ELECTRICAL BOUNDARY POTENTIAL AS AN INSTRUMENT FOR CONTROLLING THE CHARACTERISTICS OF THE POLYMERIC ION-SELECTIVE SENSORS

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Ion-selective sensors are widely used in routine analysis. Their response mechanism is based on equality of the electrochemical potentials of all the species in the sensor and sample phases. Therefore, the boundary potential at the sensor/sample interface plays a crucial role in the signal formation both for potentiometric sensors (ion-selective electrodes, ISEs) and for optical chemical sensors (optodes). The possibility of controlling the electrical boundary potential would open broad prospects for tuning the sensor characteristics.

Herein, we report on theoretical and experimental investigation of the mechanism of the boundary potential formation. The potential at the polymeric sensor/solution interface was simulated numerically. The effect of the lipophilic electrolyte partition [1, 2] between the two phases was quantified.

Furthermore, strong influence of the co-extraction of the solution anion on the interfacial potential of the cation-selective sensors was predicted theoretically and verified experimentally.

The obtained results allowed developing and quantifying a strategy for tuning and stabilization of the boundary potential at the sensor/solution interface. The latter is strongly required for obtaining optodes that respond to individual ionic activity [1], liquid junction-free reference electrodes for all-solid-state potentiometric devices [2], color standards for digital color analysis [3], and calibration-free optode arrays [4].

References

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