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Determination of Persistent Organic Pollutants pesticides 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 Hesahesa town with distance of 0, 10, 50, 100, 250, and 500 meter from the dumping site to the direction to the Blue Nile River using GC with ECD detector. The study indicated that two samples 0 and 10 meter distance from dumping site contain Aldrin with concentration of 37.4 and 5.4µg/kg, the study also showed that four 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

Keywords: *POPs, soil, GC, pesticides, Hasahesa, Sudan.*

INTRODUCTION

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.

Persistent Organic Pollutants POPs generally consist of three 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.

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 (Abdelbagi et al., 2003).

Persistent organic pollutants have some key characteristics in common they are toxic and cause adverse health effect, they are environmental resistant, they 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 (Abdelbagi et al., 2000).

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 (Ali, 2005).

MATERIALS AND METHODS

SAMPLES SOURSE

The soil samples have been collected from Qurashi pesticide store near Hesahisa town, with distance 0, 10, 50, 100, 250, and 500 meter from the store site to the direction of the Blue Nile River. Sample size is 1kg and the samples kept in freezer until analysis (Babiker, 1998).

REAGENTS

Ethyl ether, Hexane, Acetone (All solvents are pesticide quality or equivalent), Distil water, Granular Florisil (for column cleanup procedure), Sodium sulfate (granular, anhydrous), and Boiling chips.
Extraction solvent: 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 hours at 4 - 6 cycles/hour. 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 deactivated 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.

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. Elute the column again, using 200 mL of ethyl ether/ petroleum ether (15/85, v/v), into a second flask. Perform a third elution using 200 mL of diethyl ether/ petroleum ether (50/50, v/v), collecting elute in a third flask.
Concentrate the three elutes to 1ml.
The GC (Dani DD51032) (GC 1000-DPC), operating conditions were as follows:-

- Detector: ECD
- Injector: temperature 250^0C, Pressure 1.6 bar
- Detector: temperature 330^0C, Pressure 1.5 bar
- Column: AT^{M-5} (30 meters, ID 0.31mm, film thickness 0.3µm)
- Oven program: 100^0C (2min) 10^0C/min to 160^0C (1min) 8^0C/min to 220 ^{0}C (1 min) 5^0C/min to 240^0C (6 min).

Inject volume:- 1 µL.

RESULTS AND DISCUSSION

In the samples which have been analysis we find only one of the POPs pesticides which is Aldrin in tow samples from 0 and 10 meter distance from the store with concentration of 37.4 and 5.4µg/kg respectively.

The samples were also analyzed for Endosulfan I and Endosulfan II and were found in four samples with range ND-162.7 µg/kg for Endosulfan I and ND-251.1 µg/kg for Endosulfan II, table 1 show the result of the samples analyzed. Several studies were conducted to investigate the soil residue

This study is concern in analysis of soil near the pesticides dumping in Qurashi in Hasaheisa town and only one of the POPs pesticides Aldrin was found in two samples in 0 and 10 meter distance from the dumping site and other pesticides analysis are not detectable.

Table 1. concentration of the POP pesticides in the soil samples (µg/kg)

Sample pesticide	0 meter	10 meter	50 meter	100 meter	250 meter	500 meter
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

ND = Not Detected.
The detection limit is 2.5µg/kg

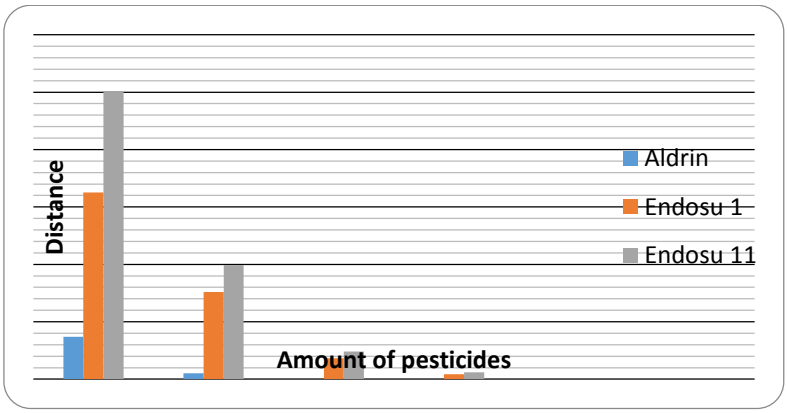

Figure 1. samples contaminated with Aldrin, Endosulfan 1 and Endosulfan 11

The samples also analysis for Endosulfan I and Endosulfan II and found them in four samples with high concentration figure 1 show the concentration of different pesticides in present samples. Ali investigated the environmental impact of pesticide dumping carried out in 1987 in Hasaheisa 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 greater than 1000 ppm in the dumping site (Elzorgani et al., 1994).

Abdelbagi reported the presence of measurable levels of DDT, gamma HCH, aldrin and heptachlor epoxide near the dumping site (UNEP, 2004a; UNEP, 2003). Babiker investigated the levels and movement of some Organochlorine insecticides from the dumping site in Hasaheisa 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 (U.S, 1985).

Elzorgani 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 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 (World Health Organization, 1995).

Some of pesticides used in Gezera plantation are stored in Gurashi near Hasaheisa 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 pesticides ones are investigated at five different distances from the store. Aldrin, as one of investigated pesticide, was detected in two samples at 0 to 10 meter 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. It is important to note that during this study four samples out of six are contaminated with Endosulfan I and II.

CONCLUSION

Persistent organic pollutant (POPs) pesticide for agricultural purposes used in Sudan stopped since1981.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

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