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# Analysis of Organophosphate Pesticides Residue on Crops in Abakaliki, Ebonyi State

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***Abstract:*** *The residual quality of organophosphate pesticide residue on pumpkin farm at Abakaliki was found to contain the following organophosphate residue on analysis using gas chromatography after three days allowed for the spray. Sample A contains dioxabenzeofos 0.0168mg/kg and phenanthrene 0.0106mg/kg, Sample B contains chlorethoxyfos 0.01248mg/kg, oxydeprofos 0.00681 mg/kg, sulfotep 0.0295mg/kg, phenanthrene 0.0117 mg/kg and dioxabenzofos, 0.0164mg/kg. Sample C contains, chlonethoxy fos 0.00648mg, oxydeprofos 0.00713mg/kg, sulfotep 0.0595mg/kg, phenanthrene 0.02019mg/kg and dioxabenzofos 0.01178mg/kg. All the above residues are below 1 – 30mg/kg in the LD50 range for the most toxic oraganophosphate as classified.*

***Keywords:*** *organophosphate, pesticide, LD50 and Abakaliki*.

## I. Introduction

Organophosphate (OP) pesticides refer to group of insecticides or nerve agent acting on the enzyme acetyl cholinesterase. The term is used often to describe virtually all organic phosphorus (V) containing compound especially when dealing with neurotoxin compound. These insecticides are esters, amides or sample derivatives of phosphoric or thiosulphuric acid. Some of the less toxic compound are used as systematic insecticides in animals against internal and external parasites (Department of Natural Resources, 2001).

About 70% of insecticides used in the Unite State are organophosphate, fruit and vegetables that can conventionally grown with organophosphate pesticides, peaches grapes, apple, green beans, and peas. Other top uses of OP pesticides include corn, cotton, wheat, other filled crops and for termites and mosquito control, certain pest control product for cat and dogs contains OP (PANNA,2008).

OP are chemically similar to the chemical warfare agent originally produced during world war ll, and since the advent of chemical warfare during the war, OP compounds because widely applied as pest control agent because of their relatives low cost and ability to be applied on a range of target insects and crops (Department of Natural Resources, 2001; PANNA,2008).

OP work by interfering with the nervous system of insects. It kills insects by disrupting their brain and nervous system. Reduced level of acetylcholinesterase cause neurological synapses to fire repeatedly and uncontrollable leading to death, usually by asphyxiation as the animal loses respiratory control. Most pesticides of this group reach their grates potencies when metabolized internally and converted to an Oxon form in the liver (Anglearn, 2001).

Poisoning from organophosphate can happen through – in gestation, eating or drinking something that has OP in it, or dermal contact, having an OP touch the skin or open wound.

While the hazards of exposure of OP are widely recognized for example, all residential uses of the OP chlorpyhrifos were banned in 2001 farm workers, their families and the agriculture communities in which their lives remains at unacceptable high risk of exposure to chlopyrifos and many others OP pesticides. Many OP pesticide, can easily move through air and drift into nearby workers or by standers (Costa, 2006; Anglearn,2001).

OP can be very toxic; however, certain classes of this group are more poisonous than others. Overall, the effect of an OP will depend on the type or time and ways that is expected. A highly concentrated solution of large amount in the air is more likely to cause severe effect, including death.

OP pesticides degrade rapidly by hydrolysis on exposure to sunlight, air and soul. Although small amount can be detected in food and drinking water, their ability to degrade made them an alternative to the persistent. Organochloride pesticides. Although OP degrades faster than organochlorides, they have greater acute toxicity posing risks to people who may be exposed to large amount.

OP of primary concern include, azino phosmethyl, chlorophyrifos, dichlor vos (DDVP) dimethoale, ethphone, malathion, nales etc.

The aim of this research is to determine the residual content of organophosphate in vegetables, its environmental effects and recommended the best practices in its application.

This study will provide the measure of determining the safe level of cypermethrine use in vegetable cultivation and also serve as a review on the OP pesticides toxicity to enable the farmer and the general public to be careful when applying them.

## II. Materials And Method

**Materials**

Weighing balance, gas chromatography, mortar, petric dish, flat bottom flask, measuring cylinder, micro syringe, helium gas, pumpkin leaves, mixture of organophosphate standard and organophosphate pesticides.

