Levels of pesticides in air from three selected school sites in Davao City

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Introduction

Pesticides used in agricultural plantations reaches adjacent school communities in the form of pesticide drift. Health hazard due to pesticide inhalation varies depending on the level of concentration and the duration of pesticide exposure. School children are more at risk to pesticide exposure because their brain and bodies are still developing.

Objectives

To determine the presence and levels of pesticides in air samples taken from school sites adjacent to agricultural plantations in Davao City

Methodology
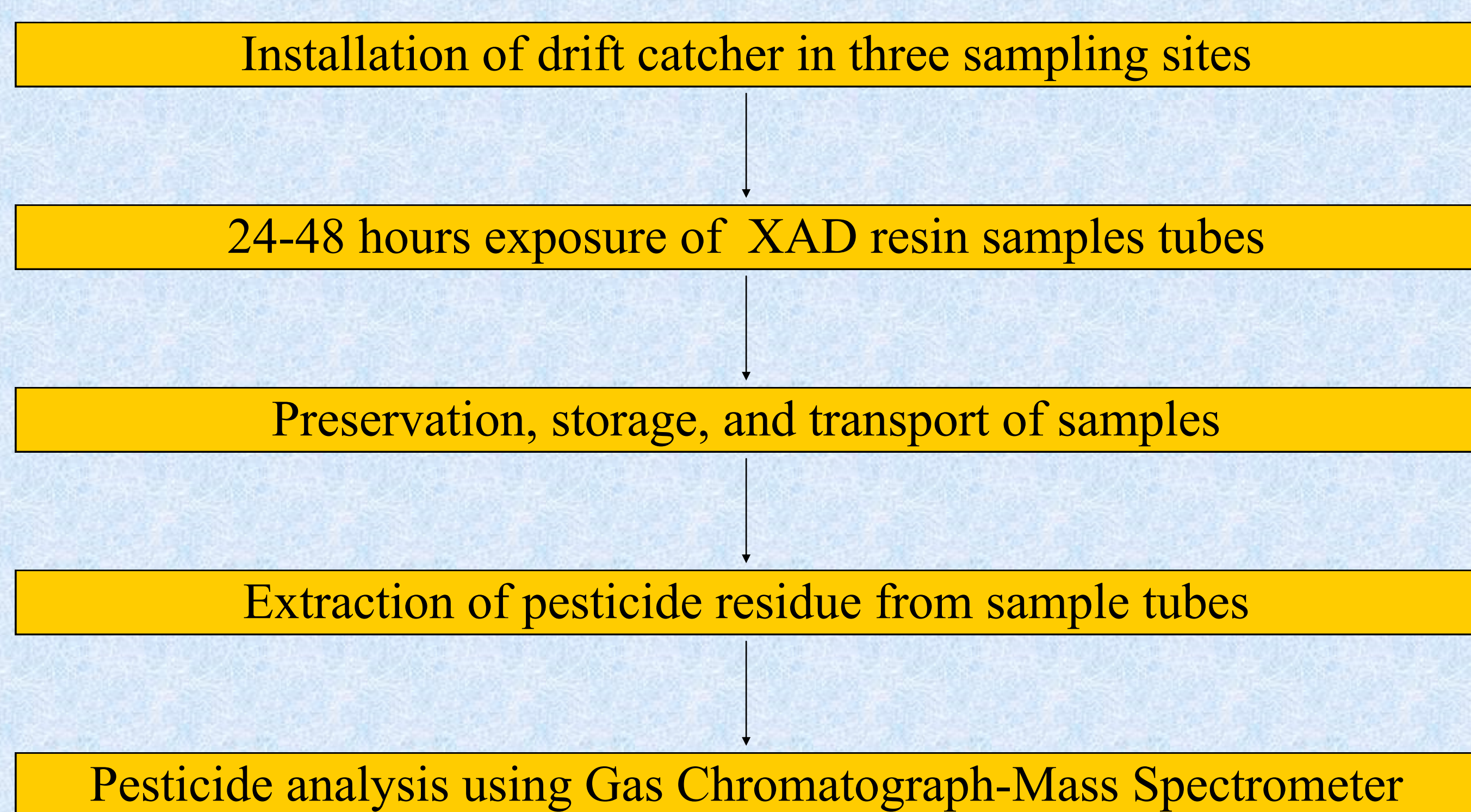
Locale of the study

Figure 1. The three selected sampling stations in Davao City

Sampling device

Process flow diagram

Figure 2. The drift catcher (A) with the rotameter to measure the air flow (B) and sample tubes covered with light shields to protect from sunlight (C).

