

**STUDIES ON INCIDENCE AND EXTENT OF PESTICIDE RESIDUES  
IN NATURAL WATER RESERVOIRS IN AKOLA DISTRICT ON  
VIDARBHA REGION (MAHARASHTRA)**

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**Minor Research PROJECT**

**COMPLETION REPORT**

**From 01/07/2013 to 02/07/2015**

**Principal Investigator: - Dr. S. G. Bhadange**

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**Amount Sanction: - 1, 20, 000/-**

**Introduction: -**

The term Pesticide is a composite term that includes all chemicals that are used to kill or control pest. Pesticide is a substance intended for preventing, destroying, repelling or migrating pests. A substance intended for use as plant growth regulator, defoliant or desiccant is also classified as pesticide. Pesticides are classified into insecticides, fungicides, herbicides or weedicides, acaricides, nematicides based on the target pest.

The fundamental contribution to the green revolution has been the development and application of pesticides for the control of wide variety of insectivores and herbivores pests that would otherwise diminishes the quantity and quality of food products. The use of pesticides coincides with chemical age which has transformed society since the 1950.

The agricultural use of pesticides is a subset of the larger spectrum of industrial chemical use in the modern society. The American Chemical Society database indicates in 1993 with some 500000 new compounds being added annually. In the Great lakes of North America for example the joint commission has estimated that there are more than 200 chemicals of concern in water and sediments of the Great lakes.

Pesticides are classified into five groups based on their structure viz, Organochlorine, organophosphate, carbamate, pyrethroids and others. Organochlorine pesticides are hydrocarbon that contains chlorine atoms and most of them are highly persistent, carcinogenic and mutagenic. DDT, DDE, Endosulfan, dicofol, Lindane, Heptachlore, methoxychlor, Chlorodane belong to this group.

Most of them are banned except endosulfan, dicofol and methoxychlor the last two being analogues of DDT but are comparatively safer. Most of them are insecticides and acaricides.

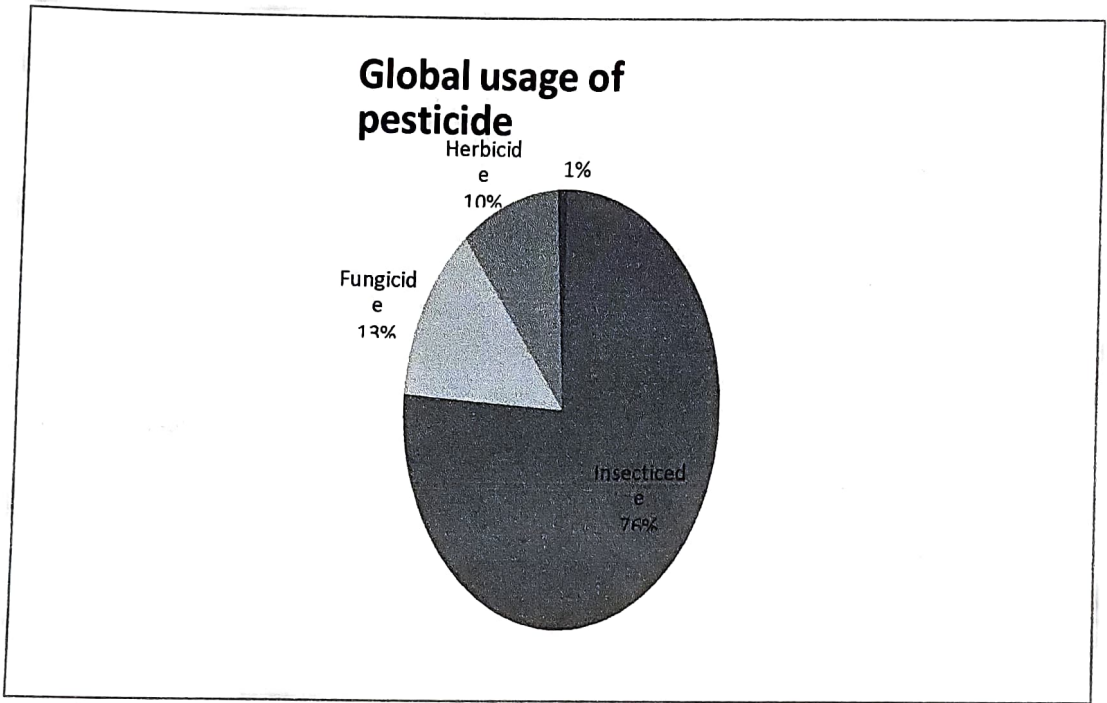
The organophosphate (OP) pesticides are ester of phosphoric, thiophosphoric or dithiophosphoric acid. They are much safer when compared to the organochlorine pesticides in that they degrade much faster in the environment and do not accumulate in animals. But they are cholinesterase inhibitors in animals and are toxic to pest-control operators who come directly in contact with them.

