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# MONITORING OF PESTICIDE RESIDUES IN DRINKING WATER

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## ABSTRACT

Twenty eight tap water samples were collected from two Governorates in Egypt and were analyzed for pesticide residues. The samples were selected to cover a range of exposure to pesticide usage and a variety of water sources (Nile river and underground water).

Results indicated that 18 samples contained DDT and its metabolites at levels varied between 0.021 and 0.054 ppm. Fourteen samples contained dieldrin at levels varied between traces and 0.004 ppm, while 13 samples contained lindane at levels varied between 0.001 to 0.006 ppm. Endrin was detected in only 12 samples at levels varied between 0.001 and 0.015 ppm. Results also indicated that more than 13 unknown compounds were detected.

Data show that most of the tested samples from Rural areas contained levels of pesticide residues higher than the samples from Urban areas.

The level of pesticide residues depends on the source of water. Underground water from depth more than 30 m, contained traces of pesticides. The highest levels of pesticides were detected in underground water from depth less than 14 m. Water samples from Nile river water sources contained from traces to 0.001 ppm of pesticide residues.

## INTRODUCTION

Looking around at what we do to water, it is difficult to believe that water is so precious to us and that our very existence depends on it. Our abuse of the purity of water is even more pervasive and more likely to damage irreversibly water's life giving properties. We pollute it with our own wastes and cause extensive and serious human health problems. Our agricultural practices pollute our Nile river and lakes with pesticides that damage the environment, harm drinking water sources and contaminate the fish that we use for food and wildlife.

Horchani 1992 reported that urban and industrial development is leading to serious degredation of rivers, lakes and even ground water. Toxic chemicals from industry, pesticides, nitrites and phosphates from agriculture are all contributing to the contamination of the freshwater resources. Fifteen million children under five years die annually in develloping countries largely because of poor water.

Poor health caused by water related diseases and unsanitary practices is a considerable cost to the economy in terms of workdays lost and reduced productivity.

The increased use of water in cities results in increasing discharges of waste water. Rivers have a limited but natural ability to decompose and purify waste water. Treatment and removal of nitrates, phosphates from fertilizers, pesticides from agriculture and a host of toxic chemicals from industrial processes is difficult and costly.

Abdel-Gawaad and Shams El-Din 1989 reported that out of 50 fresh water samples, 41 samples contained insecticide residues, 9 samples were free from endrin, dieldrin, and total DDT. The minimum and maximum residue levels of endrin, dieldrin, lindane and total DDT were 0.001 - 0.015, 0.000 - 0.004, 0.001 - 0.005 and 0.03 - 0.054 ppm respectively.

Although there have been a number of studies conducted in other countries Achari *et al.,* 1975(USA) ; McCarthy, 1976 (USA), Fuller *et al.*, 1981(South Australlia); Brodie *et al.*, 1984(North Queensland); Sutherland *et al.*, 1982; Schmitz, 1989 (West Germany); Minunni and Mascini, 1993; Kruithof *et al.*, 1994 (Germany) and Pico *et al.*, 1994 (Spain). There has been no servey of pesiticides residues in drinking water in Egypt.

The aim of this study is to assess the amount of pesticide residues in drinking water, which can be considered as an important source for pesticide daily intake as the behaviour of the Egyptian person is to drink 2.8 litre of water/day.

## MATERIALS AND METHODS

Twenty samples of tap water collected from different regions in El-Behera governorate were compared with eight samples from alexandria. The main sources of water of this tap water are the Nile river, Mahmodia canal or underground water. Each sample was 1 litre in volume. The collected samples were taken in the same month and by the same person to avoid the personal error. Samples were kept at 7-10°C until analysis.

### A - Extraction:

Five hundred ml single extraction by shaking in seperatory funnel for 15 minutes was conducted. The seperated extract was concentrated to 1 ml by blowing a stream of air over the hexane extract in a fume cubbord.

### B- Gas chromatography determination:

Analysis were performed on a gas liquid chromatograph equipment with electron capture detector.

**Columns:** Glass 6 mm OD by 4 mm ID, 183 cm - long packed with OV - 17 was used.

**Carrier Gases:** Pure nitrogen at a flow rate of 30 ml/min. Pure hydrogen at a flow rate of 60 ml/min. Air at flow rate of 300 ml./min.

**Temperature:** Injection port 200°C and oven 190°C.

## RESULTS AND DISCUSSION

Results indicated that 18 samples contained DDT and its metabolites at levels varied between 0.021 and 0.054 ppm. Fourteen samples contained lindane at levels varied between 0.001 to 0.006 ppm. Endrin was detected in only 12 samples at levels varied between 0.001 and 0.015 ppm. Results also indicated that more than 13 unknown compounds were detected.

