

Clinical Chemistry without Reagents? An Infrared Spectroscopic Technique for Determination of Clinically Relevant Constituents of Body Fluids

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In the clinical domain it is necessary to determine blood parameters like cholesterol, uric acid, urea, glucose, proteins etc. for a large amount of samples with sufficient precision. At present this is mostly done in the central laboratory, where a time-consuming preparation is needed before the measurement starts. Therefore the time span between the sample drawing and the obtaining of the results often takes too long in case of emergency. Furthermore, multiple instrumentation is needed for several different parameters.

We propose to solve this problem by using a reagent-free method which is able to determine the concentrations of various blood components within one minute [1]. This is done by measuring infrared absorbance spectra with a FTIR spectrometer. To reduce the required amount of blood and to allow fast and easy exchange of the samples, a diamond-ATR-cell was constructed.

Problems which arise due to overlapping bands of different components were solved by using a spectrometric method based on partial-least-squares regression [2]. In the present stage of development we are already able to determine eight relevant parameters in human serum or whole blood [Table 1] and seven parameters in urine. Our method complies with criteria from hospitals for a bedside point-of-care-testing and therefore will minimize the time span between sample drawing and a therapeutical decision.

Table 1: Accuracy and deviation of different parameters of human whole blood

	data set range	RMSECV
total protein	2 – 11 g/dl	± 0,32 g/dl
albumin	1 – 6 g/dl	± 0,15 g/dl
hemoglobin	8 – 17 g/dl	± 0,234 g/dl
immunglobulin g	0,3 – 2,1 g/dl	± 0,12 g/dl
glucose	20 – 340 mg/dl	± 7,5 mg/dl
urea	10 – 220 mg/dl	± 4,4 mg/dl
triglycerides	0 – 1700 mg/dl	± 19,7 mg/dl
cholesterol	35 – 360 mg/dl	± 15 mg/dl

[1] G. Hosafci, O. Klein, G. Oremek, W. Mäntele, *Anal Bioanal Chem* 387 (2007) 1815-22.

[2] T. Næs, T. Isaksson, T. Fearn, T. Davies: *Multivariate Calibration and Classification* (2002); NIR Publications Chichester, UK.