The carbamates are derivatives of carbamic, thiocarbamic or dithiocarbamic acid. All the three types of pesticides belong to this group. The pyrethroids are relatively newer pesticides. They are synthetic structural analogues of the naturally occurring pyrethrins in the pyrethrum extracted from the plants *Chrysanthemum cinerariifolium* especially in the flowers. Commonly used as insecticides, they are much safer when compared organochlorine and organophosphate compounds. Being esters, they degrade in environment and are used in small quantities due to their high toxicity to the insects. Allethrins (used in mosquito repellent product) permethrins, Phenothrins, cypermethrin, deltamethrin, cyfluthrin and cyhalothrin belong to this group.

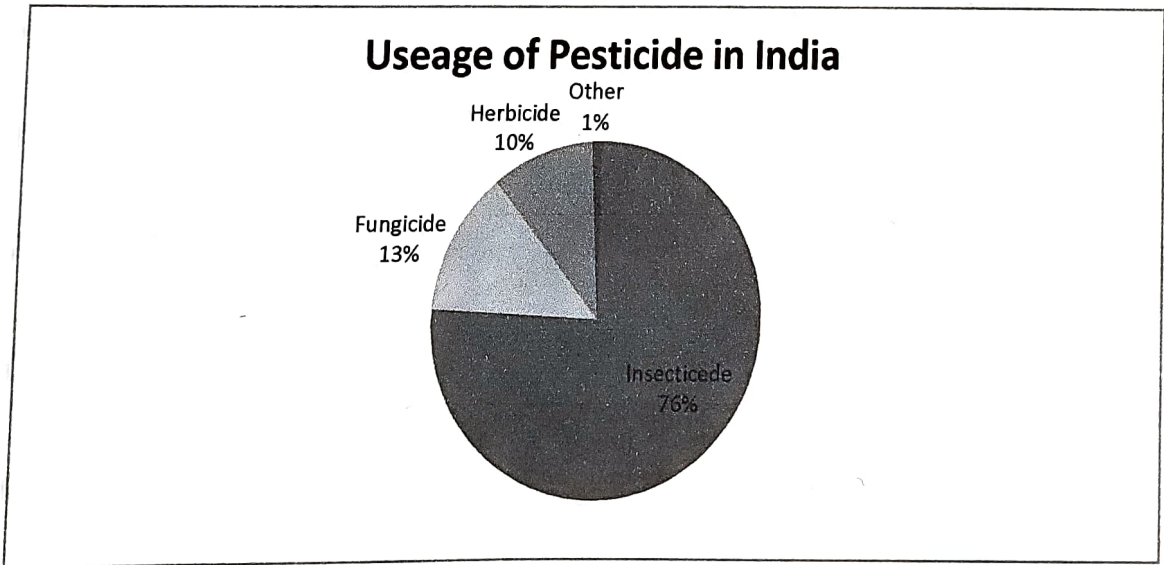
Pesticides that do not belong to these groups are triazine herbicides such as atrazine, simazine etc., plant growth regulators such as 2, 4-D, dicamba, gibberilic acid, indol-3-acetic acid etc urea herbicides, sex pheromones, and so on.

