

CHAPTER 4

CONCLUSION

A carbon paste consists of graphite powder and 1,8-dihydroxyanthraquinone mixed with liquid paraffin. The electrode construction was extremely simple and with low cost. Electronic conductivity is achieved by the contact between graphite microparticles with copper wire, while the paraffin ensures the compactness of the mixture. The paste is pressed in the hole of Teflon rod with 0.6 millimeter inside diameter. NaNO_3 0.8 M as electrolyte can not penetrate into the paste and which has low background current. The electrode reactions occur at the contact of graphite microparticles modified with 1,8-DHAQ with the analyte solution. For silver (I) analysis, complexation can be added to the surface of carbon paste electrode. The Ag(I) to be measured are firstly accumulated in the complex particles on the electrode surface, then the reduced at the electrode surface and finally reoxidized by the stripping scan in the positive direction. The use of an electrodeposition step prior to the actual measurement process forms the basis of all of the so-called electrochemical stripping techniques.

A variation of this procedure in which the preconcentration is carried out by chemical reaction and binding of the analyte at a chemically modified carbon paste electrode has been shown to offer several considerable analytical advantages over the conventional electrodeposition procedure. (1) Each analyte interested can be detected by the specific separation. The optimized carbon paste electrode can offer. (2) Some analyte can not be reductively deposited directly and in some cases it requires large negative potential for electrodeposition, therefore, carbon paste electrode can provide wider applicability over conventional stripping techniques. A carbon paste electrode increases the overall selectivity of the system by chemical separation in addition to selectivity obtained by the reduction potential of the analyte. The success of quantitative voltammetric analysis with carbon electrode modified with 1,8-DHAQ considerably depends upon the quality of carbon paste surface layer which is reflected mainly in reproducibility of the signal.

A new chemically modified carbon paste electrode has been developed using 1,8-dihydroxyanthraquinone for the determination of silver(I) at trace level by square wave

anodic stripping voltammetry. The electrode provides good stability, sensitivity, simplicity of electrode preparation and ability to easily regenerate. As there is no leaching of the electrode because of low solubility of the 1,8-dihydroxyanthraquinone in aqueous solution. Hence, a single electrode surface can be used 10 times analytical determinations without loss of sensitivity and reproducibility. The method presented here has a wide linear range and a low detection limit and is not interfered significantly by other metals ions. The selectivity can be controlled by both the property of 1,8-DHAQ and the reduction potential of Ag^+ . The analytical characteristics of the carbon paste electrode modified with 1,8-DHAQ with square anodic stripping voltammetry system were displayed in Table 36.

Table 36 The analytical characteristics of CPE-1,8-DHAQ

Analytical characteristics	Optimized value
Paste composition	Graphite 0.275 g, 1,8-DHAQ 0.050 g and liquid paraffin 0.15 mL
Electrolyte solution	0.8 M NaNO_3 , pH 2.0
Activation solution	0.5 M NaHCO_3
Preconcentration time	8 min
Accumulation potential	-0.25 V vs Ag/AgCl double junction reference electrode
Equilibrate time	10 s
Instrumental parameters	75 mV of pulse amplitude, 0.3 mV of step potential and 100 Hz of frequency
Regeneration solution	0.2 M HNO_3
Limit of detection	1.39×10^{-7} M
Linear range	9.0×10^{-6} to 9.0×10^{-4} M ($r^2 = 0.9942$)

The results showed that the modified carbon paste electrode with the 1,8-DHAQ was adequate for the determination of silver in water samples. The facility and selectivity can be achieved by CPE-1,8-DHAQ in a complex solution makes this method. The developed method excelled the ICP-AES method in the determination of Ag^+ for low concentration. The

main idea in this investigations was evaluation of a CPE-1,8-DHAQ for the detection of silver. The concept of this work about analyte accumulation on the surface of the CPE-1,8-DHAQ based on complex between analyte and modifier, can be extended over most cations on the Periodic Table by selecting the proper quinone compounds as modifiers and utilizing the any conditions mentioned above. The modifier should be sensitive enough with low percentage in the electrode and be able to preserve physical stability as well as electrical conductivity of the electrode. Further research will be in progress to find modifiers which are more sensitive and selective.

The possibility of using carbon paste electrode modified with quinone compounds for the determination of other elements depends on the functional group of quinone compounds. Which can have selective interaction with each metal. The synthesis of the new derivatives of anthraquinone is attractive applications for modified electrodes such as that 1,4-bis(prop-2'-enyloxy)-9,10-anthraquinone was synthesized for modified CPE which can be used to determine Pb(II) at low concentration (Mousavi *et al.*, 2001). The functional groups have tendency to form complex with metals, such as sulfhydrylic (-SH), aminic (-NH₂), oxydrilic (-OH), disulfuric (-SS) and carboxylic (-COOH). These groups also pertain to important molecules with catalytic, structure or transport functions. Pb, As and Hg show particular reaction with -SH groups (Apostoli, 2002). Therefore, the synthesis of new anthraquinone derivative should emphasize on -SH groups in the applications of modified carbon paste electrode in metal analysis. Voltammetric stripping of CMCPE achieves very low detection limits compared to other techniques for a considerable toxicologically and environmentally significant elements, particularly Pb, Hg, Cd and Cr which contaminate seafood, beverages and drinking water. In the application of CMCPE with quinone compounds for the determination of these metals, the special functional group on quinone compounds can be added to make them sensitive and selective with one only metal.