Monitoring data from El-Behera and Alexandria governorates (table 1 and figures 1-3), show that 5 samples contained α-BHC (α-HCH) at levels varied between 0.013 - 0.079 μg/litre. While 2 samples contained lindane at level less than 0.028 μg/litre, while most of the tested samples contained BHC in range varied between 0.009 to 0.156 μg/litre.

Heptachlor was detected in 6 samples in rates varied between 0.014 to 0.096 μg/litre.

Dieldrin was detected in 5 samples at levels beween 0.025 and 0.160 μg/litre.

Traces of DDE; p,pDDT; o,pDDT and DDD were detected in some of the samples. Nearly 50% of the samples were free from DDT and its drivatives, but the estimated total DDT was some what more than the guide levels.

Aldrin was detected in five samples at levels varied between 0.014 to 0.063 μg/litre.

WHO guideline are available for dieldrin (0.003 ug/litre); DDT (total isomers) 0.1 μg/litre; heptachlor and heptachlore epoxide (0.01 μg/litre), and for γ -HCH (lindane) 0.3 μg/litre.

All the tested samples did not exceed the WHO guidlines for lindane, while all the samples in which pesticide residues were detected, contained heptachlor, dieldrin, total DDT and aldrin more than the acceptable levels recommended by WHO.

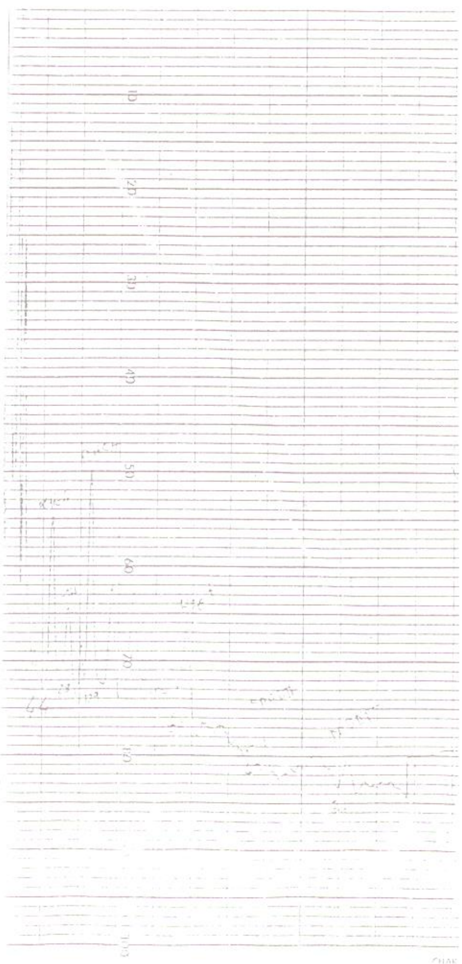

**Figure (1):** Chromatogram of pesticide residues in tap water on Mohmodia town.

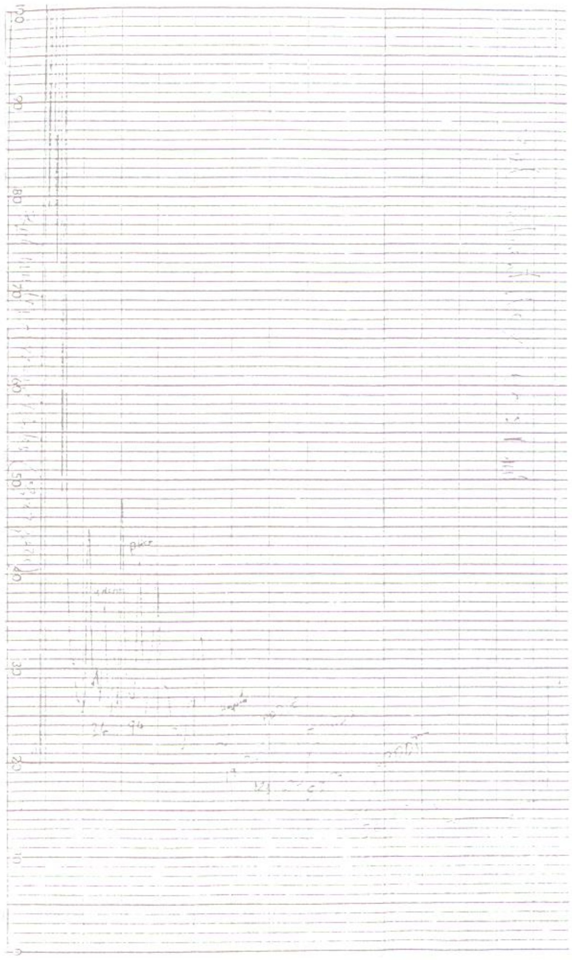

**Figure 2:** Chromatogram of pesticide residues in drinking water from underground water (30 m in depth).

**Table (1):** Estimated pesticide residues in drinking water samples.

| Samples | Pesticide Residues level (µg/Litre) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | α-HCH | β-HCH | Lindane | Hepta-chlor | Aldrin | Dieldrin | *o,p*-DDT | *p,p'*-DDT | DDD | DDE | Σ DDT |
| Tapwater (Shibrachit) | 0.079 | 0.016 | 0.013 | - | 0.021 | 0.103 | - | - | - | 0.121 | 0.121 |
| Tapwater (Damanhour) | 0.013 | 0.017 | - | - | 0.014 | - | - | - | - | - | - |
| Tapwater (Desok) | 0.018 | 0.014 | - | - | - | 0.084 | - | - | - | - | - |
| Tapwater (Itay El-Baroud) | - | 0.009 | - | 0.031 | - | 0.046 | - | - | - | - | - |
| Tapwater (Mahmodia ) | 0.044 | 0.129 | 0.028 | 0.060 | - | - | - | 0.086 | 0.043 | - | 0.129 |
| Under ground water (30 m depth) | 0.034 | 0.094 | - | 0.019 | - | - | 0.056 | - | 0.053 | 0.123 | 0.234 |
| Ground water (14 m depth) | - | - | - | 0.030 | 0.063 | 0.16 | 0.052 | - | 0.032 | - | 0.084 |
