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# Analysis of Pesticides Residue in Sub Surface Water of Kota-Bundi Region of Rajasthan

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**ABSTRACT:** Based on the available information, about 96% of the world's total freshwater resources are in underground forms. Therefore, a main part of worldwide population in both urban and rural areas depends on groundwater resources as the sole drinking water source. The crucial role groundwater plays as a decentralized source of drinking water for millions rural and urban families cannot be overstated. It accounts for nearly 80% of the rural domestic water needs, and 50% of the urban water needs in India. The natural impurities in rainwater, which replenishes groundwater systems, get removed while infiltrating through soil strata. But, In India, where groundwater is used intensively for irrigation and industrial purposes, a variety of land and water-based human activities are causing pollution of this precious resource, such as using pesticides for agricultural use. Its over-exploitation is causing aquifer contamination in certain instances. Modern agriculture practices reveal an increase in use of pesticides and fertilizers to meet the food demand of increasing population which results in contamination of the environment. In India crop production increased to 100% but the cropping area has increased marginally by 20%. Pesticides have played a major role in achieving the maximum crop production, but maximum usage and accumulation of pesticide residues was highly toxic to ground water, agricultural land, aquatic life, human life and other ecosystem.

Use of pesticides in agriculture may lead to the contamination of groundwater resources. In fact, it has been estimated that less than 0.1% of the pesticide applied to crops actually reaches the target pest and the remaining enters the environment unreasonably and thus contaminates soil, water, and air, in which it can poison or adversely affect nontarget organisms.<sup>2</sup> The World Health Organization (WHO) recommended classification of pesticides by hazard to organism.. Application of banned and expired pesticides, unsustainable and uncontrolled consumption of pesticides, the lack of farmers' knowledge about the safe use of pesticides, and the lack of proper supervision by relevant organizations can cause more contamination of water resources in developing countries. The problem has become more prominent where groundwater aquifers are used as the main source for drinking purposes.

### I. INTRODUCTION

Pesticides are being used all over the world for crop control. Most of the pesticides are inherently toxic, not only to the pests, against which they are used, but also to other organisms. Damage to non target organisms, perturbation of structure and function of environment and toxic contamination of environment are few consequences of pesticide use. Contamination of aquatic environment due to excessive use and runoff from agricultural fields effects marine life and reduces fish production. The toxicants effect entire ecological balance and result in severe health hazards to human beings. These changes occur, so slowly, that the problem becomes visible only after it has taken a serious turn, making it very difficult to reverse the trend. There is utter need for continuous monitoring of pesticide pollution, so that some corrective measures can be taken before it is late.

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A pesticide is a substance or mixture of substances used for preventing, controlling, or lessening the damage caused by a pest. A pesticide may be a chemical substance, biological agent (such as a virus or bacteria), antimicrobial, disinfectant or device used against any pest. Pests include insects, plant pathogens, weeds, mollusk, birds, mammals, fish, nematodes (roundworms) and microbes that compete with humans for food, destroy property, spread or are a vector for disease. Many pesticides are poisonous to humans. Most of these chemicals are poisonous substances capable of damaging one type of organism drastically while causing none or only nominal damage to the desired one even if the two are in a close association. It is due to this property of exerting a selective toxic action on different species that these chemicals have acquired a very important role in a modern society.

The present research is dealing with selection to determine the level of organochlorines and organophosphorous pesticides contamination in groundwater at different locations of Kota region.

## Ground Water Contamination by Pesticides

The interplay between hydro geological setting, groundwater recharge, soil conditions, pesticide use, and pesticide behavior in the vadose zone determines whether ground water in a particular area is likely to become contaminated with pesticides. The quantity and types of pesticides being applied are critical factors. Although pesticide use is highly variable and cannot be precisely monitored, the distribution of crop types and the quantities of pesticides sold to applicators may be used to obtain a general approximation.