The trend of application of different pesticides in India radically differs from rest of the world. The data presented in **Figures 1** and **2** reflects the estimates of global usage of pesticides (**Figure 1**) in general and India (**Figure 2**) in particular. The 76% of the total pesticides used in India is insecticide (**Figure 1**). Correspondingly, the lesser use of herbicides and fungicides is reflected (**Figure 2**). The main use of pesticides in India is for cotton crops (45%), followed by paddy and wheat.

The major part of the pesticides applied in any area for a specific reason (about 99%) remain unused and it gets mixed with air, soil, water and plants which by several means causes harmful effects on the people, pets, and the environment. Not only the farmers in rural areas but also the people in urban areas use more than half of pesticide in their homes and home gardeners, in and around the schools, business areas, and hospitals etc.



**Fig 1 Global Usage of Pesticide**



**Fig 2 Usage of Pesticide in India**

A pesticide is that compound which should be lethal to the targeted pests only and not to the non-target living organisms such as humans and animals. But the disproportionate application of these compounds has adversely affected the flora and fauna of the entire eco- system. After the death of about 100 people in India due to consumption of parathion contaminated wheat flour, Indian Council of Agricultural Research (ICAR) constituted a committee to suggest possible remedies to combat the toxicity caused due to presence of pesticides and their residues in the edibles. After the first warning about the poisoning of organochlorines (OC) to living systems, the reports from US National Academy of Sciences endorsed the same by studying the toxicity of OC compounds and their metabolites in birds. The pesticides have been shown to display their effects by causing xenotoxicity, alterations in body's immunity, reproductive system and other physiological processes of different organisms thereby generating several diseases including cancer.

### **Hazardous effects of Pesticides:**

The pesticides enter into surface and ground water primarily as runoff. Pesticides are the threat to health due to their inherent toxicity. There are many types of pesticides and exposure depends upon many factors. For an in depth discussion of factors surrounding pesticide exposure and human health.

Pesticides have an innate capacity to cause damage to biological systems which may involve human health, animal health or environment. The most dramatic of such effects on human and animals are the accidental acute poisoning. Several major outbreaks of poisoning with methyl and ethyl mercury compounds, hexachlorobenzene and parathion, have occurred in different causes of cause of acute poisoning have resulted from ingestion of large quantities of pesticides accidentally or with suicidal intent.

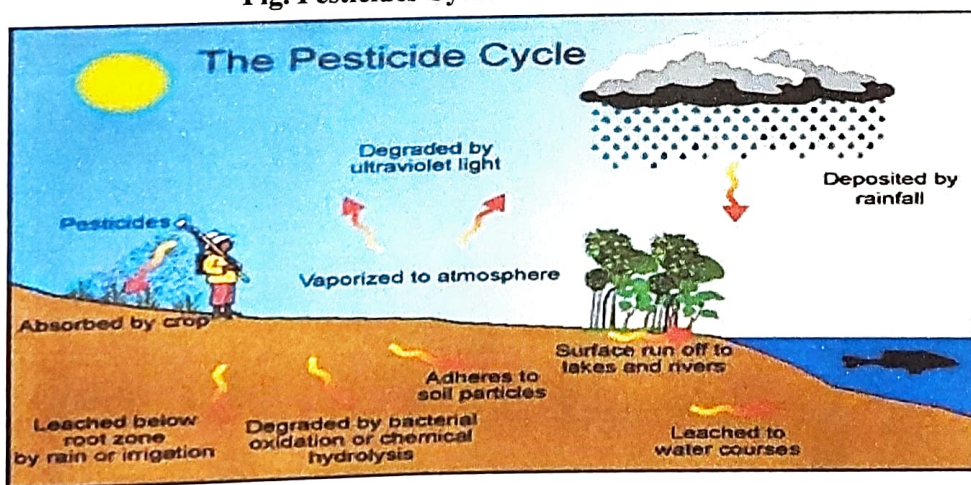
Pesticides Production can also be dangerous. One of the disasters at a pesticides manufacturing plant was in Bhopal, India. The plant accidently releases 40 tons of an intermediate chemical gas, methyl isocyanate, used to produced some pesticides. In that disaster nearly 3,000 people were killed immediately, over approximetly 15,000 deaths occurred and even today nearly 100,000 peoples are suffering from mild to severe permanent damage as a result of that disaster.

