Studies on Response Characteristics of Nitrate Ion-selective Electrodes

Megha Raj
Ashmi Rappai, Vidyashri Kesavan, R.R Lekshmi, Digambar Nadargi*
Centre for Materials for Electronic Technology (C-MET) Thrissur, Kerala-68058, India.
*d.nadargi@cmet.gov.in

Abstract

Nitrate, a vital soil nutrient, stimulates vegetative growth, including leaf, stem and root development for improved crop yield and quality. In precision agriculture, nitrate sensors play an important role in accurately monitoring the soil nitrate levels to protect the crops from under/over dosing of nitrate fertiliser. In the present work, the development of electrochemical nitrate ion-selective electrode is reported [1]. The typical electrode is the graphene modified copper substrate coated with PVC-based nitrate selective membrane which consists of tetra dodecyl ammonium nitrate (TDDA) as the ionophore [2]. The electrode demonstrates high selectivity for nitrate ions, with a stable potential response over a range of 0.0062 ppm to 62000 ppm. In addition, the developed ion selective electrodes were tested for analytical reproducibility in the standard solution of nitrate ion with an assay of 99.999%. In view of real-time practical application, the sensors were treated with two different concentrations of regenerating solutions (NaCl with 10^{-5} and 10^{-3} M), which resulted in improved regeneration with 10^{-3} M NaCl. The facile composition of TDDA along with PVC has shown the remarkable nitrate ion selectivity, which makes them promising tools for nitrate monitoring in precision farming.

References

[1] H. J. Kim, J. W. Hummel, and S. J. Birrell, Transactions of the ASABE,49 (2006) 597.
[2] L. Zhang, M. Zhang, H. Ren, P. Pu, P. Kong, H. Zhao; *Comput. Electron. Agric.*,112 *(2015)* 83.

Figures

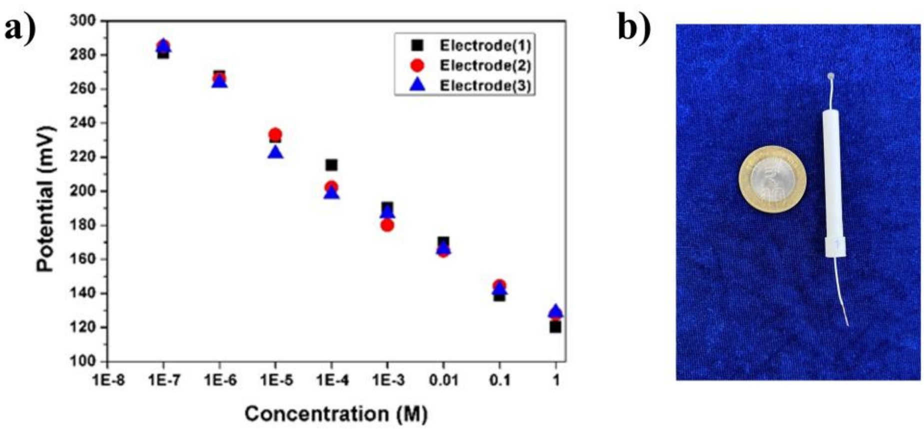

Figure 1: (a) Response curve of Potential against concentration of the nitrate ion and (b) Nitrate ion selective electrode.