Optimization of Manufacturing Method for Solid-Contact Ion-Selective Electrodes: Towards Sensor Reproducibility and Operational Stability

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High demand for easily accessible chemical information provoked the shifting of traditionally laboratory-based analyses to distributed, simplified designs aimed for application in various environments, and not strictly by trained individuals. Owing to mechanistic simplicity and improvements in analytical selectivity, electrochemical sensing platforms are chosen for integration into devices for rapid screening of complex matrixes, such as biological and environmental samples [1]. As mass-production methods are evolving, ensuring sensor reproducibility becomes very important for quality assurance [2]. With the simplest operational principle of potentiometric sensing, reproducibility is defined by the uniformity of the standard potential, E^0, as well as response stability. These prerequisites can be achieved by properly selecting ion-selective membrane materials and careful optimization of production parameters.

A fluid dispenser was used to deposit ion-selective membranes on screen-printed carbon electrodes. The reproducibility of the electrodes was optimized by adjusting the membrane composition and deposition parameters such as the spotting pressure and substrate temperature. The electrodes were evaluated using a new colorimetric absorbance method [3]. The analytical performance of the devices were assessed by calibrating potassium-selective membranes. Additionally, the stability of the sensor's operation was examined by identifying the impact of sample introduction on the underlying ion-to-electron transducer layer.

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