Analysis of Dust Samples Collected from Storage and Shops of Pesticides at Riyadh City, Saudi Arabia

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Abstract. Dust samples from inside and outside pesticide storage and shops at Riyadh City were collected on June, 2002. The collected samples were extracted with a mixture of methylene chloride and methanol (3:1, v:v), and analyzed by gas chromatography-mass spectrometry (GC-MS) in order to determine the presence of pesticides compounds. The data indicated that the components of the total extracts consisted mainly of different variety of hydrocarbons. The detected components in the samples collected inside storage, shops and outside the shops belong to different groups of pesticides. These preliminary results may help in the process of environmental assessment and in predicting the effects of pesticides on human health.

Key Words: Riyadh; Analysis, detection, Mass- spectra; pesticides, storage, shops.

Introduction

Characterization and identification of the molecular composition of the organic matter in dusts, soils, aerosols, and aquatic systems are important for understanding the nature of the components and assessing their potential toxic effects to human health (Al-Mutlaq, 2002 and Al Mutlaq *et al*, 2002). This is important because certain classes of different compounds such as pesticides which cause detrimental health effects to human and can be found in soil, water, atmoshere and food (Alsberg *et al.*, 1985; Choudhury, 1982; Westerholm *et al.*, 1988; Whiteaker and Prather, 2003). In addition, characterization of pesticides may serve to further define and elucidate the spatial variation and geographical sources of organic burdens in urban versus rural areas (Simoneit, 1984). Thus, the identification of the organic compounds, their amounts, sources, and the compound classes is essential for environmental assessment processes.

Pesticides have received attention because they are detrimental to human health. Much of the research to date on pesticides has been guided by the mutagenic and genotoxic potential of certain compound classes found in the soil, water and food (Alsberg *et al.*, 1985; Choudhury, 1982; Westerholm *et al.*, 1988).

Since the major environmental problems that result from pesticide spillage in pesticide storage facilities and shops have received little attention.

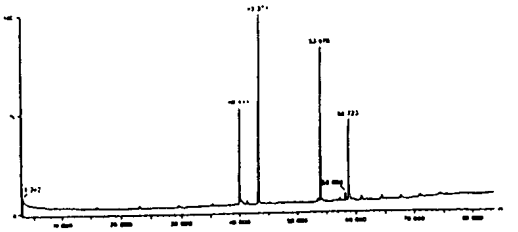

Fig 1. GC-MS total ion current tracers of the total extracts of the spiked dust samples showing the major organic components.