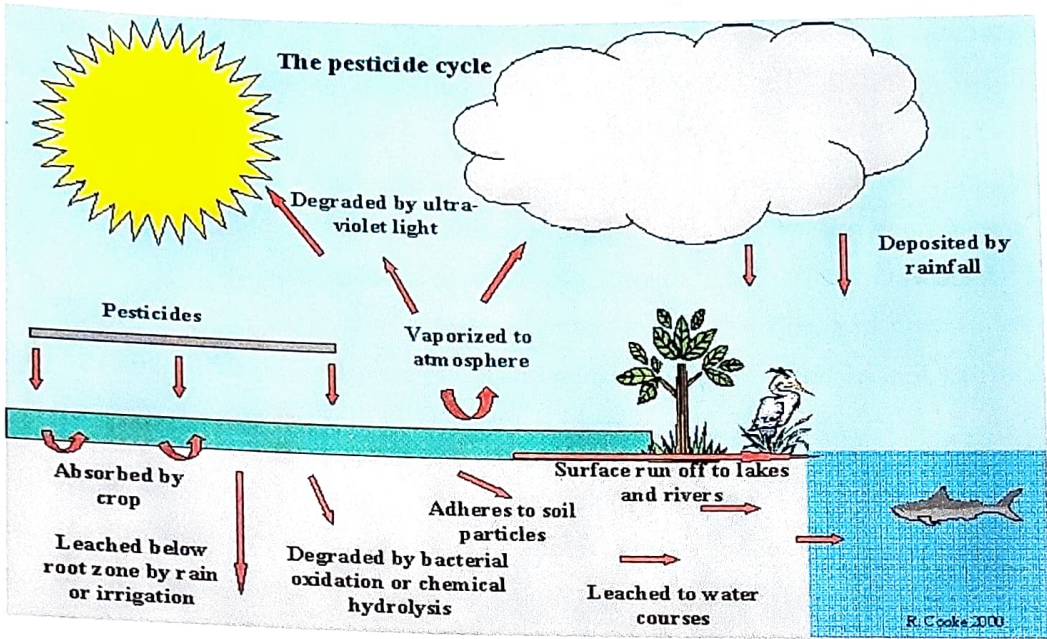
Pesticides can enter the human body through inhalation, ingestion, or by dermal penetration through the skin. Those who work with agricultural pesticides are the most at risk if they are not

properly dressed or if there are broken and leaking equipment. The majority of average citizens who are affected by the pesticides intake the pesticide through consumption of a food that was been contaminated with a pesticide."In 1958, all members of the family of a local chief who is a prominent cocoa farmer at Okebode in southwestern Nigeria were hospitalized after eating a leaf vegetable undergrowth of a cocoa farm that was earlier sprayed by lindane. In 2004, carbofuran pesticide residues found on several batches of noodles manufactured in Nigeria may have resulted in 23 reported cases of vomiting and one death". Pesticides cause headaches, blurred vision, vomiting, abdominal pain, suppress the immune system, lead to blood and liver diseases, depression, asthma, and nerve damage. The issue with these effects is that they may wait appear until a while after being ingested so tracing the symptoms back to the pesticide can prove to be quite difficult. Many of the symptoms can be mistaken for the flu and therefore not properly treated. The inactive ingredients such as chloroform can also cause serious risks to the liver and nervous system. These effects can also be experienced by the animals living around the streams where the pesticides accumulate. The pesticides bioaccumulate within the animals as they are not easily soluble, as that animal is eaten by another animal the pesticide then biomagnifies and obtains an even higher concentration as it moves further up the food chain.

