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Estimation of Some POPs Pesticides Levels in Soil in Qurashi Store Area, Hasahesa Town, Sudan

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Abstract: A preliminary analysis of POPs pesticides in soil samples from Qurashi in Hasahesa town with distance of 0, 10, 50, 100, 250 and 500 m from the dumping site to the direction to the Blue Nile river using GC with ECD detector. The study indicated that 2 samples 0 and 10 m distance from dumping site contain aldrin with concentration of 37.4 and 5.4 μg kg^{-1}, the study also showed that 4 samples were contain Endosulfan I and II with high concentration. The present study concluded that POPs pesticides create health risk for both human and animal and had environmental impacts, hence further research are need in this field.

Key words: POPs, soil, GC, pesticides, Hasahesa town, Sudan

INTRODUCTION

POPs generally consist of 3 different groups pesticides such as (aldrin, dieldrin, endrin, chlorodane, mirex, toxaphene, heptachlor, Hexechlorobenzene (HCB) and DDT), industrial chemical products such as Polychlorinated Biphenyl's (PCBs) and unintentionally produced polychlorinated dibenzo-doxins and dibenzo-furans (IPCS, 1995). Persistent Organic Pollutants (POPs) are organic compounds that persist in the environment are liable to bioaccumulate through the food web and pose a risk of causing adverse effects to human health and the environment. The potential disorders caused by even relatively low levels of chronic exposure to POPs are thought to include reproductive and immune effects, developmental anomalies and cancer. Due to their resistance to degradation, POPs have long environmental half-lives. Successive releases of these chemicals over time result in continued accumulation in the global environment (UNEP, 2004).

Persistent organic pollutants have some key characteristics in common, they are toxic and cause adverse health effect, they are environmental resistant and resist breakdown by natural processes in some cases, remain in the environment for decades, they are soluble in fatty tissue which makes them bioavailability to mammals. They bioaccumulate exponentially up the food chain, reaching the greatest magnitudes in predatory birds, mammals and humans they are semi-volatile and thus are capable of traveling grater distance through cycles of evaporation and atmospheric cycling and deposition. Wind and water carry these chemicals great distances regionally and globally with the evidence of long-range transport of these substances to regions where they have never been used or produced and the consequent threats they pose to the environment of the whole globe, the international community has now at several occasions called for urgent global actions to reduce and eliminate releases of these chemicals.

Extensive scientific studies have shown that POPs are some of the most dangerous pollutants released into the environment by humans. Hence, they constitute a serious environmental hazard that comes to expression as important long-term risks to individual species to ecosystems and to human health.

Many persistent organic pollutants are considered possible human carcinogens by the International Agency for Research on Cancer (IARC) of the World Health Organization. In addition to exposure as fetuses in the womb, humans are exposed to persistent organic pollutants through diet, occupation and natural and indoor environments. POPs chemicals may cause cancer and disorders in the reproductive and immune systems as well as in the developmental process. They constitute a particular risk to infants and children who may be exposed to high levels through breast-milk and food (IPCS, 1995).

MATERIALS AND METHODS

Samples sourse: The soil samples have been collected from Hasahesa town near Qurashi pesticide store with distance 0, 10, 50, 100, 250 and 500 m from the store site to the direction of the Blue Nile river.

Reagents: Ethyl ether, hexane, acetone (all solvents are pesticide quality or equivalent), distil water, granular

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florisil (for column cleanup procedure), sodium sulfate (granular, anhydrous) and boiling chips. Extraction solvent is acetone/hexane (1:1) (v/v). The cleanup solvents are:

- Ethyl ether/petroleum ether (6/94, v/v)
- Ethyl ether/petroleum ether (15/85, v/v)
- Ethyl ether/petroleum ether (50/50, v/v)

Extraction and cleanup: Blend 50 g of the solid sample with 10 g of anhydrous sodium sulfate and place in an extraction thimble in the soxhlet extractor, add approximately 300 mL of the extraction solvent and extract the sample for 24 h at 4 - 6 cycles h^{-1}. Allow the extract to cool pass it through a drying column containing about 10 cm of anhydrous sodium sulfate. Collect the dried extract and evaporate it on a hot water bath until volume of extract is 2 mL.

Place approximately 20 g of deasctivated florisil into a 10 mm ID chromatographic column add approximately 2 cm of anhydrous sodium sulfate to the top. Elute the column with 60 mL of hexane with rate about 2 mL min^{-1}. Quantitatively transfer the 2 mL sample extract onto the column using an additional 2 mL of hexane to complete the transfer add 40 mL of hexane and continue the elution of the column. Discard all hexane eluate.