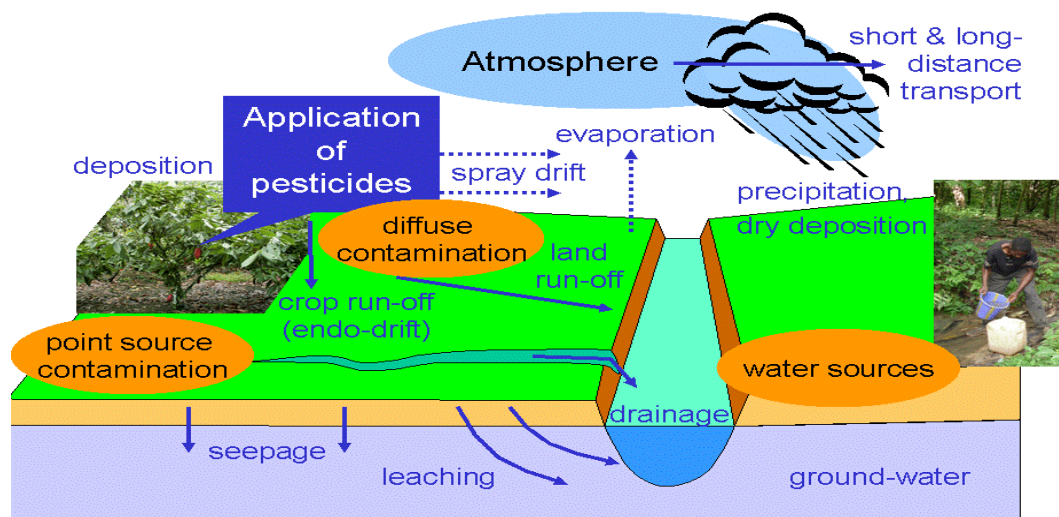


Fig. 1.0 Ground water contamination through pesticides

Ultimately, the only reliable method for detecting ground-water contamination by pesticides is an adequate ground-water monitoring program, with special emphasis on areas where these pesticides are being applied and areas where such application is most likely to impact ground water. Vulnerability is determined on the basis of whether irrigation is used, what crops are being grown, and which pesticides are generally applied to particular crops. Areas of corn and sorghum production, in particular, would indicate areas where atrazine and similar herbicides might be used.

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## II. MATERIALS AND METHODS

In this work, pesticides residue found in groundwater determine the adverse effect and reducing the quality of groundwater and soil which gives very serious results in future. This problem is caused due to lack of awareness to the farmers in developing countries, human activities and climate change and so on.

Water is a very valuable resource of these days. Most of the deaths are caused by the unhealthy and contaminated water consumption in India. These are due to the lack of awareness among peoples and technology which is cost worthy to installation and maintenance.

### Steps in Pesticide Residue Analysis

There are five important steps in pesticide residue analysis.

- i. Sampling (Collection, transport and storage of samples)
- ii. Sample Preparation
- iii. Extraction
- iv. Clean-up
- v. Quantification and confirmation

## III. OBSERVATION AND ANALYSIS

For this research work of groundwater samples have been collected from four different identified locations that is Raipura Village, Kheda Rasulpur , Bundi Road, Tathed at specified time interval where agricultural practices were carried out at various direction.

These samples were tested in the laboratory with the help of different equipment. Gas chromatography and HPLC is most prominent sophisticated equipment among them to analyse pesticides residue in groundwater.

The given following pesticides have been detected from different regions of Kota in ground water samples:

### Organochlorine (mg/l)

- i.  $\gamma$  HCH( Lindane )
- ii.  $\alpha$  Endosulphan
- iii. DDT( Dichloro Diphenyl trichloroetane )
- iv. Heptachlor
- v. DDD( Dichloro diphenyl dichloroetane )

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vi. DDE( Dichloro diphenyl Dichloroethylene )

### Organophosphorus (mg/l)

- i. Dimethanoate
- ii. Methyl parathion
- iii. Chlorpyrifos
- iv. Malathion
- v. Parathion

Tables for the above mention pesticides at different region of Kota plotted below which is analyzed from groundwater samples at specified time interval that have been collected during sampling period.