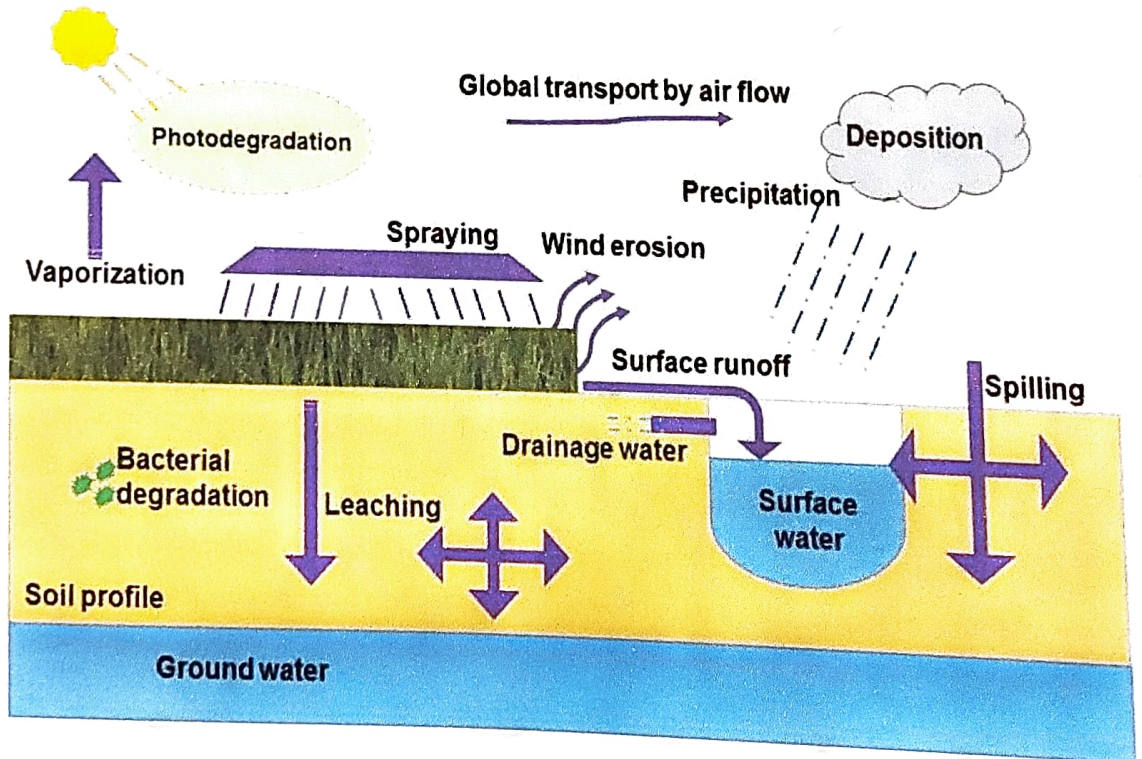


Fig. Pesticides Cycle in Environment





**Fig: Pesticide Cycle**



**Fig: Entry of Pesticides in Environment**



Pesticides have been linked from a short-term to a chronic impact of a wide range of health hazards. The chances of getting its health effects depend on the type of pesticides and the chemical it contains as well as how much and how long or how often you are exposed. It can cause different kinds of cancer and some of the most widespread type is breast cancer, leukemia, brain, bone, ovarian, prostate, & liver cancers. Excessive exposure also increases neurological disorders, lymphoma, asthma, and Parkinson's disease. These chronic health effects may not be noticed for weeks, months or even years after exposure, which makes it difficult to connect its impact to pesticides. Some of the pesticides with high human toxicity are organochlorines, organophosphates & carbamates.

The major public health concern, however, is the ingestion of pesticides residues in drinking water, foods as these may involve large population over a long period of time. In addition to these human health hazards, pesticides may have serious impact on the environment. Apart from the large scale accidental release to the environment, only minimal levels are found in various environmental media. However, the levels are likely to be higher with pesticides that are persistent and or have a propensity for bio magnifications. In latter case the concentration of pesticide increase as it moves through the tropic chain.

