

The development of the urine analyser prototype



Figure 1: Urine Analyser Prototype developed by QRT

One of the goals of the NUTRISHIELD project is the development of novel monitoring devices using laser-based technology provided by project partner Alpes Lasers. With the help of The Medical Research Institute of Hospital La Fe and I.R.C.C.S. Ospedale San Raffaele, nutrition dependent parameters in urine have been determined. The requirements for the parameters chosen was the availability of distinct absorption bands in the mid-IR spectral region. Furthermore, the selection was motivated by unsuitable existing standard methods which were either time consuming or regarding high amounts of (hazardous) consumables.

After the analytes have been defined, the method for the quantification was developed by Technical University Vienna using an FTIR. Infrared spectroscopy is a non-invasive technology, where no alteration of the sample takes place, compared to alternative methods which use colour reactions followed by colorimetric measurements. The FTIR used for the method development uses a Globar as a light source. Changing the light source to a quantum cascade laser (QCL) has a lot of advantages: A QCL has a higher light density, which means that the path length of the flow cell can be increased and in correspondence with the Beer-Lambert law, the absorbance increases proportionally. A thicker flow cell reduces the risk of clogging and results in a more robust device. With a higher light power, a lower limit of detection can be reached as well. All these advantages were used for the development of the urine analyser prototype developed by project partner Quantared.

In the figure below, the analyser prototype is displayed. It has an autosampler, where 4 ports can be used for the measurement of the samples. The other ports are connected to cleaning solutions, which ensure the proper usage and cleaning of the device, to reduce carry over. The needed sample volume is very low, 250 μL , and the device can measure two analytes simultaneously. The analyser prototype is portable with a weight of 13 kg and dimensions of 0.35 m x 0.355 m x 0.355 m. Currently, the prototype is currently being validated under laboratory conditions and will be sent to HULAFE afterwards for the validation in environmental relevant conditions with real urine samples from mothers and infants.