### Sample Collection

The sample was collected from a pumpkin vegetable farm at Agwu. 16m/s of the organophosphate pesticides (cypernetrine) was dilute into two liters of water contained in a knap sack sprayer. The solution was stirred to ensure a homogenous mixture. More water was added, making it up to 16 liters of water. The solution was stirred again to have a ready to sue solution, the solution was sprayed on the vegetable using the knap sack sprayer. After three days, three sampl (A,B and C) of the vegetables (pumpkin leaves) was collected at random.

**Samples Digestion**

The digestion and analysis of the sample took place at light house petrochemical engineering company at Warri, Delta State. Three flat bottom flask was washed dried and labeled A,B and C. the samples A, B and C was pounded in a creamic mortar to reduce the surface areas, 5g of each sample was weighed into the corresponding labeled flat bottom flask 50m/s of methanol (extracting solvent) was measured using a measuring cylinder and was added into each flask containing the samples. The sample was allowed to stand for one day, and then was filtered using a filter paper and the extract was obtained.

**Gas Chromatography Analysis Of The Vegetable Extract**

The following are the working conditions of the G.C for the analysis columns:

(i) 10'' wide bore capillary column

(ii) 25cm x 46mm packed column.

Column temperature: 1200C for 8 minutes then 3000C at 40C/min

**Flow rate:** 10µl

**Carrier Gas:** Helium

**Detector :** TCD (Thermal Conductivity Detector)

**Injector :** Direct, Uniliner inlet liner, 2000C.

**Standard:** Organophosphate mix in methanol 200mg/l each.

One micro liter of the standard was collected using micro syringe and was first introduced into the G.C via the injector pot; five standard eluents were obtained which were used for standardization. One micro liter of each of the sample was again collected using the micro syringe and was again introduced into the G.C under the same condition. Again five eluents of each of the sample were obtained (see Table 1,2 and 3).

## III. Results And Discussion

**Results**

The chromatogram gives the quality of residue in Ng/l, this is converted to Ng/kg = $\frac{AXB}{G}$

Where A is concentration of insecticides in Ng/l.

B is the volume of sample injected in GC

C is grams of sample used.

**Table 1: Result for OP pesticides residue in sample A**

| Peak No | Component name | Amount (mg/l) | Amount (mg/kg) | Amount (mg/kg) |
|---|---|---|---|---|
| 1 | Dioxabenzofos | 84.486 | 16.8972 | 0.016897 |
| 2 | Chlorethoxyfos | 29.966 | 5.9932 | 0.00599 |
| 3 | Oxydeprofos | 108.197 | 21.63 | 0.02163 |
| 4 | Sulfotep | 94.687 | 18.9371 | 0.0189 |
| 5 | Phenanthrene | 53.617 | 10.617 | 0.010617 |

**Table 2: Result for OP pesticides residue in sample B**

| Peak No | Component name | Amount (mg/l) | Amount (mg/kg) | Amount (mg/kg) |
|---|---|---|---|---|
| 1 | Chlorethoxyfos | 62.417 | 12.4834 | 0.01248 |
| 2 | Oxydeprofos | 34.028 | 6.8056 | 0.0681 |

| | | | | |
|---|---|---|---|---|
| 3 | Sulfotep | 147.54 | 29.504 | 0.02950 |
| 4 | Phenanthrene | 58.663 | 11.7326 | 0.011733 |
| 5 | Dioxabenzofos | 82.029 | 16.4056 | 0.016406 |

**Table 3: Result for OP pesticides residue in sample C**

| Peak No | Component name | Amount (mg/l) | Amount (mg/kg) | Amount (mg/kg) |
|---|---|---|---|---|
| 1 | Chlorethoxyfos | 32.402 | 6.4804 | 0.006480 |
| 2 | Oxydeprofos | 32.067 | 7.0134 | 0.007132 |
| 3 | Sulfotep | 297.504 | 59.08 | 0.05951 |
| 4 | Phenanthrene | 100.933 | 20.1866 | 0.02019 |
| 5 | Dioxabenzofos | 58.936 | 11.7872 | 0.11787 |

## IV. Discussion

Minton and Murray (1998) have divided organophosphate compounds into three groups based on their toxicity. The first most toxic group eg. Chlorofenvinfor has an LD 50 (lethal dosage) in range 1-30mg/1k. the LD50 range for the second group e.g dichlorvous is 30-50mg/kg and the least toxic group e.g malathion has a range 60 -1, 300/kg.