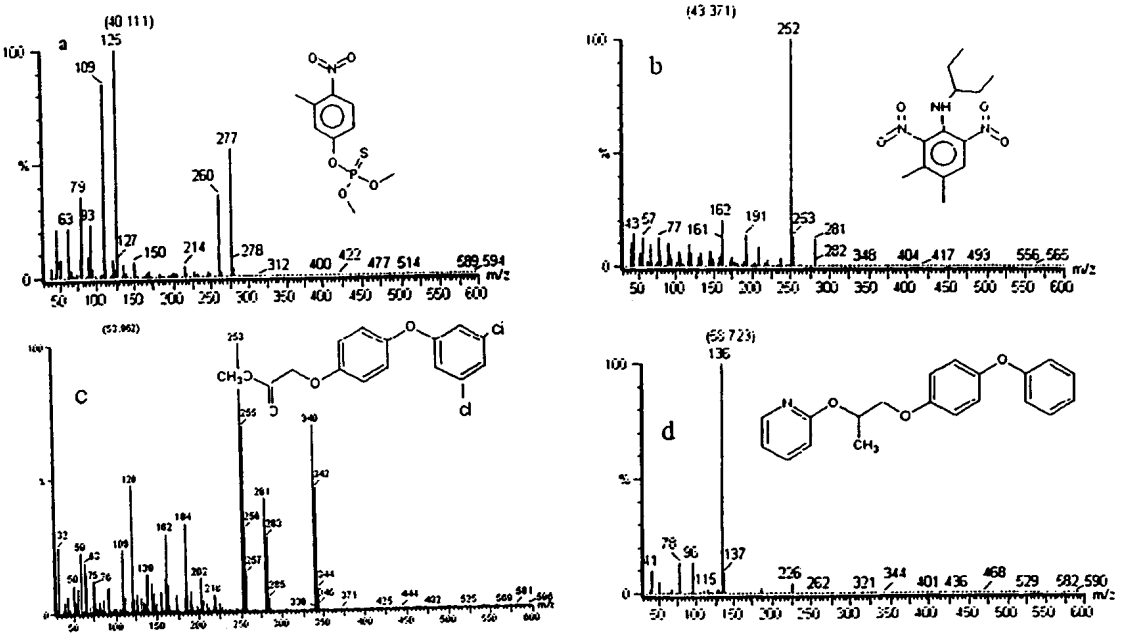

Fig 2. Mass spectra of pesticides detected in the spiked dust samples: **a)** Fenitrothion **b)** Pendimethalin; **c).** Diclofop-methyl; **d)** Pyriproxyfen.

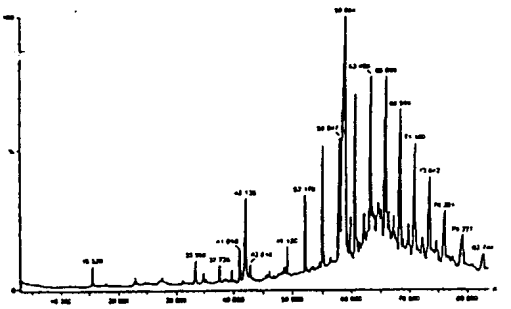

Fig 3. GC-MS total ion current tracers of the total extracts of the shops dust sample showing the major organic components.

