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Quantitative Evaluation of Organochlorine Pollutants in Cabbage Plant Cultivated Along River Getsi, Kano State

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ABSTRACT

Contamination of cabbage plant cultivated along river Getsi through water, soil and air by industrial, domestic and agricultural waste poses great health risk to the public when consumed. The study is aimed at evaluating the health risk associated with organochlorine pollutants (OCPs) in cabbage plant cultivated along River Getsi. Cabbage plant samples are collected fresh in the farmyard, with clean sampling container, washed, dried, extracted, cleaned up before identification and determination of organochlorine pollutants. Gas Chromatography-Mass Spectrometer (GC-MS) equipped with Electron Capture Detector (ECD) was used for the analysis. Percentage recovery obtained was 53% with a spiked sample concentration of 0.264µg/kg and control sample concentration of 0.155ng/kg. The concentration 0.007µg/kg of the analyte in cabbage was below the WHO and NESREA guideline limit of 0.01mg/kg. Hence, there are detective concentration of OCPs in cabbage plant examined, continuous exposure may exceed threshold level, which is dangerous,so it is necessary for regulatory bodies to prevent and minimized the contamination load.

Keyword: *Gas Chromatography, Mass Spectrometer, Electron Capture Detector, organochlorine pollutant.*

INTRODUCTION

Vegetable is a plant or part of a plant used as food, such as cabbage, potato, carrot or beans. Eating vegetables regularly in diet can have many health benefits by reducing many health related diseases and enhances the digestion of fats and carbohydrates (Elsevier, 2008). Unfortunately, harmful elements such as organic pollutants and heavy metals are found in these vegetables which may lead to harmful effects (Usman and Ayodele, 2002). Toxic metals (also referred to as heavy metals) and organic pollutants concentrations in soil are associated with biological and geochemical cycles and are influenced by anthropogenic activities such as agricultural practices, industrial activities and waste disposal method (Uwah et al.,2009). Contamination and subsequent pollution of the environment by heavy metals have become a global concern due to their distribution and multiple effects on the ecosystem. Heavy metals are present in agricultural soils at various levels. Due to their cumulative behaviors, toxicity and non-biodegradability, they have potential and hazardous effect not only on plants but also on human health (Rout,1997; Shinggu et al.,2007). Distribution of heavy metals in plants depends upon bio-availability and concentration of heavy metals as well as plant species. This research work was aimed at conducting a comparative study of heavy metals, organochlorine pesticides levels and human risk assessment in soil, water and some vegetables cultivated on bank of River Getsi.

MATERIAL AND METHODS

All reagents used were of analytical grade. Distilled, deionized or potable water was used throughout the study as necessary. Pesticide Residue grade or GC grade Acetone, n-Hexane, DCM, Anhydrous Sodium Sulfate (Na_2SO_4), Mix OCP Congeners Standards (Sigma Aldrich Chemical Company) among others.

Description of Sampling Site

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The sampling locations of this research are banks along River Getsi. Figure 1 shows the map of Kano State illustrating the sampling site and displaying the various sampling points.

Figure 1: Sampling points along River Getsi

Sample Collection and Treatment of Organochlorine Pollutant in cabbage Plants

Cabbage plant samples were harvested (in triplicate session), washed, dried, labeled and appropriately kept in refrigerator. A portion was slashed and pounded in a mortar to a paste of its solution by adding distilled water. Extraction and cleaned up was done by adding DCM/Hexane/Na_2SO_3 in 25g of paste solution placed in a sonicator and decanted. Cleaning up was done by passing it through column containing silica gel prior to GC-MS (Ritter *et al.*,2004).

Sample clean-up

The extracted cabbage samples were taken to Earth Quest international laboratory Agency, Warri, Delta State for GC-MS analysis.

RESULT AND DISCUSSION

Table 1.0 Showing various samples with control concentration, unspiked concentration, spiked concentration and percentage recovery.

