Investigation of Portable Phosphate Ion-Selective Sensors for Field Based Soil Monitoring in Precision Agriculture

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Abstract

Phosphorous is one of the important primary nutrients essential for effective plant growth. The amount of phosphate in the soil strongly affects the crop yield. Each crop has certain level of phosphate-need for the effective growth, which makes it essential to timely monitor the soil phosphate level for efficient nutrient management in agriculture. Conventional soil testing methods are often time-consuming, laboratory-based, and unsuitable for real-time field applications [1]. Therefore, there is a growing need for portable and rapid sensing technologies for soil analysis. In the present work, a phosphate ion-selective sensor is developed using simple silver salts and polyvinyl chloride slurry. Graphene is used to surface coat the substrate, prior to sensing slurry deposition, which improved not only the adhesion but also protected the substrate from corrosion. The systematic study of various membrane compositions of silver ionophore along with PVC polymer was carried out to optimise the slurry composition for effective phosphate response [2]. The electrodes showed a high degree of selectivity towards monohydrogen phosphate with a concentration range of 0.009598 to 9598 ppm. The development of the sensor finds the potential application in the real-time phosphate ion-selective monitoring for nutrient management in agriculture.

References

[1] M. Bralić, A. Prkić, J. Radić, I. Pleslić; *Int. J. Electrochem. Sci.*, 13 (2018)1390.
[2] L. Zhang, M. Zhang, H. Ren, P. Pu, P. Kong, H. Zhao; *Comput. Electron. Agric.,* 112 *(2015)* 83.

Figures

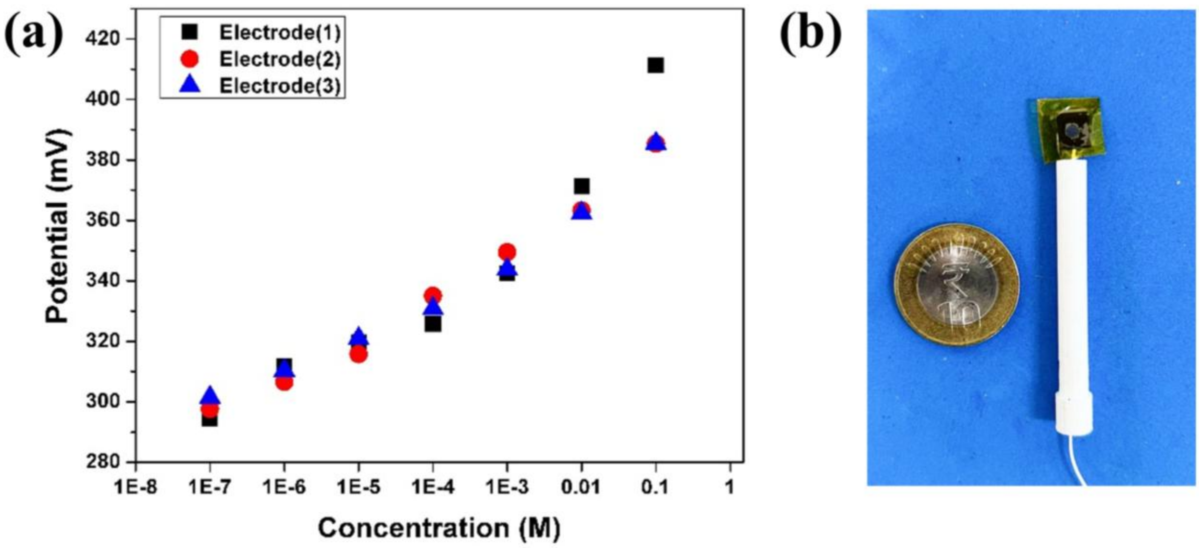

Figure 1: (a) Response curve of Potential against Concentration of the phosphate ion, and (b) Phosphate ion selective electrode