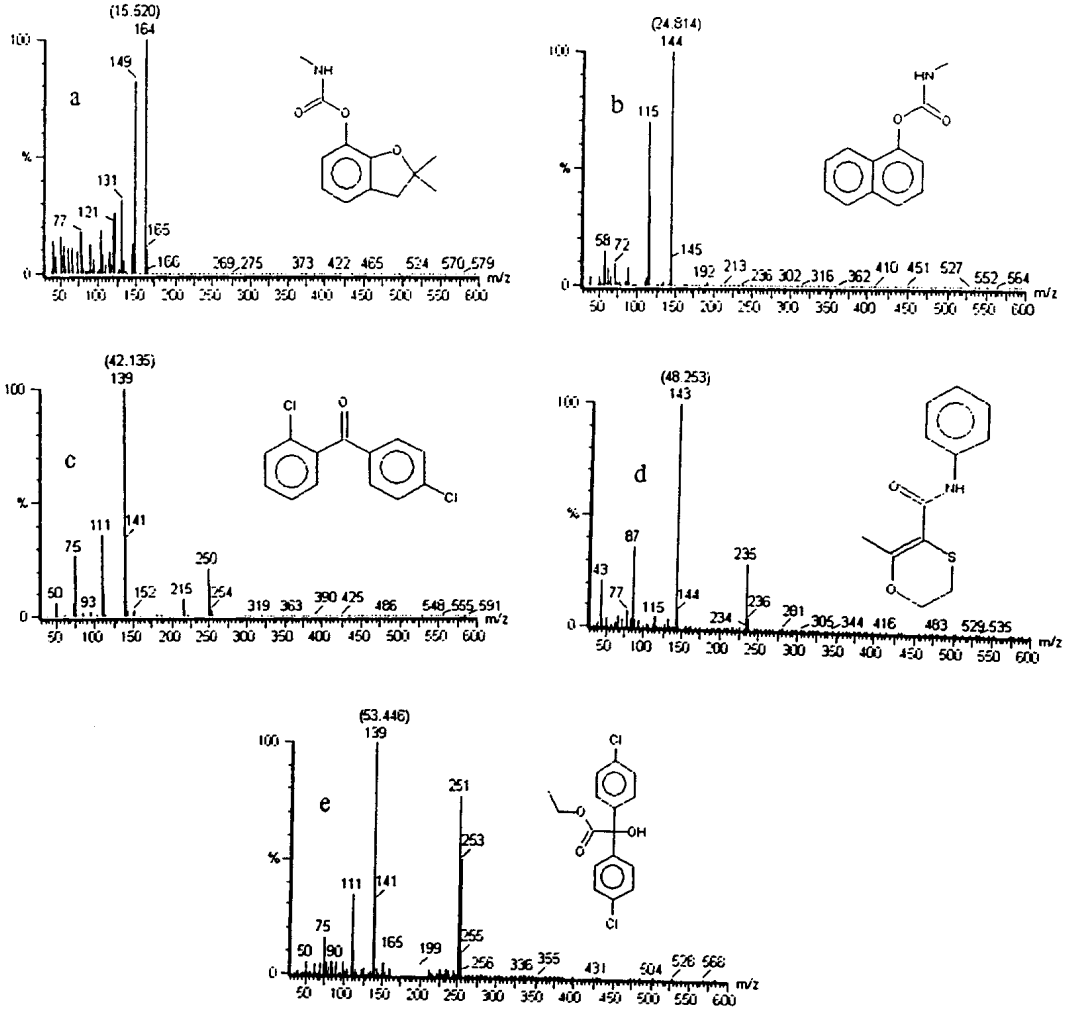

Fig 4. Mass spectra of pesticides detected of the shops dust sample: **a)** Carbofuran; **b)** Carbaryl; **c)** 2,4-dichlorobenzophenone; **d)** Carboxin; **e)** Chlorobenzilate.

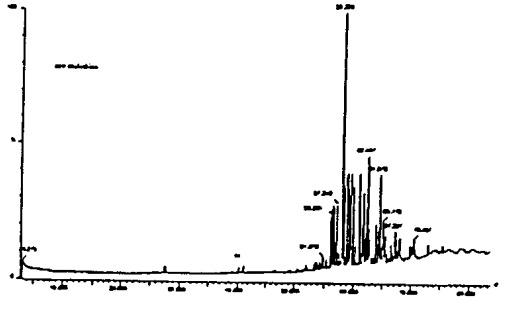

Fig 5. GC-MS total ion current tracers of the total extracts of the outside shops dust sample showing the major organic components.

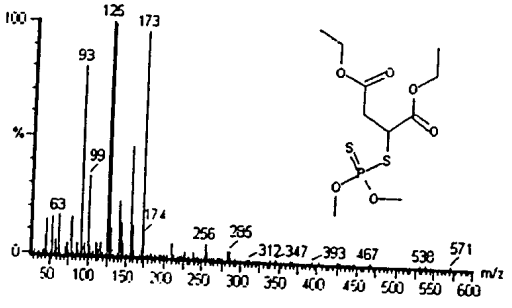

Fig 6. Mass spectra of pesticide (Malathion) detected in the outside shops sample.

This study aimed to carryout a preliminary qualitative investigation to detect the presence of pesticides in the dust collected from storage facilities, shops and surrounding areas in Riyadh city.

Experimental Methods

Sampling and Extraction Procedure

Dust samples were collected in June, 2002 from the Riyadh city, Saudi Arabia to determine their organic matter content by using gas chromatography-mass spectrometry (GC-MS) analysis. The first sample was collected from outside Riyadh city, where sand dunes were dominant and no human activity was observed. 50 gm of this sample was spiked with 0.1 ml of formulated product of fenitrothion, pendimethalin, diclofop-methyl and pyriproxyfen and used to validate the chemical analytical results of this study. Samples were collected from inside local pesticide storage (storage sample), shops selling pesticides and areas surrounding the pesticide storage and the shops. In addition, other samples were collected from areas surrounding the pesticide storage facility and to the shops selling pesticides in order to determine if there is drift of polluted dust to these outside areas. Each sample was sieved through 200 mesh sieve to remove larger particles before total organic matter extraction. The extraction was performed by adding 2 X 100 ml of a mixture of methylene chloride/methanol (3:1 v/v) to 50 gm of sieved fine particles of each dust sample. The mixture was then ultrasonicated for 30 minutes before solvent collection. Each total extract was then concentrated under nitrogen stream at room temperature to approximately 500 µL before GC-MS analysis.

