QUALITATIVE AND QUANTITATIVE DETERMINATION OF ORGANOPHOSPHATES IN POST-MORTEM WHOLE HUMAN BLOOD BY GAS CHROMATOGRAPHY

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ABSTRACT

Pesticides, particularly organophosphates and carbamates are widely used in suicidal, homicidal and accidental poisoning in agricultural countries all over the world. A tremendous increase in pesticide poisoning has been observed in Sri Lanka during last few years.

In suspected pesticide poisoning cases, the forensic toxicologists play a vital role in the identification and quantification of pesticides in victim's body fluids and viscera samples. Analysis of blood samples for the presence of pesticide is mandatory to find out the cause of death in such cases. Although whole blood is a more complex sample compared to plasma and serum, whole blood has to be analysed in post mortem cases, since it is not possible to separate serum or plasma from post-mortem blood.

Organophosphates are mainly metabolised in the liver. However, parent pesticides can also be expected in cases of acute intoxication or poisoning, where the concentration levels are high enough to be detected unaltered in biological fluids or tissues, in spite of their rapid metabolism. Selective and sensitive methods are required for the analysis of organophosphates in whole blood and tissues. In this respect one of the challenges that the forensic toxicologists have to face with is the use of simple, rapid and efficient sample preparation method for the extraction of organophosphates from whole blood.

In this research, five extraction procedures were studied using four organophosphates namely chlorpyrifos, diazinon, fenthion and phenthoate. The extraction efficiencies for the selected organophosphates were evaluated. The recovery studies were carried out at three fortification levels of 4.0 μg/ml, 10.0 μg/ml and 20.0 μg/ml for each of the pesticide. Analysis of a blank blood sample showed that there were no interferences due to endogenous substances.

A procedure involving liquid-liquid extraction with n-hexane and further purification with acetonitrile was found to be the best sample preparation method.

The qualitative and quantitative analysis of four organophosphates were carried out by gas chromatography (GC) for which a gas chromatographic method was developed and validated in terms of limit of detection, limit of quantification, relative standard deviation, correlation coefficient and percentage recovery.

The selected extraction procedure and the GC method were found to be acceptable and successfully applied in five cases where organophosphate poisoning was suspected. In three cases, chlorpyrifos were quantified in blood samples at the levels of 8.98 μg/ml, 15.8 μg/ml and 7.98 μg/ml respectively. The organophosphate, fenthion was quantified in the blood samples of the other two cases at the levels of 7.11 μg/ml and 7.0 μg/ml respectively.