From the result obtained, in table 1,2,3, the residual content of the entire five compound detected on the leaves after below the LD50 of the first most toxic group according to Minton and Murray. This implies that the vegetable is safe for consumption after a waiting period of three days from the day of last application of the insecticides.

Although OPS hydrolysis easily they can be toxic (Ecobinchon, 1996). However, certain classes of this group are more poisonous than other. Overall, the effects of an organophosphate will depend on the type of chemical, the person comes into contact with concentration of exposure, length of time and the way the person is exposed. A highly concentrated solution of large amount in air is more likely to cause severe effect including health (Fee et al, 2005). It is worth to note that although these vegetables are safe for consumption after three days certain condition can lead to higher residual content on the food and therefore will require longer days for the hydrolysis of the chemical.

These conditions include: The rate of degradation of the chemical Ops hydrolysis in exposure to air, water and soil (Fee et al, 2005) but certain pesticides can hydrolyze easily than others. While cypernathrine which is less toxic and easily degradable pesticides (Gallo, 1991) is save for consumption after a waiting period of three days. Parathion a less easily degradable chemical may require longer waiting period. This implies that systemic Ops will require longer period of analysis. Due to this reason, it is important that the pesticides are used as specified by its manufactures.

Another condition that can lead to higher residual content is the concentration of the ready – to – use solution. There is usually a specified volume of the insecticide (in m/s) to water (in liters) per hectare of land. The higher the volume of the insecticides to water, the higher the concentration and hence may result to appreciable residual content after a waiting period of three days.

Therefore, for us to have our vegetable crops free from residual pesticides after its use to combat insect, we should have the knowledge of the OP insecticide to be used by reading through the label attached on the bottle. This will enable us to know the crops. It is best used for, the dilution per hectare and also the waiting period.

Apart from the knowledge of the insecticides, farmers attitude can also lead to higher residual content of OP during consumption. The use of contaminated container to put harvested vegetable can contaminate the food and thereby lead to higher pesticide consumption.

## V. Recommendation

Organophosphate pesticides can be acutely toxic (Ecobinchon, 1995), but hydrolysis rapidly on exposure to sunlight, air and soil (Fee et al, 2005). This hydrolysis is a function of time, it is therefore recommended that a longer waiting period should be observed from the last day of spray of the insecticide to the consumption time to ensure complete hydrolysis of this compounds.

The use of less toxic and easily degradable OP compound is also recommended, since certain active ingredients are less toxic than others, the use of less toxic ones easily lead use of less toxic ones can easily lead to mind poisoning in case of food contamination. Also, the use systemic Ops on vegetable should be discourage since they will be no appreciable time for their hydrolysis.

It is recommended that the farmers should use the specified concentration of ready – to – use solution and should not use contaminated containers used during the spray to put harvest crops. It is equally recommended that individual should stop the attitude of collecting vegetables or fruits from their neighbour's farms, since they are not sure whether OP is used on the crops or not.

Alternatives to pesticides are also recommended. These alternatives include

- Cultivation practice which include poly-culture, crop rotation, and use of trap crops that attract pest away from the real crop.
- Release of other organisms that fight the pest, these organisms can include natural predators or parasites of the pest (Ecobinchon, 1996).

