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An Analysis of Pesticide Residue in Vegetables Sold in Zamboanga City, Philippines

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ABSTRACT

Pesticide contaminations on vegetables are widespread and found to be one of the causes of food poisoning in the Philippines. The study examined the presence and determined the quantity of pesticide present in three (3) samples of vegetables sold at the Zamboanga City Public Market and Bagsakan Center, Sta. Cruz Market, Zamboanga City. Purposive random sampling was used in the selection of the three vegetable samples, which were Cabbage (*Brassica oleraceaorvarcapitata* Linn.), Lettuces (*Lactucasativa* Linn.), and Cauliflower (*Brassica oleracea var. botrytis*). This was analyzed at Cagayan de Oro Bureau of Plant Industry, Pesticide Analytical Laboratory. Gas Chromatography was used in the determination of the presence of pesticide residue. Three trials were conducted for each sample and the average was computed for the final result. A No Detection (ND) results the findings to all the samples, an implication that the vegetables which were sold and bought from the two public markets in Zamboanga City were free from pesticide residues. It is recommended that other fruits and vegetables may be analyzed on different kinds of pesticides

considered to be systemic and non-systemic, and after a heavy rain fall. Similarly, recommended that periodic monitoring for pesticide residue and other hazardous chemicals by the appropriate agency responsible for the health and welfare of the general public.

Keywords— Environmental Toxicology, pesticide, residue, analysis, experimental method, Cagayan de Oro, Philippines

INTRODUCTION

Pesticide poisoning is a major issue worldwide. Moreover, this is also serious matter relating to public health in the Philippines (Official News Service of Catholic Bishops Conference of the Philippines, 2010). In Central Mindanao for example, news on the presence of endosulfan was traced (Sunstar, November 17, 2008) seen in the vegetables sold in the market. Pesticides are highly poisonous not only to pests but also to human and animals (Mohammad Idris, 2010) Bukidnon is one of the biggest suppliers of cabbage and lettuce and cauliflower in Zamboanga City. The need to conduct a relevant study on the residue detection of residue limit of pesticides triggered the researcher to conduct on the following:

This study aims to determine the presence of pesticide in the three vegetable samples and quantify the amount of the pesticide residue when found present and if beyond tolerable and acceptable levels. The use of pesticides has increased 50 folds since the 1950s, and 2.5 million tons of industrial pesticides used annually, as mentioned in the study of (Artoh, 2011). A Study on Organo chlorine pesticide residues in three leafy vegetables in Iligan City, Philippines (Almeda, 1998) showed that most of the vegetables samples like pechay, cabbage, and Chinese pechay were all observed to exceed the tolerance level. On this existing study made by the researcher revealed, all the vegetable samples from Zamboanga City Markets resulted to a No Detection (ND) determined by a pesticide analysis that could detect 17 types of commonly used pesticides through

Gas Chromatography. Cited in the Pesticide Manual, that Pesticides may either be Non-systemic or systemic in plants. Meaning, when a pesticide is non systemic it is not absorbed by plants from leaves nor soil via the roots on which its residue is being metabolized and slowly degraded. A pesticide like Chlorpyrifos a non-systemic pesticide has a half-life of c.60-120 days which is subsequently degraded into organochlorine compound and carbon dioxide. Half- life (Deer, 2004) is the period of time it takes for one half of the amount of pesticide in the

soil to degrade. Degradation under the Pesticides-formulation, effects, and Fate by Keitkotihale and Spanoghe (2011) is influenced by different environmental processes volatilization, photolysis chemical and microbial degradation. Volatilization of pesticides immediately occurs after application, while photolysis occurs when molecules absorb energy from sunlight resulting in its degradation. Microorganisms however, can use pesticides as nutrients thereby breaking them into carbon dioxide and other components.

