

Micro-Analysis of Biomedical Samples by Infrared ATR-Spectroscopy Using Novel Silver Halide Fiber Probes

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Infrared microscopy plays an important role in the chemical analysis of biosamples such as tissues and single cells. The number of applications of infrared spectroscopy in pathology and histochemistry studies has increased recently using such a technique. Equipment employing a simple arrangement of a silver halide fiber of sub-millimeter diameter cross-section is presented which shows promising properties for trace analysis and micro-domain measurements with a minimum spot size of $20 \times 60 \mu\text{m}^2$. This system is significantly less complex than a conventional IR-microscope and offers a similar performance at a much lower cost. Another micro-probe was developed employing a fiber coupled diamond micro-prism. These probes were tested for the analysis of various biomedical samples. One challenging task was the analysis of skin specimens and hair samples of ancient corpses after 2000 years of interment in bog soil.

The desiccated dermis samples looked leather-like, but were rather brittle, which did not allow the preparation of microtome sections for IR-microscopic studies. Therefore, skin cross sections were analysed using the attenuated total reflection technique with our silver halide fiber accessory. Comparable results were obtained with an IR-microscope. Natural dermis samples are mainly composed of collagen, primarily of type I and III. Fibril structure within the mummified samples was still observable by electron-microscopy. Protein composition was evaluated by comparison with spectra from reference materials and horse leather prepared by vegetable tanning. Our results are compared to those of previous investigations on the skin of the 'Iceman' [1, 2]

Further infrared studies were performed on different cell cultures. Primary epithelial cells are of particular importance for *in-vitro* experiments in toxicological and clinical research. More than 90 % of all tumors in the human urinary tract derive from urothelial cells. Cultures of exfoliated epithelial cells from different locations of the human urinary tract and the renal tubular system were prepared [3]. Preliminary results from infrared spectroscopic investigations are reported. Also MDCK (Madin Darby Canine Kidney) cells were studied, which are in use for positive controls of renal tubular cells. Infrared spectra were recorded after application of different preparation techniques. Interpretation of the spectra of the different cell lines is in progress.

References

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