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Fabrication of Cd(ii) ion-selective membrane electrode based on single walled carbon nanotubes Ce(iv) phosphate nanocomposite

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A single-walled carbon nanotubes cerium(IV) phosphate composite cation exchanger was synthesized using sol gel method[1]. The ion-exchange properties such as elution concentration, elution behavior and effect of temperature on ion exchange capacity were studied. The composite cation exchange material showed an ion-exchange capacity (IEC) of 1.64 meq dry g^{-1} of ion exchanger (Table 1).

Table 1: Conditions of preparation and ion-exchange capacity of SWCNT Ce(IV) phosphate

Sample	Mixing volume ratios (V/V)		Dispersion of functionalized SWCNTs (mg)	Appearance of beads after drying (color)	Na^+ IEC (meq dry g^{-1})
	0.1 M $CeSO_4.4H_2O$ in 0.5 M H_2SO_4	6 M H_3PO_4			
S-1	1	1.0	0	White	1.20
S-2	1	1.5	0	White	1.20
S-3	1	2.0	0	White	1.20
S-4	1	1.0	50	Grey	1.42
S-5	1	1.0	100	Grey	1.53
S-6	1	1.0	150	Grey	1.64
S-7	1	1.0	200	Grey	1.64

The distribution studies [2] revealed that the composite cation exchanger is highly selective for Cd(II) ions. A Cd(II) ion-selective membrane electrode based on single walled carbon nanotubes Ce(IV) phosphate has fabricated using solution casting method[3]. The membrane with 300 mg of single walled carbon nanotubes Ce(IV) phosphate and 10 µL of plasticiser exhibited highest proton conductivity. The membrane electrode showed a Nernstian response for Cd(II) ions over a wide concentration range of 1×10^{-1} to 1×10^{-7} M and exhibited a sub-Nernstian slope of 27.42 mV per decade change in concentration of cadmium ions (Figure 1). The limit of detection was found to be 1×10^{-7} M.

The fabricated membrane electrode exhibits a fast response time (10 s) and can be utilized for 130 days without any considerable divergence in response potential. The effect of interference of various metal ions on the selectivity of electrode towards Cd(II) ions was also examined in order to demonstrate the utility of proposed electrode in the presence of other ionic species. The practical utility of the membrane electrode was demonstrated by employing it as an indicator electrode for the estimation of Cd(II) by the potentiometric titration with ethylenediamine tetraacetic acid, disodium salt.

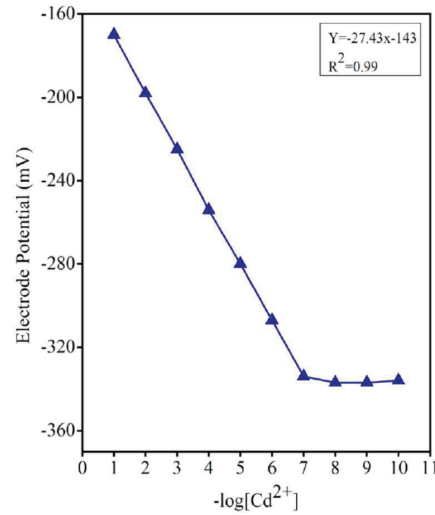

Figure 1: Calibration curve for Cd^{2+} ion-selective membrane electrode

References

1. Inamuddin, T. A. Rangreez, A. Khan, POLYMER COMPOSITES, DOI 10.1002/pc.23664.
2. S.A. Nabi, R. Bushra, M. Shahadat, JOURNAL OF APPLIED POLYMER SCIENCE, DOI 10.1002/app.36325.
3. Inamuddin, A. Khan, M. Luqman, A. Dutta, Sensors and Actuators A 216 (2014) 295-300.