Moreover, Kuet (2010) explained what affects the pesticide residue dissipation on vegetables are morphology of the crop, pesticide application and climate such as sunshine, rainfall, temperature. He also said that higher and frequent rainfall, high temperature and high solar radiation can increase the rate of dissipation. The study found out that that no pesticide residue was detected on all the vegetable samples bought from both Zamboanga City Public Market and Bagsakan Center at Sta. Cruz Market. All yielded "No Detection (ND)" findings which mean therefore, that the three types of vegetables are safe for consumption by the consumers in Zamboanga City.

MATERIALS AND METHODS

This study made use of the three (3) vegetable samples such as Cabbage (*Brassica oleraceaorvarcapitata* Linn.), Lettuces (*Lactucasativa* Linn.), and Cauliflower (*Brassica oleracea var. botrytis*). These vegetables were bought from the two markets in Zamboanga City, the Zamboanga City Public Market and from the Bagsakan Center. Each samples required one kilogram of sample for the analysis. Three trials for the analyses were made to stablish validity of the test. For every kilogram of vegetable sample was packed on a polyethylene bag and placed on an iced chest to maintain the freshness of the vegetables. This was transported to Cagayan de Oro for the Standard Pesticide analysis.

A. Sampling Procedure

Letters to the managers of Z.C. public markets were sent for the identification of the vendors in the area and was acknowledge. The list of the vendors was handed to the researcher as basis for the purposive random selection for the purpose of buying the vegetables. Each of the vendors name was written on a sheet of paper and placed on a box for the drawing of lots. The vendors was contacted via phone call for the purchase of the vegetables.

B. Laboratory Analysis

The researcher made its confirmation of the laboratory analysis via mail and phone call to get the expertise of the laboratory chemist

Three trials (3) were employed in each of the vegetable samples to established validity of the results. Each of the three trials was computed and only the average results were declared by the laboratory chemist. Three (3) analyses for each were employed on three (3) separate dates e.g. May 19, 30 and June 15, 2012 . Three trials were employed in every analysis on the three selected vegetable samples. Each of the three trials was computed and only the average result was declared by the laboratory chemist. The presence and quantitative analyses made used of Gas Chromatography.

In the laboratory, the researcher was allowed to observe the step by step procedures made. There are three major steps: First is the homogenization of the sample to obtain a uniform matrix. For each sample, one kilogram was chopped into small sizes and placed separately in a polyethylene bag and chilled over night until frozen. The sample was homogenized thoroughly in a heavy-duty blender. Second is the extraction of the pesticide residue with solvents. Fifteen (15) g of the homogenized sample was placed in a 50-ml centrifuge tube. Acetonitrile (the extraction solvent) was added then shook by hand vigorously for 1 minute. Magnesium Sulfate and Sodium chloride were added and again shook by hand vigorously for 1 minute. The tubes (for different samples) were centrifuged at 3500 rpm (revolution per minute) for 1 minute. A heterogeneous mixture was observed from each tube, the organic solvent (top layer) and water with the vegetable pulp (bottom layer).The organic layer is where the pesticide residue is extracted (if any). Finally, a cleanup step is employed using SPE (Solid Phase Extraction) tubes to remove interfering matrix components from the GC (Gas Chromatography). There were two cleanup steps, the first was done using C18 SPE to remove non-polar interferences and next is using GCB/NH2 propyl SPE to remove pigments, sterols and nonpolar interferences. The SPE tubes were in a vacuum manifold set-up. An aliquot of the organic layer was loaded to a C18 SPE tube then Acetonitrile was loaded to elute analyses to an eggplant flask. The volume was reduced approximately to 2 ml using a Rotavapor at 38.3^0C. The 2ml extract from cleanup 1 was loaded to GCB/NH2 propyl SPE. The extract was eluted with a mixture of 60:40 Acetonitrile-Dichloromethane to an eggplant flask. The volume was reduced to dryness using the rotavapor then 3 ml acetone was added for final volume. This extract is ready for determination of Pesticide Residues using GC.

RESULTS AND DISCUSSION

The results of the analyses made on the Pesticide residues on Selected Vegetables sold at the Zamboanga City Public Market and at the Bagsakan Center, Sta. Cruz Market, ZC. The tables below reveals the findings.