| Ground water (27 m depth) | - | - | - | 0.014 | 0.048 | - | - | - | - | 0.096 | 0.096 |
| Tapwater (Alexandria) | 0.056 | 0.156 | - | 0.096 | 0.048 | 0.025 | 0.058 | - | - | 0.082 | 0.140 |

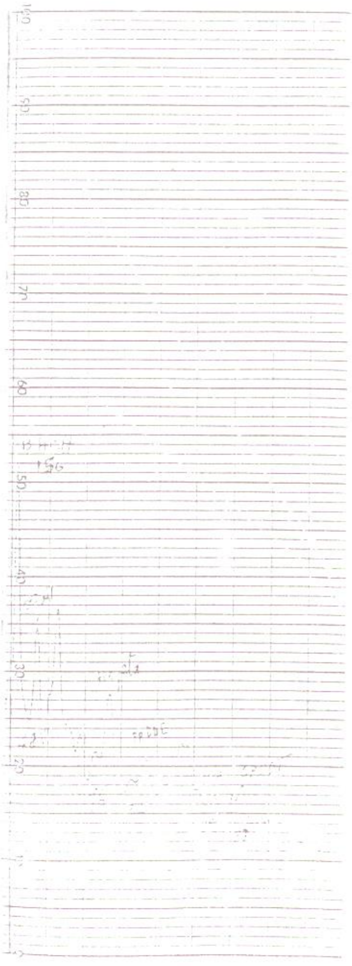

**Figure (3):** Chromatogram of pesticide residues in tap water of Alexandria.

It is clear that pesticide residues find their way to tap water over three roots : their leaching from agriculture soil to surface water, penetration from soil to the underground water and the third root is through mixing the Nile river water with drainage and sewage water.

Egypt used in the last fourty years 690000 metric tons of pesticides, these pesticide persisted in the agriculture soils for long time and accummulated year by year. While aldrin, dieldrin, heptachor and DDT were not used since more than 15 years, their residues still find their way to our water and foodstuffs.

In Egypt Abdel-Gawaad *et al.*, 1971 reported that their previous results about the leaching of pesticide residues from Egyptian soils indicated that the leaching of these residues differed according to soil type, where 29.71% lindane was leached from sandy soil, 13.99% was leached from loamy soil and 13.33% from sandy clay loamy soil. Leaching also depends on the type of pesticide. 34.09%, 3.30% and 10.60% of thimet and 47.12% 42.30 and 56.14 of temik soil residues were leached from sandy, loamy and sandy clay loamy soils respectively.

Abdel-Gawaad, 1981 indicated that chlorinated hydro-carbons pesticides tested and their breackdown products were leached more readly from soil than organophosphorous pesticides.

As sources of good quality drinking water diminish at an alarming rate, there is an urgent need to protect the still usable sources from degredation. Where water quality has dropped below acceptable levels, water treatment will be needed, and in rural areas this can only be done on a sustainable basis if existing appropriate technology is used and new technologies are developed.

The formulation and application of sound cost recovery and cost containment policies and practices in drinking water sector need to be stopped up in the face of increasing scarcity of good quality drinking water, if the sector is to expand or even maintain its present level of coverage.

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