein anchored in the liver tissue sections is greater than that of regular glycan structure. And A_{28R}/ A_{22R} ratio would be a useful signpost for assessing the safety of using LED illumination indoor.

Reference

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