

DIY-CAPILLARY-ELECTROPHORESIS WITH C4D-DETECTION FOR TEACHING PURPOSES

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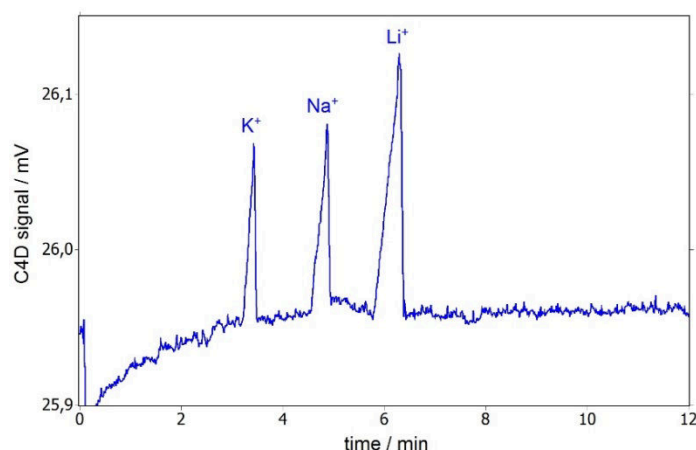
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Introduction: The transfer of knowledge in the STEM fields (science, technology, engineering and mathematics - in German called as MINT = Mathematik, Informatik, Naturwissenschaft und Technik) is the main task of the registered association AATiS. In last years, the AATiS has created a series of practice-tested kits from the field of low cost instrumental analytical devices (e.g. Geiger-Müller-Counters, LED-photometers, gas chromatography)^[1]. As a supplement to the separation in the gas phase, a separation technique in the liquid phase is currently added as a new project. In contrast to HPLC, which can hardly be constructed without special components in a DIY-project, capillary electrophoresis opens up an easily accessible approach. The detection of the separated ions can be easily conducted by capacitively coupled contactless conductivity detection (C4D) – an inexpensive and robust system.

Technical design: The AATiS kits are primarily designed for didactic teaching purposes. For this reason, the constructions of the systems are as transparent as possible and components, which are not absolutely necessary, are omitted. A DIY-high-voltage source, which is based on an auto-ignition coil, is used for HV-generation. Alternatively, a commercially available HV-module can also be used. Monitoring of voltage and current is concerned by analogue moving-coil instruments. The C4D-part is based on the low cost multistage logarithmic amplifier IC AD8307. This device transforms the signal from the electrode directly to a d.c. level. By using this IC the typical circuit configuration with several operational amplifiers can be substantially simplified.

Application and Résumé: The separation of earth alkali cations can be selected for first experiences. The figure shows a separation carried out with the DIY-CE-C4D-system.



- Electropherogramm with C4D-detection
- Sample: 20 mg/L K⁺, Na⁺, Li⁺
- Electrolyte solution: 12 mmol/L HIS, pH 4.2 with HOAc
- Capillary: fused silica, 50 μ m i.d., L_{total} = 60 cm (L_{eff} = 50 cm)
- Hydrodynamic injection by elevating capillary 30 sec at 15 cm
- Separation: -20 kV at 8 μ A

The system can be constructed for approx. 100 Euro material costs and allows a feasible access to this instrumental analytical method. The only disadvantage is the need of high voltage. The system can therefore only be operated on the responsibility of qualified users.

Reference: [1] www.aatis.de; for more information use the kit-numbers AS622 (Geiger-Müller-counter), AS535 (LED-photometer), AS513 (Vis-spectrometer), AS656 (gas-chromatograph) and AS516 (thermopile).