CONTACTLESS MICROWAVE SENSORS AND THEIR APPLICATION IN BIOLOGICAL SINGLE USE TECHNIQUES

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In bioprocess technology, highly-sensitive robust sensors are required for operation in single use bioreactors (SUB) without direct contact to the fluid under analysis. Measuring the change of dielectric properties (permittivity and conductivity) at microwave frequencies allows the investigation of biological and chemical matter and processes, e.g., cell growth, cell metabolism and the concentration of large aqueous based molecules. This contribution describes a high frequency sensor that combines detection in macro- or microfluidic networks with quick and precise analysis. These kinds of sensors can be installed directly to the outer surface of the culture device (Figure 1) or can be clamped onto tubing (Figure 2). A clamped on sensor consists of a fluidic channel placed between a micro-strip line waveguide combined with resonant properties.

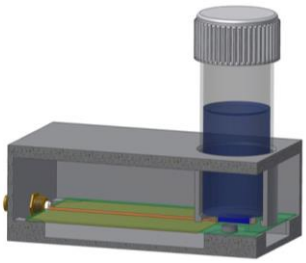

Figure 1 –MW-Sensor with a disposable flask

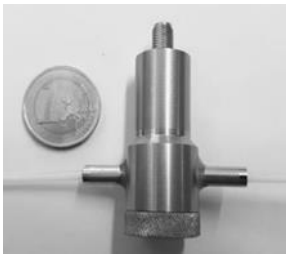

Figure 2 – MW Sensor as clamp-on device

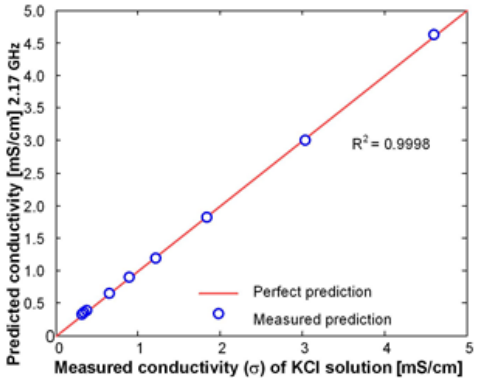

Figure 3 - Measurement of conductivity of KCl solution

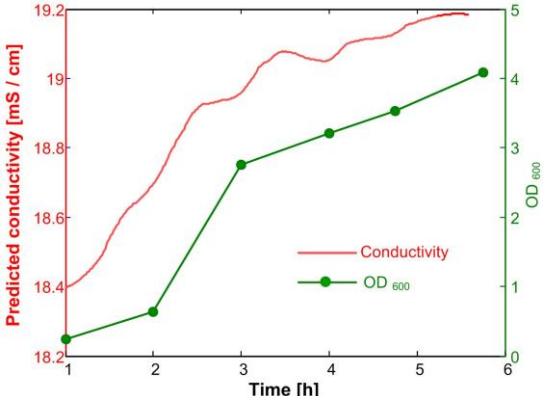

Figure 4 – Cultivation of E. coli bacteria

The developed contactless sensors can be connected to the SUB by means of a special port and associated cabling. Microwave Sensors can measure through optically opaque materials und are particularly suited to contactless measurement of permittivity and conductivity as can be seen form the measurement of KCl concentration (Figure 3) and the growth of *E. coli* bacteria (Figure 4). This contribution describes the scalable contactless monitoring system of liquids in cell culture reactors and dosing systems using high frequency sensors.