Table 1. Results of the Average of the Standard Pesticide Analyses

Market Place	Vegetables	Result
Zamboanga City Public Market		
	Cabbage	ND
	Cauliflower	ND
	Lettuce	ND
Bagsakan Center	Cabbage	ND
	Cauliflower	ND
	Lettuce	ND

The average results of the standard analyses for pesticide residue on the three trials showed ND which means no Pesticide Residue detected at the limit of determination for all the samples submitted in the Pesticide Analytical Laboratory at Cagayan de Oro. There were three sets of samples made for each of the two sites, those bought from Zamboanga Public Market and from Bagsakan Center, Sta. Cruz Market. All the vegetable samples were found to be negative of residues. The analyses were limited to the determination of the following commonly used pesticides in the Philippines such as cadusafos, chlorpyrifos, cyhalothrin (lamda), cyfluthrin, cypermethrin, deltamethrin, diazinon, dimethoate, endosulfan, fenamiphos, fenvalerate, fenitrothion, malathion, methamidophos, permethrin, phentoate, and triazophos.

All the vegetable samples were found t negative of residues. Factors to consider for its absence may be ruled out to many possible factors. It could be that the farmers did not use pesticides at all or they may have used organic pesticides. Moreover, Rainfall may wash off the residue [2] as another factor to consider because month of May to June is wet season in the Philippines and it was when the sampling was done. The heavy rainfall during the said period may determine the absence of residue in the vegetable samples.

Consequently, the BPI laboratory in-charge pointed out that for as long as the farmers follow the proper handling procedure and its application as well as the required harvest period, pesticides are therefore safe to use. Halflife of the

pesticide may significantly lessen or absolutely degrade the residues (Deer, 2004) until the required harvest period attained.

The in-charge also added by saying that the problem of pesticide residue also arises when farmers are in a hurry to harvest in instances when the vegetables demand of the buyers are high and immediate, the tendency farmers resort to rush harvest.

Thus, may also be deduced that the pesticide analyzed in the vegetables under study were not one of those pesticide used by the vegetable farmers. It is also possible that the farmers were compliant with the process and procedure on the handling and application of pesticides because they are very much aware of the harm it does to the consumers, the environment, their families and neighbors in the community.

CONCLUSION

The results of the analyses on the presence of pesticide residues in three of the vegetable samples (cabbage, cauliflower, and lettuce) bought from the Zamboanga city Public Market and at the Bagsakan Center, Sta Cruz Market, Zamboanga City and analyzed at the Pesticide Analytical laboratory of the Bureau of Plant Industry in Cagayan de Oro City revealed that no pesticide residues were detected. It can be concluded therefore, that the three types of vegetables included in the study sold both at the Zamboanga city Public Market and at the Bagsakan Center, Sta Cruz Market, Zamboanga City do not contain pesticide residues and are safe for human consumption.

RECOMMENDATION

Since the findings of this research revealed no detection (ND) of pesticides from the vegetable samples included in the study, the following are recommended;

A similar study be conducted but using other leafy vegetables and fruits frequently bought by consumers in the public markets. Further, it is recommended that the analyses must consider the two seasons, that is samples be analyzed during the wet and dry season. It is also recommended that vegetables and fruits be analyzed for pesticide residues during the pre-harvest and the post-harvest seasons since there are literature which reveals that pesticides are applied even after harvest to preserve the fruits and vegetables. It is also recommend that other fruits and vegetables may be analyzed on different kinds of pesticides considered to

be systemic and non-systemic, and after a heavy rain fall. It is also recommended that periodic monitoring of fruits and vegetables for pesticide residue and other hazardous chemicals be conducted by the appropriate agency responsible for the health and welfare of the general public. Lastly, that the appropriate agency in the government should conduct regular training and information dissemination to farmers, on the proper use and application of pesticides, fertilizers, fungicides and the like since these chemicals when applied in excess is detrimental to the users, consumers and the environment in general.

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