An all-solid-state Ion-Selective Electrode with Ag_3AsO_4 as the Sensitive Membrane for Detecting Arsenate in Aqueous Environments

Yifan Zhou, Jianbo Wu, Pingping Zhang*, Qiujin Wang, Ying Ye

Ocean College, Zhejiang University, Zhoushan 316021, China

*E-mail: marin011@163.com

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In this work, an all-solid-state ion-selective electrode, using Ag wire as a substrate, Ag particles as a mid-layer and Ag_3AsO_4 as a sensitive membrane was prepared for detecting arsenate in aqueous environments. The Ag particles were electrodeposited using a function generator and Schottky diode in AgNO_3 solution. Electrochemical polymerisation of the Ag_3AsO_4 sensitive membrane was achieved via chronoamperometry on an electrochemical workstation. The membrane successfully polymerised on the surface of the electrode, which was demonstrated from scanning electron microscopy images. The energy-dispersive X-ray spectroscopy results prove that the sensitive membrane is Ag_3AsO_4 , based on the main elements of the sensitive membrane being determined as, As, O and Ag. The detection limit of the electrode was measured as 1.8165×10^{-6} M with a linear range of 5×10^{-6} – 1×10^{-1} M, which indicates that the Ag_3AsO_4 electrode has a wide response range and low detection limit, exhibiting a response time of around 1–2 s with good stability and repeatability. The average potential fluctuation of the electrode in 1 h was 1.48 mV. The electrode shows good anti-interference properties in that it is far more sensitive to arsenate than interfering ions, including sulfate, carbonate, acetate and nitrate. The lifespan of the Ag_3AsO_4 electrode was confirmed as being more than 80 days, showing great recovery in water sample testing, which shows that the electrode is accurate and can be used for aqueous environmental testing.

Keywords: arsenate; sensitive membrane; ion-selective electrode; all-solid-state

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