**Table 3.1 Residual Pesticides observed in agriculture intensive areas.**

Location & Samples	Organochlorines (mg/L)	Organophosphorous (mg/L)	Total (mg/L)
<b>Raipura Village</b> Sample 1	.0113	0.0534	0.062
Sample 2	ND	0.0542	0.074
Sample 3	0.122	ND	ND
<b>Kheda Rasulpur</b> Sample 1	0.0107	.0642	.0990
Sample 2	0.0119	0.0589	0.0708
Sample 3	0.0103	ND	ND
<b>Bundi Road</b> Sample 1	.0082	.0369	.0517
Sample 2	0.0117	ND	ND
Sample 3	0.0123	0.0756	0.1073
<b>Tathed</b> Sample 1	.0098	.0654	.0752
Sample 2	0.0102	0.0439	0.0541
Sample 3	0.0004	0.0328	0.0332

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The above table shows the total amount of organochlorines and organophosphates at different areas of Kota region. These areas are taken in consideration because of a huge cultivation of crops takes place in these areas.

**i. Organochlorines (mg/l) Observed at Kota:**

SAMPLE S NO.	YHCH (LINDAN)	$\alpha$ ENDOSULPHAN	HEPTA-CHLOR	DDT	DDD	DDE
1	0.0010	0.0012	0.0005	ND	0.0009	0.0030
2	0.0009	ND	0.0004	0.0035	0.00105	0.0040
3	ND	0.0015	0.0008	ND	0.00092	0.0024

**Table 3.2 Different Organochlorines concentration detected from Raipura village**

SAMPLE S NO.	YHCH (LINDAN)	$\alpha$ ENDOSULPHAN	HEPTA-CHLOR	DDT	DDD	DDE
1	0.0023	0.0009	ND	0.0024	0.0006	0.0017
2	0.0024	0.0011	0.0005	0.0029	0.0009	0.0027
3	0.0028	ND	0.0004	0.0027	ND	ND

**Table 3.3 Different Organochlorines concentration detected from Kheda Rasulpur**

SAMPLES NO.	YHCH (LINDAN)	$\alpha$ ENDOSULPHAN	HEPTA-CHLOR	DDT	DDD	DDE
1	0.0012	0.0021	0.0005	0.0011	BDL	0.0007
2	0.0026	ND	0.0004	0.0010	ND	0.0004
3	ND	0.0036	0.0007	ND	ND	ND

**Table 3.4 Different Organochlorines concentration detected from Bundi Road.**

.SAMPLE S NO.	YHCH (LINDAN)	$\alpha$ ENDOSULPHAN	HEPTA-CHLOR	DDT	DDD	DDE
1	0.0021	0.0019	0.0009	0.0010	BDL	0.0021
2	ND	0.0022	ND	ND	ND	ND
3	0.0026	ND	0.0010	ND	ND	ND

**Table 3.5 Different Organochlorines concentration detected from Tathed.**

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**Organophosphorus (mg/l) in Kota city:**

Samples no.	Dimethanate	Methyl-parathion	Chlorpyrifos	Malathion	Parathion
1	ND	0.0051	0.0081	0.0040	0.0046
2	0.0319	0.0043	0.0067	0.0032	0.0052
3	0.0267	ND	0.0055	0.0037	ND

**Table 3.6 Different Organophosphorus concentration detected from Raipura village**

Samples no.	Dimethanate	Methyl-parathion	Chlorpyrifos	Malathion	Parathion
1	0.0315	0.0058	0.0170	0.0046	0.0061
2	0.0421	ND	0.0163	ND	ND
3	0.0332	0.0049	0.0175	0.0053	0.0060