Installation of drift catcher in three sampling sites

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24-48 hours exposure of XAD resin samples tubes

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Preservation, storage, and transport of samples

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Extraction of pesticide residue from sample tubes

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Pesticide analysis using Gas Chromatograph-Mass Spectrometer

Results and discussions

. A total of 18 pesticides and breakdown products were found in the air samples, 12 of which are already banned including aldrin, dieldrin, and breakdown products of DDT, chlordane, endrin, heptachlor, and lindane.

. Chlorothalonil (62%) is the most detected pesticide followed by diazinon (56%) and fenitrothion (16%).

. 13 or 33% chlorothalonil-present samples exceeded the 1-year old REL of 260 ng/m^3 while levels for diazinon exceeded the 1-year old and 7-year old RELsr of 145 ng/m^3 and 220 ng/m^3, respectively. Chlorpyrifos was also detected at values exceeding the 1-year old REL of 82 ng/m^3.

. A total of 115 instances where pesticide was detected in the samples with 86% containing at least one pesticide and an average of 2 pesticides present in a sample.

. Maximum number of 8 pesticides detected in a day, 7 of which are already banned.

Table 1. List of pesticides found in air in three selected schools in Davao City
(highlighted in green are the banned pesticides and breakdown products detected)

Pesticides and breakdown products	Reference Exposure Levels (RELs) ng/m^3	TAWAN-TAWAN (ng/m^3)[a]	TAWAN-TAWAN (#)[b]	TAWAN-TAWAN (%)[c]	MANUEL GUIANGA (ng/m^3)[a]	MANUEL GUIANGA (#)[b]	MANUEL GUIANGA (%)[c]	DALIAON PLANTATION (ng/m^3)[a]	DALIAON PLANTATION (#)[b]	DALIAON PLANTATION (%)[c]	TOTAL (#)[d]	TOTAL (%)[e]
1. Aldrin								26.96	1	5%	1	2%
2. Dieldrin					83.97	1	5%	58.12—88.94	2	10%	3	5%
3. Chlorothalonil	1-year old: 260	70.8—848.78	9	43%	97.87—1092.26	16	76%	22.58—1258.89	14	67%	39	62%
4. Chlorpyrifos	1-year old: 82	29.18	1	5%	14.15—143.19	6	29%				7	11%
5. Cypermethrin	1-year old: 45,600	547.59	1	5%							1	2%
6. Diazinon	Adult: 340 7-year old: 220 1-year old: 150	1.36—179.81	18	86%	2.38—273.31	9		53.04—233.74	8	38%	35	56%
7. Fenitrothion	1-year old: 4,760	130.7—140.56	4	19%	61.06—158.15	6	29%				10	16%
8. Gamma chlordane								23.58	1	5%	1	2%
9. Heptachlor								137.46	1	5%	1	2%
10. α-Lindane								102.07	1	5%	1	2%
11. β-Lindane								90.03	1	5%	1	2%
12. γ-Lindane	1-year old: 730							93.73	1	5%	1	2%
13. δ-Lindane								90.74	1	5%	1	2%
14. Malathion	1-year old: 43,400							360.16	1	5%	1	2%
15. Endrin ketone					109.97	1	5%	85.03—115.34	2	10%	3	5%
16. Heptachlor epoxide					42.53—66.28	2	10%	51.41—91.6	4	19%	6	10%
17. o,p-DDT					138.25	1	5%				1	2%
18. p'p-DDE								40.15—53.8	2	10%	2	3%
TOTAL DETECTION		5	33		8	42		14	40		115	

Legend:
[a]Range of values detected
[b]Number of tubes contaminated with specific pesticide
[c]Percentage of tubes contaminated with specific pesticide over the number of samples collected in site
[d]Total number of tubes contaminated with specific pesticide from three sampling sites
[e]Percentage of tubes contaminated with specific pesticide over the total number of samples

Conclusions

1. Pesticides including those that are already banned are present in air in three selected schools, some in levels exceeding the reference exposure levels (RELs).
2. The fluctuating levels of pesticides and its residues in the environment is a result of degradation or accumulation.
3. Multiple pesticides were found in air . However, there are no acceptable levels established for multiple pesticide exposure.

Recommendations

1. Strict implementation of buffer zones as stipulated in the Watershed Code of Davao City.
2. Review of existing policies and regulations pertaining to pesticide use.
3. Strictly regulate the use of pesticides.
4. Develop and enhance technical and analytical capacities of mandated regulatory bodies.
5. Further study which shall include a control area that is far from agricultural plantations and longer sampling period to attain more conclusive data set.
6. Develop air quality monitoring protocol and formulation of air quality criteria/guidelines as basis for comparison with the monitoring results.
7. Establish network for air monitoring in schools and residential areas with multi-stakeholder approach.