1.2. SUMMARY

Preliminary electrochemical survey of pesticides which are commonly used in Sri Lanka was conducted. This includes Monocrotopus, Cyhalothrin, Gramaxone, Manzate 200, Carbaryl, Elsan 50, Harcros Selecron and Ekalux. It could be observed that Gramoxone(Paraquat) and Grenade 5 EC (Cyhalothrin) were electrochemically active within the working potential range at the bare glassy carbon electrode in aqueous systems.

Glassy Carbon Electrodes coated with stearic acid provide an amperometric sensor for detection of paraquat, the active ingredient of the herbicide Gramoxone. The linear dynamic range of the sensor for Paraquat is 1.02×10^{-3} mol $dm^{-3}$to 1.02×10^{-2} mol dm^{-3} with the lower detection limit 6.37×10^{-4} mol dm^{-3}.

An electrochemical oxidation of Cyhalothrin, which is an active ingredients of Grenade 5 EC insecticide [LD_{50} value is (orally for male rats) 243 mg/kg] was carried out at a Glassy carbon electrode in an aqueous solution using cyclic voltammetry and amperometry. Preliminary electrochemical characterizations conducted by cyclic voltammetry indicated that the oxidation of Cyhalothrin occurs at +0.72 V vs. SCE, which is a completely irreversible system. Amperometric detection based on electro oxidation of Cyhalothrin also achieved with Glassy carbon electrodes coated with stearic acid. With this study it was possible to obtain calibration graphs, with linear dynamic range from 1.75×10^{-6} to 1.36×10^{-5} mol dm^{-3} at

optimized potential of +0.80 V vs. SCE in 0.1 mol dm^{-3} of NaCl as supporting electrolyte. A sensor provides reproducible responses at a very low concentration with the minimum detection limit (S/N = 3) of 1.75×10^{-7} mol dm^{-3} and the coefficient of the variation was 5.17 %.

The development of an amperometric biosensor for the detection of hydrogen peroxide is described. In-vitro cultured carrot callus which contains a high peroxidase activity is used as a molecular recognition element. The callus tissue was incorporated into carbon paste matrix along with ferrocene as an electron mediator. This system is based on the enzymic reduction of hydrogen peroxide by peroxidase and subsequent electron transfer from a carbon paste electrode to the enzyme via a ferrocene mediator. The linear dynamic range of the sensor for hydrogen peroxide was found to be 1.99×10^{-5} M to 2.72×10^{-4} M with the lower detection limit 1.72×10^{-7} M hydrogen peroxide and the sensitivity was 17.8 mA $moll^{-}$. The response time of the sensor was 2.5 sec. Additionally the sensor exhibits a long life time more than one month.

An electrochemical activity of Propanil, which is an active ingredient of 3,4 DPA [N-(3,4-Dichlorophenyl) propanamide] was studied. Cyclic voltammetric experiments of 5×10^{-3} mol dm^{-3} Propanil in an aqueous solution of Phosphate buffer(0.1 mol dm^{-3}) at bare glassy carbon electrodes showed one oxidation peak and one reduction peak. The peak located at -0.84 V was found to be the

most significant peak. Amperometric detection scheme based on this peak was subsequently developed for propnil. Furthermore, careful cyclic voltammetric investigations carried out with the pH of the electrolyte and the type of commercial sample revealed that there is a possibility to contain 3,4 -dichloroaniline in addition to the pesticide 3,4 DPA in the commercial samples. 3,4 dichloroaniline is a hydrolyzed product of the herbicide which is much more toxic and persistent than the pesticide, 3,4 DPA. Therefore the quality of the pesticide that the farmers buy should be checked before they are applied on the crop as the pesticide action could be questionable. In addition, 3,4 dicloroaniline could pose more detrimental impact on the environment than the pesticide itself.