**Table 3.7 Different Organophosphorus concentration detected from Kheda Rasulpur**

Samples no.	Dimethanate	Methyl-parathion	Chlorpyrifos	Malathion	Parathion
1	0.0103	0.0061	0.0082	0.0040	0.0049
2	ND	0.0056	0.0061	0.0045	ND
3	0.0123	ND	0.0045	ND	0.0068

**Table 3.8 Different Organophosphorus concentration detected from Bundi Road**

Samples no.	Dimethanate	Methyl-parathion	Chlorpyrifos	Malathion	Parathion
1	0.0316	0.0059	0.0089	0.0053	0.0047
2	0.0301	ND	0.0072	0.0044	0.0039
3	ND	0.0068	0.0091	ND	ND

**Table 3.9 Different Organophosphorus concentration detected from Tathed**

#### IV. RESULTS & DISCUSSION

Groundwater samples collected from the four different locations showed the frequent presence of HCH, DDT, Malathion and other pesticides. The observation and analysis test result that has been carried out in three months on analysis of pesticides residue in groundwater at Kota region is classified as below:

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### 3.1 Results of Raipura Village

- i. Three samples were collected from Raipura Village. Dimethanoate that comes in the category of organophosphorus pesticides has a very high concentration in all the samples. 0.0342 mg/l is its maximum concentration level. On the other side DDD that comes in the category of organochlorines is detected in a very high concentration at Raipura Village. 0.0105 mg/l, 0.0092 mg/l, 0.0009 mg/l are the values that were beyond the permissible limit.
- ii. The second highest organophosphorus and organochlorines pesticide detected at Raipura Village were Chlorpyrifos and DDE. Maximum concentration level in the samples is 0.0096 mg/l and 0.0040 mg/l respectively.
- iii. On third number Parathion and DDT were detected from samples. The concentration levels of these pesticides were 0.0071 mg/l and 0.0035 mg/l respectively. It means that it is greater than the acceptable limit and not good for environment.
- iv. Concentration level of Methyl-parathion that is an organophosphorus pesticides and  $\alpha$  Endosulphan which is organochlorines pesticides was detected in samples of groundwater from Raipura Village. Maximum concentration level of these organophosphorus and organochlorines pesticides were 0.0051 and 0.0017 that is higher than the permissible limit.
- v. Malathion is an organophosphorus and its level of concentration is high in Raipura Village. YHCH (Lindane) is detected in four samples out of five. The maximum concentration of YHCH (Lindane) is 0.0013 mg/l in the groundwater sample and a minimum of 0.0006 mg/l detected and in one sample it is not detected. Hence the concentration of YHCH (Lindane) in Raipura Village is not more as compared to others Organochlorine pesticides.
- vi. Heptachlor is detected in all five water sample collected from Raipura Village. The three samples are in acceptable limit but the concentration of two samples is more that is 0.0010 and 0.0008 mg/l.

### 3.2 Results of Kheda Rasulpur

- i. three samples were collected from Kheda Rasulpur. Dimethanoate that comes in the category of organophosphorus pesticides has a very high concentration in all the samples. 0.0421mg/l is a maximum concentration level. On the other side YHCH (Lindane) that comes in the category of organochlorines is detected in a very high concentration at Kheda Rasulpur. 0.0032 mg/l is the value that is beyond the permissible limit.
- ii. The second highest organophosphorus and organochlorines pesticide detected at Kheda Rasulpur were Chlorpyrifos and DDT. Maximum concentration level in the samples is 0.0175 mg/l and 0.0029 mg/l respectively.
- iii. Methyl-parathion and DDE, levels of concentration detected from samples were 0.0063 mg/l and 0.0027 mg/l that are beyond the permissible limit according to the standards.

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- iv. Concentration level of Parathion that is an organophosphorus pesticides and  $\alpha$  Endosulphan which is organochlorines pesticides is detected in samples of groundwater. Maximum concentration level of these organophosphorus and organochlorines pesticides were 0.0061 and 0.0011 that is higher than the permissible limit.
- v. Heptachlor is observed at a very low concentration in Kheda Rasulpur. The observation of samples comes in an acceptable limit. In two samples this pesticide is not detected and in remaining three it appear in acceptable limit.