Instrumental Analysis

The analysis of the extracts was carried out by GC-MS, Fisons GC 8000 with MD800 mass selective detector (Thermofinnigan) with a DB-5MS (J and W Scientific), fused silica capillary column (30 m x 0.32 mm i.d., 0.25µm film thickness) and helium as carrier gas (50kPa). Injection 1µL of sample (autosdampler AS800, Fisons) splitless was set at 260°C. The GC was temperature programmed from 60°C to 280°C at 3°C min^{-1} (isothermal for 10 min final time). The MS was operated in the electron impact mode at 70 eV and scan range of 30–600m/z. Data were acquired and processed with MassLab software (Thermofinnigan version 1.4)

Results and Discussion

The total extract contents, compound identities, yields and parameters of the dust sample extracts are shown in Figures 1 to 9. The data demonstrated that the total extract components were a mixture of different variety of hydrocarbons including pesticides compounds.

The sensitivity of chemical analysis for the dust samples was confirmed by the spiked sample with fenitrothion, pendimethalin, diclofop-methyl and pyriproxyfen (figure 1 & 2). The presence of pesticide compounds in the samples from the inside shops (figure 3) were identified as carbofuran, carbaryl, propoxur, carboxin and chlorobenzilate (Fig. 4). Moreover, residues of pesticides carbaryl, malathion, and dimethoate were detected in sample from inside the storage facility (Figure 7 and 8) Similar results were observed in previous study (Al-Mutlaq, 2002 and Al Mutlaq et al, 2002).. These pesticide residues in the dust might be due to volatility or spills inside the pesticide storage facilities and shops selling pesticides that might cause a major health hazard to people working in such an environment. Contaminated dust can be moved outside these storage facility and shops by sweeping the contaminated dirt out of the place or by plowing the dust out via exhaust vent. This may

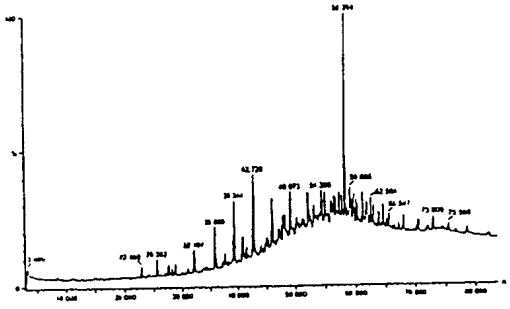

Fig 7. GC-MS total ion current tracers of the total extracts of the storage sample showing the major organic components.