Elute the column with 200 mL of ethyl ether/petroleum ether (6/94, v/v) in flask using a drip rate of about 5 mL min^{-1}. Elute the column again using 200 mL of ethyl ether/petroleum ether (15/85, v/v) into a 2nd flask. Perform a 3rd elution using 200 mL of diethyl ether/petroleum ether (50/50, v/v), collecting elute in a 3rd flask. Concentrate the 3 elutes to 1 mL. The GC (Dani DD51032) (GC 1000-DPC), operating conditions were as follows:

- Detector: ECD
- Injector: temperature 250°C, pressure 1.6 bar
- Detector: temperature 330°C, pressure 1.5 bar
- Column: AT^{M-5} (30 m, ID 0.31 mm, film thickness 0.3 μm)
- Oven program: 100°C (2 min) 10°C min^{-1} to 160°C (1min) 8°C min^{-1} to 220 °C (1 min) 5°C min^{-1} to 240°C (6 min)
- Inject volume: 1 μL

RESULTS AND DISCUSSION

The results of the samples analysis shown in Table 1. In the samples which have been analysis, we find only one of the POPs pesticides which is aldrin in 2 samples from 0 and 10 m distance from the store with concentration of 37.4 and 5.4 μg kg^{-1}, respectively. The

Table 1: Concentration of the pesticides in the soil samples (μg kg^{-1})

Sample pesticide	0 m	10 m	50 m	100 m	250 m	500 m
Lindane	ND	ND	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND	ND	ND
Aldrin	37.4	5.4	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	ND	ND
DDT	ND	ND	ND	ND	ND	ND
Endosulfan I	162.7	75.8	18.2	4.2	ND	ND
Endosulfan II	251.1	99.3	24.1	6.1	ND	ND

Ahmed (2009). ND = Not Detected. The detection limit is 2.5 μg k^{-1}g

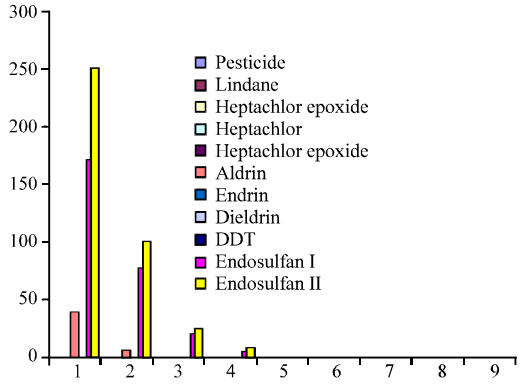

Fig. 1: POPs pesticides in the soil samples

samples were also analyzed for Endosulfan I and II and were found in 4 samples with range ND-162.7 μg kg^{-1} for Endosulfan I and ND-251.1 μg kg^{-1} for Endosulfan II. The pesticide dumping in Qurashi store occurred in 1987. Soil represents the final depot of most environmental contaminants including POPs pesticides. Several studies were conducted to investigate the soil residue. This study is concern in analysis of soil near the pesticides dumping in Qurashi in Hasahesa town and only one of the POPs pesticides. Aldrin were found from 2 samples in 0 and10 m distance from the dumping site and other pesticides analysis are not detectable.

The samples also analysis for Endosulfan I and II and found them in four samples with high concentration. Figure 1 show that Endosulfan I and II are the most contaminate for the soil in in Hasahesa town. Elgadi (1991) investigated the environmental impact of pesticide dumping carried out in 1987 in Hasahesa town. He questioned witnesses, residence and neighbours about the incidence and analysed soils over the dumping pits for DDT residues. In his study, he reported several animal deaths, severe respiratory and allergy-related symptoms among neighbours and total DDT residues >1000 ppm in the dumping site. Elzorgani *et al.* (1994) reported DDT and related compounds from all soil samples within the store enclosure at maximum level ranging from 275-340 ppm. Abdelbagi *et al.* (2003) reported the presence of measurable levels of DDT, gamma HCH, aldrin and

heptachlor epoxide near the dumping site. Babiker (1998) investigated the levels and movement of some organochlorine insecticides from the dumping site in Hasahesa town.

He reported the following levels over the dumping site; gamma HCH in the range of ND-32.5 ppm, heptachlor ND-58.03 ppm and DDD ND-87 ppm. Elzorgani *et al.* (1994) found traces of DDT (0.1-5.5 ppb) in all extracts from wells near Qurashi pesticide store 7 years after the dumping incident. Babiker (1998) investigated pesticide residues in four drinking wells near Qurashi pesticide store 11 years after the dumping incident. He found measurable levels of heptachlor in three wells at a range of 0.003-0.065 ppm, gamma HCH in two wells at a range of 0.01-0.028 ppm and no detectable levels of DDD.

Some of pesticides used in Gezera plantation are stored in Qurashi near Hasahesa town. In this site, some obsolete and out dated pesticides are dumped. Limited investigations for pesticides contaminated the soil of this area ware conducted.

In this study, pesticides residue in soil, mainly the pops ones are investigated at three different distances from the store. Aldrin as one of investigated pesticide was detected in two samples at 0-10 m distance from the dumping site. From this limited samples analysis, we are not concluded that the area is free from contamination by other POPs pesticides. To come this conclusion, more soil samples at different distance and different depth in all direction of area has to be studied. It is important to note that during this study, four samples out of 6are contaminated with Endosulfan I and II.

CONCLUSION

Persistent Organic Pollutant (POPs) pesticide for agricultural purposes used in Sudan stopped since, 1981. Sudan has never been exported any POPs pesticides. POPs may injuries to human and their environment. In Sudan, there is significant shortage in epidemiologic studies on exposed of humans and animal to POPs pesticides. Medical reports of poison with POPs pesticides are not available.

RECOMMENDATION

Furthermore, investigations are recommended to be carried out routinely to study contamination with POPs pesticides residue in soil near the pesticide dumping in Qurashi store and surrounding area.

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