### 3.3 Results of Bundi Road

- i. three samples were collected from Bundi Road. Dimethanoate has a very high concentration in all the samples. 0.0123mg/l is a maximum concentration level. On the other side  $\alpha$  Endosulphan that comes in the category of organochlorines is detected in a very high concentration at Bundi Road. 0.0036 mg/l is the value that is beyond the permissible limit that means this value is 36 times greater than the permissible limit.
- ii. The second highest organophosphorus and organochlorines pesticide detected at Bundi Road were Chlorpyrifos and YHCH (Lindane). Maximum concentration level in the samples is 0.0082 mg/l and 0.0030 mg/l respectively.
- iii. Methyl-parathion and DDE, levels of concentration detected from samples were 0.0072 mg/l and 0.0013 mg/l this means that levels of concentration of Methyl-parathion and DDE is 72 and 13 times greater than the permissible limit.
- iv. Concentration level of Parathion that is an organophosphorus pesticides and DDD which is organochlorines pesticides is detected in samples of groundwater. Maximum concentration level of these organophosphorus and organochlorines pesticides were 0.0068 mg/l and 0.0011mg/l that is higher than the permissible limit.
- v. Malathion and Heptachlor are detected with a maximum value of 0.0058 mg/l and 0.0010 mg/l.

### 3.4 Results of Tathed

- i. Three samples were collected from Tathed. Dimethanoate has a very high concentration in all the samples. 0.0323 mg/l is a maximum concentration level and a minimum concentration is 0.0301 mg/l. On the other side YHCH (Lindane) that comes in the category of organochlorines is detected in a very high concentration. 0.0026 mg/l is the value that is beyond the permissible limit.
- ii. The second highest organophosphorus and organochlorines pesticide detected at Tathed are Chlorpyrifos and  $\alpha$  Endosulphan. Maximum concentration level in the samples is 0.0096 mg/l and 0.0022 mg/l respectively.
- iii. On third number Methyl-Parathion and DDE were detected from samples. The concentration levels of these pesticides were 0.0063 mg/l and 0.0021 mg/l respectively. It means that it is greater than the acceptable limit and not good for environment.
- iv. Concentration level of Malathion that is an organophosphorus pesticide is 0.0053 mg/l at Tathed while Heptachlor and DDT maximum level observed at Tathed is 0.0010 mg/l.



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- v. At Thated the level of DDD is not detected. This result shows that DDD is not used by the farmer and it is good for environment.

## V. CONCLUSIONS

It has been concluded from the present dissertation work that the ground water gets seriously polluted due to discharge of pesticides in ground water at Kota. The present study is done on analysis of Organochlorine (OCPs) and Organophosphates (OPPs) pesticides residue in ground water. The ground water as well as soil in agricultural land is polluted by these OCPs and OPPs. A relatively high level of these compounds was observed in most study areas. The dissertation work has been carried out at five different locations named as Raipura Village, Kheda Rasulpur, Bundi Road, and Thathed. Most of the organochlorines pesticides found in this study were officially banned, but they were still detected in ground water at selected sites in Kota region.

Regular monitoring and strict law enforcement is needed to develop a strategy to manage the environmental hazards due to these elements and to improve environmental protection of these area. Thus, using pesticide effectively while maintain water quality presents an important challenge and is needed for life. As citizens, we must recognize the significant role of pesticides in maintaining a high quality of life. The effective production of food and fiber relies on pesticides to control weeds, insects and plant diseases that interfere with the growth, harvest and marketability of crops, and also acknowledge the importance of pesticides in controlling pests in our homes, restaurants, hospitals, parks, ornamental plantings, golf course etc. but at the same time we must be aware that pesticides application can affect water quality of both surface and ground water sources. Human and environmental health may be threatened when excessive concentration of pesticides enters to ground water.

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