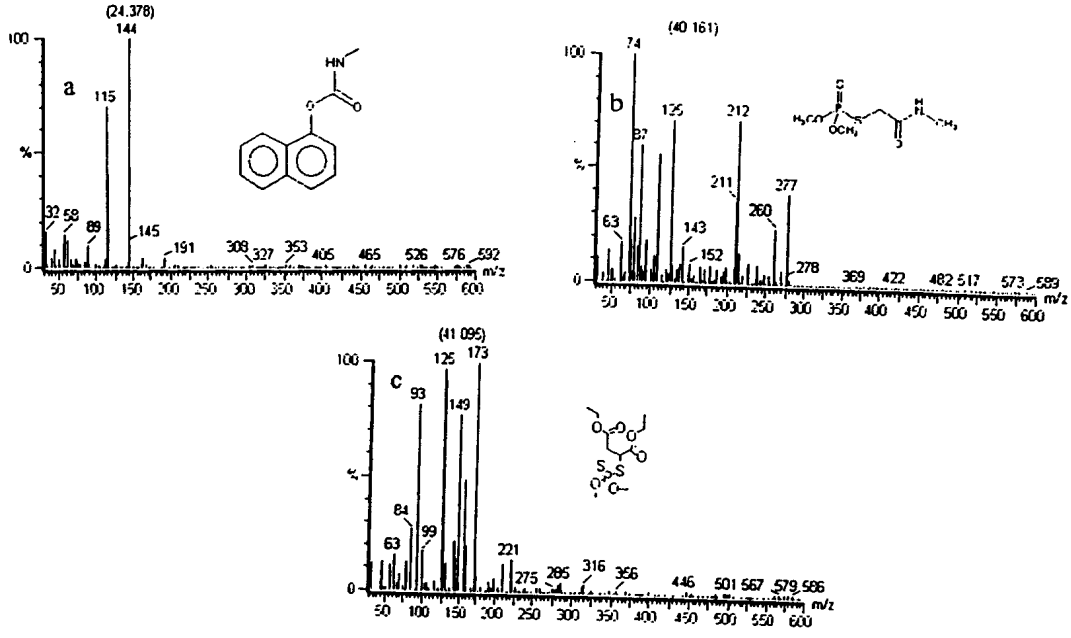

Fig 8. Mass spectra of pesticides detected inside pesticides storage: a) Carbaryl; b) Dimethoate; c) Malathion.

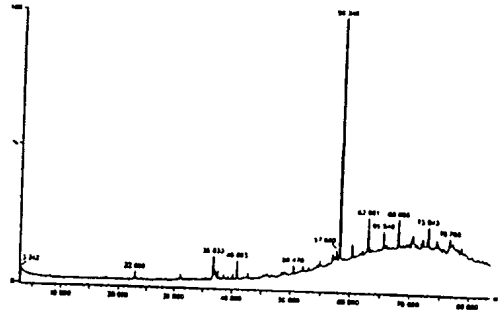

Fig 9. GC-MS total ion current tracers of the total extracts of the outside storage dust samples showing the major organic components.

pose an environmental threat. Detection of malathion in the samples that had been collected from around shops (figure 5,6) confirm this conclusion. However no pesticides residues were detected in the sample collected outside the pesticide storage facility (figure 9). In conclusion, this study has highlighted the health and environmental issues surrounding dust contamination with pesticides in such locations as pesticide storage facility and shops selling pesticides. In doing so, it has also highlighted the need for a much more detailed study to obtain data on pesticides that have been stored and soled in certain locations and to use specific analytical methods to quantify contaminating residues and assess their possible impact on health and on the environment.

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تحليل عينات الأغبره المجمعة من مخزن و محلات المبيدات بمدينة الرياض المملكة العربية السعودية

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قراهم سمو:. مدرسة علوم الحياة. جامعة كاردف. UK-CF 10 3TL. كاردف. المملكة المتحدة البريطانية.
كارستن ت. ملر:. مدرسة علوم الحياة. جامعة كاردف. UK-CF 10 3TL. كاردف. المملكة المتحدة البريطانية.

الملخـــــص : جمعت عينات أغبره من داخل و خارج مخزن ومحلات بيع المبيدات بمدينة الرياض خـــلال يونيـــو ٢٠٠٢م. وتم استخلاص العينات المجمعة باستخدام مخلوط من مذيبي الميثلين كلوريـــــد والميثـــانول بنســبة ١:٣ حجم/حجم. و تم تحليل المستخلص العضوي بواسطة جهاز التحليل الكروماتوجرافي بالغاز و المتصـــل بـــة جـــهاز الطيف الكتلي للكشف عن وجود مركبات المبيدات. أوضحت النتائج أن معظم المركبات في المستخلص الكلي تتكون من هيدروكربونات علاوة على وجود متبقيات لعدة مبيدات من مجاميع كيماوية مختلفة في العينات المجمعـــة مـــن داخل المستودع وداخل وخارج محلات بيع المبيدات.هذا و تساعد هذه النتائج المبدئية في عمليات التقديرات البيئيـــة وتوقع التأثيرات العكسية للمبيدات على صحة الإنسان.