PESTICIDE AND PESTICIDE RESIDUE ANALYSIS OF DRINKING WATER IN GIRANDURUKOTTE AREA WHERE CHRONIC KIDNEY DISEASE IS PREVALENT

Ayanthi N. Navaratne[1], A. M. Devasurendra[2], C. Magamage[3] C. B. Dissanayake[4], T. Abeyasekara[5] and N.T.C. Athuruliya[6]

[1]Department of Chemistry and [2]Postgraduate Institute of Science, University of Peradeniya

[3]Office of the Registrar of Pesticides, Peradeniya, [4]Department of Geology, University of Peradeniya, [5]Nephrology Unit, Teaching Hospital, Kandy, [6]Department of Pharmacology, Faculty of Medicine, University of Peradeniya.

Introduction

About 20 years back, an apparently new form of chronic kidney disease of unknown aetiology (CKDu) had emerged in the North Central Region of the country including some parts of the North Western and Uva provinces (Girandurukotte). In the North Central Provice a high prevalence was observed in Medawacchiya, Padaviya, Dehiatt-akandiya, Medirigiriya and recently in the Nikawewa area in North Western Province (Bandara *et al.*, 2008). Widespread use of agrochemicals such as pesticides, heavy metals (Navaratne *et al.*, 2009), in soil and water sources and presence of high levels of fluoride could be postulated as contributing factors to the high prevalence of CKDu in these areas (Herath *et al.*, 2005). However, there is a tendency for it to be more prevalent among men engaged in agriculture, typically around the age of 40-60 years. Although a range of research studies of various types has been carried out over the years in view of elucidating the causative factors for the prevalence of CKDu, any definite evidence has not been indicated up to now to support a particular environmental nephrotoxin. Therefore, the main objective of this research is to investigate the pesticide content in the drinking water which is suspected to be one of the main causes for the chronic kidney disease of unknown aetiology in the Giranduru- kotte area.

Materials and Methods

Study area and sample collection

During this study, drinking water samples were taken from wells of several Gramaniladhari divisions in the Girandurukotte area including Bathale--yaya, Galporuyaya ,Ulhitiya, Millat--tawa, Aluttarama, *etc.* In this preliminary study the main objective was to test the quality of water with respect to pesticide content covering the entire area mentioned above. Altogether, sixty samples were obtained with a sampling frequency of three (20 samples in each day) which was carried out from October 2008 to June 2009. All the samples were collected into dry 500 cm^3 pre-cleaned amber coloured glass bottles and transported to the laboratory and kept under refrigeration conditions (at 4 ^{O}C) until chemical analysis was performed.

pH, conductance measurements and determination of COD

pH and the conductance of water samples were measured at room temperature before refrigeration using the ORION 420 A pH meter and WAP CM 35 conductivity meter soon after the samples were brought into the laboratory. COD value of the each sample was determined using open reflux method.

Analysis of Trace Organic Compounds: Liquid-liquid extractions of collected water samples were carried out with dichloromethane. Then the combined successive extraction were concentrated and the residue was dissolved in 5 cm^3 of Hexane and analyzed with AGIELENT 6890 N gas chromatograph equipped with an electron-capture detector (Figure 1).

Results and Discussion

Table 1 shows the summary of pH, Conductivity and COD of drinking water samples collected from the Girandurukotte area. In general, pH and the conductivity values for all samples shows a value around the acceptable range for drinking water whereas, COD values are significantly high indicating that there are some organic materials in their drinking water. According to the gas-liquid chromatographic analysis, there are some characteristic peaks in all samples which can be identified as organic pesticides such as Diazion, Dimethoate, Chlopyirfos and Phenthoate by comparing with the standard samples which were analysed under identical conditions (Table 2).

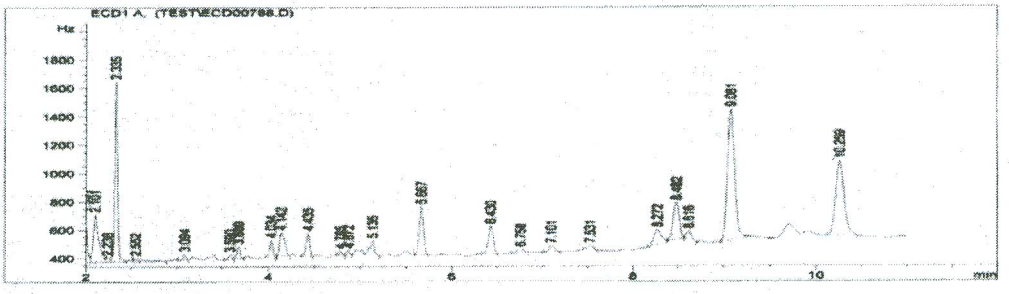

Figure 1. Gas Liquid Chromatograph of a water sample extracted with dichloromethane

Table 1. pH, Conductivity and COD values of water samples collected from Girandurukotte area

Sample Date* (Sample Frequency)	pH	Conductivity µS/cm	COD Value ppm
1st sampling (28th October 2008)	6.08-7.84	224.17-807.95	16.50-48.00
2nd Sampling (03rd February 2009)	5.76-7.65	168.13-798.95	16.90-46.15

*n = 20 for each date.

Table 2. Pesticide concentration in drinking water samples collected from Girandurukottte area

Pesticide (Range in ppm)	Standard Value (ppm)	Sample Date	
		28th October 2008*	3rd February 2009*
Dimethoate	0.02**	6.864×10^{-4}- 7.827×10^{-1} (Mean 2.474×10^{-1})	1.201×10^{-2}- 1.950×10^{-1} (Mean 1.001×10^{-1})
Diazinon	0.02***	8.705×10^{-2}- 6.313×10^{-1} (Mean 3.043×10^{-1})	2.058×10^{-2}- 2.899×10^{-2} (Mean 1.14×10^{-1})
Chlorpyrifos	0.09**	2.269×10^{-2}- 2.912×10^{-2} (Mean 2.561×10^{-2})	9.329×1^{-3}- 2.962×10^{-2} (Mean 1.251×10^{-2})
Phenthoate	--	8.755×10^{-3}- 1.250×10^{-2} (Mean 2.666×10^{-2})	1.849×10^{-2}- 8.577×10^{-2} (Mean 5.776×10^{-2})

*n = 20 for each date ** WHO standards ***Canadian Standards

Conclusion

The gas-liquid chromatographic analysis for pesticides of drinking water samples of Girandurukotte area indicates that almost all the samples contain commonly used pesticides although the results were not confirmed by Gas Chromatography coupled with Mass Spectroscopy (GC-MS). Furthermore, the results indicate pesticides dimethoate and diazinone present in harmful levels. The presence of pesticides in drinking water resources simultaneously with other possible nephrotoxins such as heavy metals and fluoride may contribute to CKDu synergistically. Analysis of controlled water samples (where CKDu is not observed) and its comparison with that of water samples of Girandurukotte for the content of pesticide residues is currently under investigation.

References

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