Recent reports of increased incidence of abnormal development of testis and reproductive in capabilities related to exposure of environmental chemical have are used a great concern. The male reproductive system may be affected via different mechanism. The pesticides adversely affect spermatogenesis and cause testicular atrophy and fetotoxicity. In addition to reduced sperm count resulting from adverse effect on spermatogenesis, a toxicant may render spermatozoa defective, less mobile or even dead. A toxicant may also affect the reproductive functions via endocrine example DBCP (Dibromochloropane), a fungiant used in agriculture. It is one of the known supermatoxin pesticide, causes infertility in men. It has been observed among the occupational workers to induce azoospermia and ligospermea, along with an elevated serum concentration of leutinizing hormone (LH) and follicle stimulating hormone (FSH).

Persistent chemicals like DDT, dieldrin and polycyclic hydorocabons have been reported to alter the level of testosterone and to decrease the reproductive ability. Impotancy in farm workers on exposure to pesticides has also been reported.

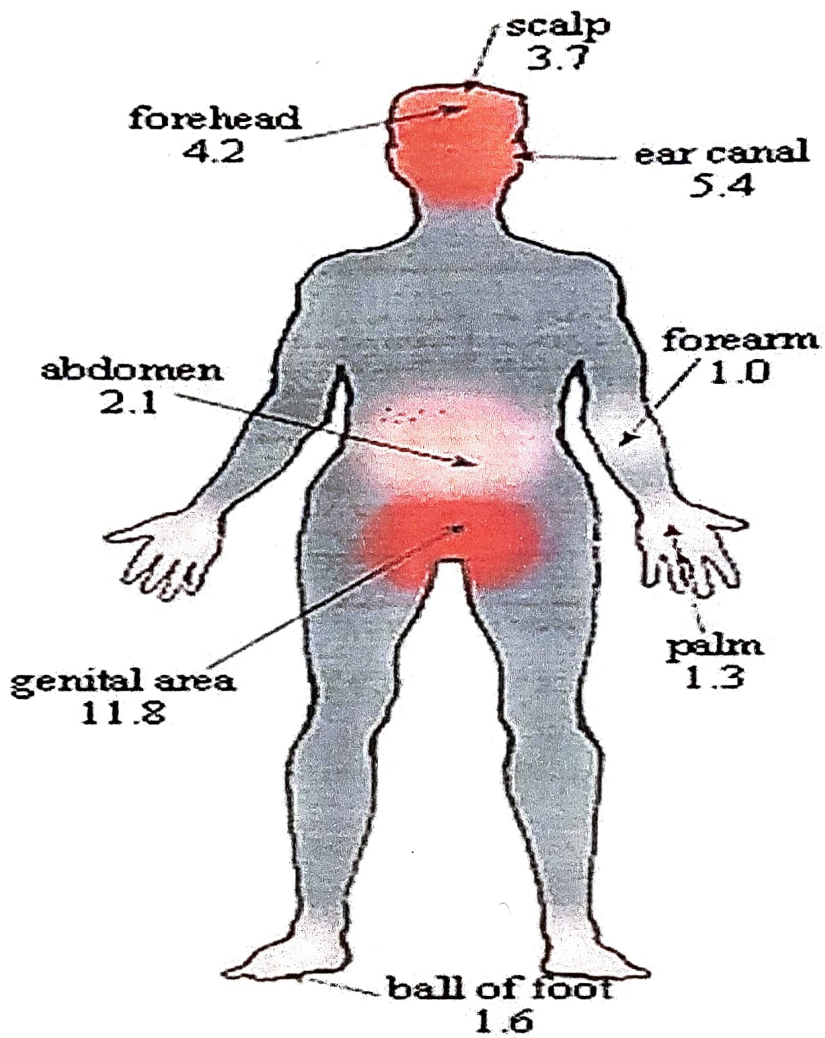
Epidermilogical studies have confirmed that women married to men exposed to DCBP and chloropyrene have higher rate of abortions. Pesticides chemical like DDT, dieldrin and polycyclic

hydrocarbon have been reported to alter the level of testosterone and to decrease the reproductive ability. Impotency in farm workers on exposure to pesticides has also been reported. Epidemiological studies have confirmed that women married to men exposed to DBCP and chloropyrene have higher rate of abortions. Pesticide like endosulfan is also found to cause birth defect in newly born Childs. It was found that in Kasargod district in Kerala more than 50,000 villagers been exposed to endosulfan which is persistan organic pesticides sprayed on cashew plantation. More than 3000 people living near, downstream and downwind were affected by rare diseases like mental retardation, cerebral palsy, cancer etc. Due to these injurious effects , many of the highly toxic chlorinated hydrocarbon pesticides have been banned in the United States, Still these chemicals persists as environmental contaminants and are in wide spread use in developing countries.