Samples	K value (ug/kg)	Control samples ng/kg	Main Sample µg/kg	Spiked sample µg/kg	Percentage Recovery %
Cabbage	0.5	0.155	0.003	0.264	53

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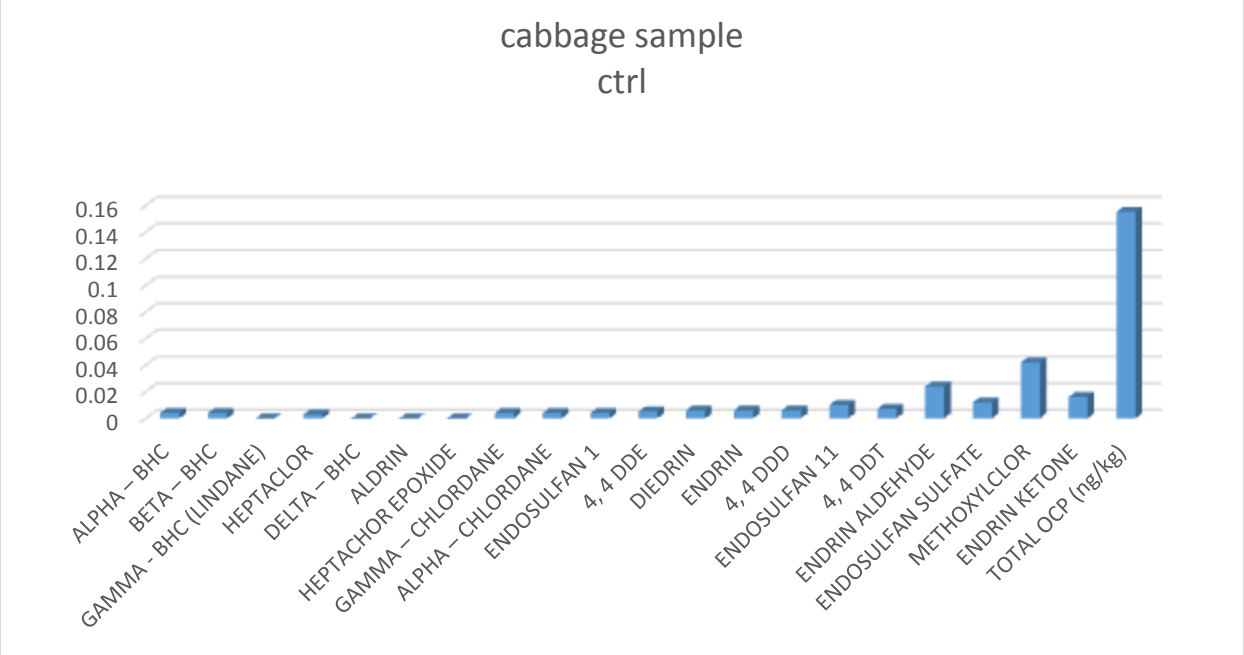
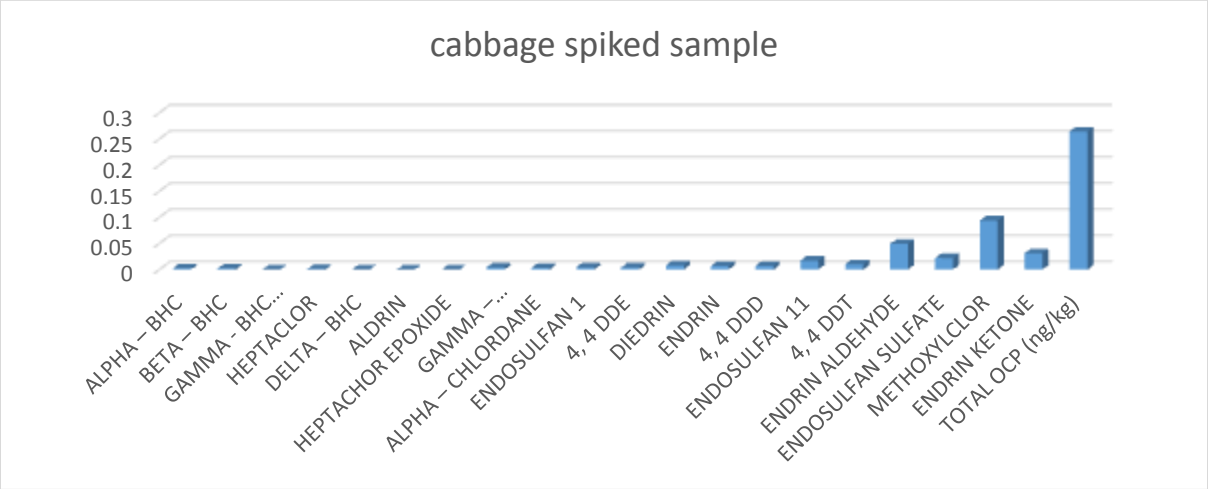


