

Poster Presentation

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"Rapid, non-invasive, in vivo skin analysis using Raman spectroscopy"

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Abstract: Skin analysis plays important role in understanding drug penetration kinetics, skin hydration status, disease diagnosis etc. The scientific interest ranges from the basic understanding of biochemical composition and physiological functions up to the diagnosis of pathological skin diseases. There is a necessity to study absorption process of harmful substances for risk assessment and safety studies. Also, skin absorption processes can be used to deliver substances via the skin for cosmetic, protective or therapeutic purposes. Thus, for investigation and evaluation of novel skin therapeutics, suitable analytical techniques are essential prerequisites.

For *in vivo* skin analysis using Raman spectroscopy it becomes difficult to get good quality of Raman signal with sufficient signal to noise ratio, less integration time and less laser exposure on the skin. Due to the trade-off between exposure, integration time and signal to noise ratio, there is need of developing novel instrumentation which uses less exposure level on tissue and increases more Raman signal to noise ratio. Less exposure levels and good Signal to noise ratio makes instrument suitable for *in vivo* investigations. With current experimental set up using fiber optics for illumination and collection, one can get *in vivo* Raman spectra of skin with less than 10 second accumulation at lowest power density on the skin. Monte Carlo simulation studies are used to investigate and validate the efficiency of the novel technique using photon transport of Raman signal in tissue irradiated by a diffused finite beam. The experimental results show that the variations in the molecular composition such as melanin present in the skin layers can be determined in vivo, non-invasively

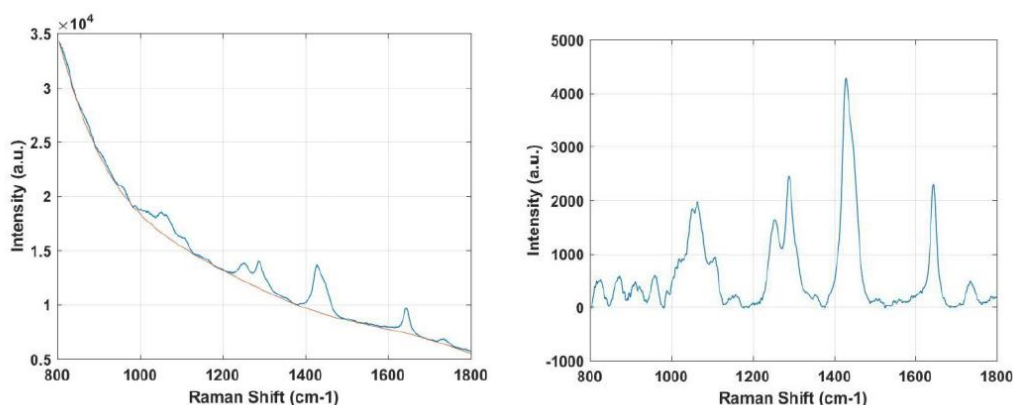


Figure 1. *in vivo* human skin Raman spectra (Raw and processed) obtained at 10 sec accumulation and exposure of 11.46 mW/cm² (power density) using 785nm excitation.

References

1. B. Gotter, W. Faubel, R.H.H. Neubert, Skin Pharmacol. Physiol. 21 (2008) 156– 165.
2. Lutz Franzen a, Maik Windbergs, Advanced Drug Delivery Reviews 89 (2015) 91–104.
3. Zhiwei Huang, Haishan Zeng, Calum E. MacAulay, Iltefat Hamzavi, David I. McLean, Harvey Lui, Biophotonics Instrumentation and Analysis, (2001), doi: 10.1117/12.446645.