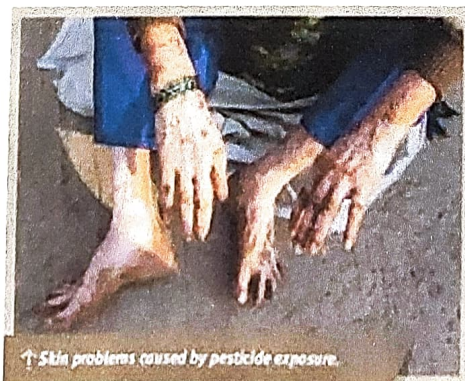
In recent times, the extent of the use of pesticides, and their mode of application including their abuse especially in agriculture have been of much concern to environmental scientists. Alongside their uses are also the residual effect of these pesticides and particularly their replicating effect on human health. Pesticide residue as used in this research work is the residual amount of active components of a particular pesticide or group of pesticides found in a commodity (that is food or water) after the pesticide has accomplished the primary purpose of its application; or the residual amount of a pesticide found in a product which has been in the area of the pesticide application. Though pesticides are often misunderstood to refer only to insecticides, the term pesticide also applies to herbicides, fungicides, acaricides and other substances used to control pest.

The presence of pesticides in water (particularly bio-refactory organics that is aromatic chlorinated hydrocarbons) impacts objectionable and offensive taste, odours and colours to fish and aquatic plants even when they are present in low concentrations. The organochlorine (OC) pesticides are among the major types of pesticides, notorious for their high toxicity, their persistence in the physical environment and their ability to enter the food chain. Although the production and use of many types of OCs and organophosphorus (OPs) have been severely limited in many countries, they are, nevertheless, still being used unofficially in large quantities in many developing countries because of their effectiveness as pesticides and their relatively low cost.

Pesticides are widely used in the agriculture and industry around the world due to their high insecticidal activity. The presence of pesticide residues and metabolites in food, water and soil currently represents one of the major issues for environmental chemistry. Pesticides are, in fact, among the most important environmental pollutants because of their increasing use in agriculture.



**Relative absorption rates, as compared to the forearm (1.0)**





**Effect of Pesticides on Human Health**

### **Interdisciplinary relevance:-**

As water is used in dairy and food industries in addition its use for drinking purpose, higher quantities of residual pesticides result into heavily contaminated dairy and food products. It may not permit the trade of natural water reservoirs in respect to its residual pesticide content. In addition, as the Akola is a rural district, these residues will pose serious health hazards to the most illiterate population. Hence in the context of aquatic fauna and flora, milk, food and health point of views this type of investigation is important.

### **International Status:-**

It was reported that pesticides residues reduced sperm count resulting from adverse effect on spermatogenesis, a toxicant might render spermatozoa defective, less mobile or even dead. A toxicant may also affect the reproductive functions via endocrine e.g. DBCP (Dibromochloropropane), a fumigant used in agriculture. It is one of the known spermatotoxin pesticides, cause infertility in men. It has been observed among the occupational workers to induce azoospermia and oligospermea along with an elevated serum concentration of leutenizing hormone (LH) and follicle stimulating hormone (FSH).

Persistent chemical like DDT, dieldrin and polycyclic hydrocarbons have been reported to alter the level of testosterone and to decrease the reproductive ability. Impotency in farm workers on exposure to pesticides has also been reported. Pesticides contamination of water result of the united state geological surveys (USGS) found that more than 90% of water and fish sample from all streams sampled in U.S. contain at least one pesticide. It is also USGS found that around 50% of well sample contain one or more pesticides.