Cabbage control samples depicted above (figure 2), shows twenty OCPs depicted above shows, Alpha -BHC (0.004ng/kg); Beta-BHC (0.004ng/kg);Heptachlor (0.003ng/kg);Gamma-chlordane (0.004ng/kg); Alpha-chlordane (0.004ng/kg);Endosulfan 1 (0.004ng/kg); 4,4 DDE (0.005ng/kg); Diedrin (0.006 ng/kg); Endrin (0.006ng/kg); 4,4 DDD (0.006 ng/kg);Edosulfane 2 (0.0010 ng/kg); 4,4 DDT (0.007ng/kg);Endrin aldehyde (0.024ng/); Endosulfan sulfate (0.012 ng/kg);methoxyclor (0.042ng/kg);Endrin ketone (0.016ng/kg) only three is undetected and the total concentration summed up to be 0.155 ng/kg.



Cabbage spiked samples depicted above (figure 3), shows the twenty OCPs identified, Alpha -BHC (0.002 µg /kg); Beta-BHC (0.002 µg /kg); Heptachlor (0.001 µg /kg);Gamma

-chlordane (0.004 µg /kg); Alpha-chlordane (0.003 µg/kg); Endosulfan 1 (0.004 µg /kg); 4,4 DDE (0.004 µg/kg); Diedrin (0.008 µg/kg); Endrin (0.007 µg/kg); 4,4 DDD (0.007 µg /kg);Edosulfane 2 (0.017 µg /kg); 4,4 DDT (0.010 µg/kg);Endrin aldehyde (0.049 µg/kg); Endosulfan sulfate (0.022 µg/kg);methoxyclor (0.094 µg/kg);Endrin ketone (0.031 µg/kg) only three is undetected and the total concentration summed up to be 0.264 µg/kg. Cabbage main samples depicted above (figure 4), shows the twenty OCPs identified, Alpha –BHC (0.001 µg /kg); Beta-BHC (0.001 µg /kg);Gama-BHC (0.001 µg /kg); Aldrin (0.002 µg /kg)Alpha-chlordane (0.001 µg /kg) and Endosulfan 1 (0.001 µg /kg). The other fourteen are undetected and the total concentration examined for cabbage samples are 0.007 µg/kg.

Table 2: GC/MS average value of spiked, unspiked and control result of OCPs concentration in cabbage samples from river Getsi.

TOTAL average concentration	Cabbage
TOTAL average OCPs value in main samples(µg/kg)	0.007
TOTAL average OCPs value in spiked samples (µg/kg)	0.264
TOTAL average OCPs value in control (unspiked) samples (ng/kg)	0.155
European union limit guidelines for OCPs	0.01mg/kg

Table 2. Depicted above shows total OCPs in main cabbage sample is 0.007 µg/kg and spiked cabbage sample is 0.264 µg/kg while the control (unspiked) cabbage sample is 0.155 ng/kg. The main sample is greater than the control sample but lesser than the EU guideline limit. The spiked sample is greater than the control (unspiked) and main sample because of the presence of standard addition. The control sample is less than the main sample which may be attributed to activities like industrial, domestic and agricultural inherent in it.

CONCLUSION

Contamination of water and soil along river course used for irrigation by pesticides residues, industrial, domestics and agricultural wastes poses significant health risk to the public consuming the contaminated fruits and vegetables. The concentration 0.007µg/kg of the analyte in cabbage was below the WHO and NESREA guideline limit of 0.01mg/kg. Hence, there are detective concentration of OCPs in cabbage plant examined, continuous exposure may exceed threshold level, which is dangerous, so it is necessary for regulatory bodies to prevent and minimized the contamination load.

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