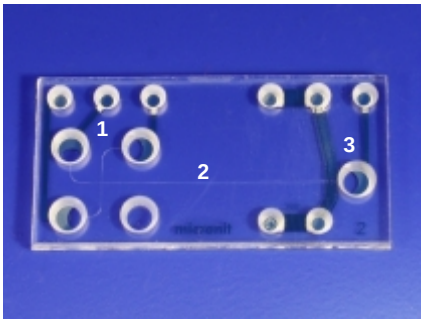
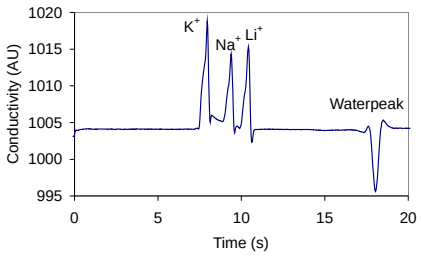
CONTACTLESS CONDUCTIVITY DETECTION

APPLIED TO MICROCHIP CAPILLARY ELECTROPHORESIS

Capillary electrophoresis (CE) microchips can be used with a variety of detection principles. Conductivity detection offers a relatively simple method to detect the separated zones on a CE microchip. In order to measure the conductivity changes in the liquid, dedicated electrodes are integrated in the microchip that are either insulated, for contactless conductivity detection, or in direct contact with the background electrolyte. When the detection electrodes are in contact with the background electrolyte a very good decoupling between the high voltage power supply and conductivity detector is required. Even small electrical leak currents through the detection electrodes caused by poor decoupling will start the electrolysis of the background electrolyte resulting in the formation of gas bubbles inside the separation channel. Another potential problem is the degradation of the detection electrodes over time, for example due to the deposition of material, which can alter the characteristics of the detection cell over time.



Photograph of the CE chip with integrated electrodes. Size of the chip is 15 x 30 mm.
1. platinum high voltage electrodes
2. separation channel
3. conductivity detection electrodes



Separation of 1 mmol/L potassium, sodium and lithium. Separation at 2 kV.

Contactless conductivity detection solves many of the problems encountered by contact conductivity detection for CE applications. An insulating material, for example glass, separates the conductivity detection electrodes from the background electrolyte. The full decoupling between the electrical circuit of the high voltage supply and conductivity detector provided by the insulating layer prevents the occurrence of any electronic issues. In order to reach the optimum sensitivity the insulating layer should be very thin. Micronit can manufacture CE chips with a bottom plate thickness of 175 µm or less which includes a structured electrode layer. Using a commercially available conductivity detector, high signal-to-noise ratios can be obtained from these chips as demonstrated by the figure.

Key features:

- **Borosilicate CE microchips with a thin glass bottom down to 175 µm**
- **Conductivity detection electrodes patterned on the bottom of the chips**
- **Compatible with commercially available conductivity detectors**