

Development of High Performance Sodium Ion Optodes for Medical Applications

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Summary

A novel polymer waveguide-(active waveguide) type optode possessing the advantages of both selective analyte determination and optical signal propagation was developed. The noteworthy concept of this active waveguide is the integration of plural functions into the planar waveguide itself, such as molecular recognition, color change, and light propagation. In order to demonstrate this concept, the analyte sensing layer is utilized as the light propagating layer. An ion-selective optode membrane consisting of a plasticized PVC membrane containing a neutral ionophore and a color changeable lipophilic anionic dye was used as the planar active waveguide sensing layer. The principle of the response of this active waveguide is based on the measurement of the output light signal intensity in which this light is propagated through the color changeable PVC membrane phase, and its intensity is decreased by interaction with the analyte ions. In this report, calcium and sodium ion-sensitive waveguides were prepared based on our developed neutral ionophores. Comparison of the experimental responses between the novel active waveguide optode and a commonly utilized conventional waveguide optode based on evanescent wave spectrometry demonstrated that the sensitivity of the active waveguide optode is obviously greater than that of the conventional waveguide optode. This concept of an active waveguide fully demonstrates the advantageous property of a planar waveguide with respect to highly sensitive and selective optical chemical sensing. The sodium ion-selective active waveguide optodes developed here can be applied to the determination of sodium ion in the medical samples such as serum or plasma.