## References


[1]. Anglearn, Network for sustainable agriculture (2001): organophosphate Aglearn-net : New York Pp 3-4.
[2]. Barmall, R.A. and Huggins, V.J. (1988): "The Effect of Glyphosphate on Resistance of Tomato to Fusarium Crown and Root Rot Disease and on the Formation of Host Structural Defensive barriers". Journal Production Agric. 66 (2): 1547- 1549.
[3]. Brenner, G.M (2000): Pharmacology W.B Sander's Company : Philadelphia PP144-45.
[4]. Costa, I.G (2006): Current Issue in Organophosphate Toxicity, Chin Chin Auta; China, 24.
[5]. Charaverty, P and Sidhu, S.S. (1987): ''Effects of Glyphosphate, Hexzionone and Triclopy, on Invitro Growth and Five Species Ectomycorihizal fungi" Journal of forest Pathology. 17 (3): 204-210.
[6]. Department of Natural Resources (DNR) Michigan Government (2001): Organophosphate, available at http:/www.michigan.gov/dnr pp1-5).
[7]. Echobinchon, D.J. (1996): Toxic Effect on Pesticides in : Cassaretti and Dault's Toxicology: The Basic Science of Poison 5th ed, Macmillian, New York, 403-405.
[8]. Estok, D.B, Freedman, L and Boyle, D: Effects of the herbicides 2,4-D Glyphosphate,Hexezionone and Triclopy on the Growth of Three Species of Atomycorchizal Fungi, Bull Environ Contamination; Toxicol 835-839.
[9]. Fee, D.C. Gard, D .R and Yang C. (2005): Phosphorous Compounds, John Wiley and Sons New York, 1054-1056.
[10]. Gallo, M.A. and LA wryk, N.J. (1991): Organic Phosphorus Pesticide, Academ Press: New York 105-107.
[11]. Glotfelly and Schaum Burg (19890: Volatile of Pesticides from Soil Reaction and Mocement of Organic Chemicals in Soils. Journals of Forest Research, 12(3): 60-65.
[12]. Greenwood, N.N and Earnshaw, A (1997): Chemistry of Elements, 2nd ed.,Bullerwork Heinemann Oxford: UK, 125-126.
[13]. Jess, Silver and Becky Riley (2001) : Environmental Impact of pesticides Commonly used on Urban Land Scapes P Lenum Press ; New York, 181 -200.
[14]. Johnson, J. and Ware, W.G. (1991): Pesticide Litigation Manual, (1992) Edition, Clark Boardman Collaghan Environmental Law Series : New York, 5-8.
[15]. Kelly, W.D and South, D.B. (1978): In Vitro Effect of Selected Herbicides on Growth and Mycorchizal Fungi Aubum university; Aubum Alabama, 38-40.
[16]. Lide, David, R (1998): Handbook of Chemistry and Physics. 87th Edition CRC press. Boca- Roton, 3-8.
[17]. Lucas, W.J. and Lobb, P.G. (1987): Response to Foliar Application of MCPLA. 2,4-D, Clopyralid and Amitrole. Academic press, New York, 90-95.
[18]. Majewski, M and Capel, P (1995): Pesticide in Atmosphere: Distribution Trends and Government factor, Pesticides in the Hydrogic system, Vol. I, Ann Anbor Press Inc: Canada, 118-120.
[19]. Miller, G.T. (2002): Sustaining the Earth. 6th Edition, Thomson Learning California, 211-216.
[20]. Minton, N.A and Murray (1998): A review of organophosphate poisoning; medical toxicology. Academic press; New York , 350-375.
[21]. Monman T.B. (1989): "A Review of Pesticide Effect on Micro-Oganophosphate poisoning; medical toxicology Academic press; News York, 350-375.
[22]. Nilson, H. (1983): " Persistence and Mobility of Herbicides in Arable Soil. Investigation in 1980-81, weed and weed control, A Journal of agricultural Science, 4(2); 1-23.
[23]. Norris, E. (1987): Triclopyi persistence in western Oregon hill pastures, bill environment contain : toxicol, 134-141.
[24]. Osibanjo, O. (1983): Excepts from M.Sc Department of Chemistry, University of Ibadan, Nigeria, 87-90.Pesticide Action Network Network North America (PANNA) (2008). The truth about organophosphate (OP) pesticide PANNA; America, 1-5.
[25]. Sassor, D.I Telling, G.M and user. C. (1968): A rapid sensitive procedure for routine determination for the organochlorine residue in vegetables, J. Chiom: Canada, 433-438.
[26]. Tetra, Tech incorporated (1988): Pesticide concern in the Puget sound basin- A review of contemporary pesticide usage, cattle wash, prepared for the U.S. environmental protection agency, region 10, contracted IC 3338,32.
[27]. US,EPA office of pesticide and toxic substance (1986): guidance for the registration of pesticide products containing glyphosate as the active ingredience, Washington D.C office of prevention, pesticides, toxic substances (October).