Epidermiological studies have confirmed that women married to men exposed to DBCP and chloropyrene have higher rate of abortion. Due to these injurious effects, many of the highly toxic chlorinated hydrocarbon pesticides have been banned in the United States, but still these chemicals persists as environmental contaminants and are in wide spread use in developing countries.

The organ chlorine pesticides have become ubiquitous contaminant and have been implicates in a broad range of deleterious health effects in man. The Toxic effects include reproductive failures immune system malfunction endocrine disruption.

### National Status:-

Recent reports of increased incidence of abnormal development of testis and reproductive in capabilities related to exposure of environmental chemical have are used a great concern. The male reproductive system may be affected via different mechanism. The pesticides adversely affect spermatogenesis and cause testicular atrophy and fetotoxicity. It was observed that water and other food commodities have shown high levels of residual pesticides. The Ganga revier water contained 0.38 ppb at Patna. Whereas the HCH at a level of 0.36 ppb at Kanpur. It was recently observe that the Ganga River water at Bhagalpur in Bihar in monsoon DDT 489 mg/lit, Endosulfan 739 mg/lit. In winter DDT is 56.78 mg/lit, Endosulfan 108.02 mg/lit. and in summer season Endosulfan 130 mg/lit, Was found. It was also recently observed that the packaged drinking water sold in India contained very high levels of pesticides. In Human milk at Bomby DDT is found 0.224 ppb HCH 0.053 ppm in Lucknow 0.127 ppb DDT and 0.107 ppb HCH was found. It was recently observed that pesticides residue found in lakes of Bijapur Endosulfan 0.005 mg/lit 4-bromo-2-chlorophenol 0.009 mg/lit and oxyfluorfen was found to be 0.002 mg/lit.

Use of pesticides on large scale in the sector of Agriculture tends to increase the percentage of pesticides in water. The effect can be seen on human and animal life. The growing proportion of pesticides in drinking water gives rise to miscarriage in women. The recent study has shown that women reproductive system has been affected. The recent observations have been shown that sperm count is going lesser in male above all human immunity system is deteriorating. You will find cases of breast cancer in women where pesticides have been used in greater amount.

The Central pollution control Board Delhi had found  $\alpha$  and  $\beta$  isomers of endosulfan recidues in Yamuna River. High concentration of HCH (0.259  $\mu\text{g/l}$ ) and malathion were detected in the surface water samples collected from river Ganga in Kanpur Uttar Pradesh. High concentration of methyl parathion, endosulfan and D.D.T. were observed in water samples collected from river at Bhagalpur Bihar. The ITRC Lucknow study also found 0.5671 ppb concentration of endosulfan in river at Allahabad. Similar resources were found in other water samples in India (Agrawal A and others, Pesticide residue in water- a challenging task in India, *Environ Monit Assess* 2015 Feb 1;187(2):54. Epub 2015 Feb 1.)

Between July and December 2002 pollution monitoring laboratory New Delhi analyzed 17 different brands of Pdw and Pnmw. The samples were tested to see if they content pesticides. The tests were for two kinds of pesticides Organochlorine and Organophosphrus pesticides. The PML tested the

samples for 12 organochlorine and 8 organophosphorus pesticides. Chloropyrifos was detected in 28 out of 34 samples. This extremely toxic chemical was found in quantities exceeding the maximum permissible limits by huge margins. Bisleri (longterms), Kinley of Coca cola (longtimes) and Aquafina of Pepsi was 23 times high than the permissible limits for an individual Pesticides.

The resource of analysis of water samples from Vidarbha region affirmed the presence of HCH ( $\alpha, \beta, \gamma, \delta$  Hexachlorocyclohexan), Endosulfan, DDT, Dichlorovos, Chloropyritos, Phorates etc. The highest concentration of 0.44  $\mu\text{g/l}$  was observed for Chloropyrifors in Bhandara and Yavatmal region and 0.42  $\mu\text{g/l}$  for Parathions methyl in Bhandare region. Pesticides in the surface water samples from Bhandara and Yavatmal region exceeded in the E.U. limits of 1.00 $\mu\text{g/l}$ . A Highest of 0.39 $\mu\text{g/l}$  HCH has been reported in Amravati district. Isomers of endosulfan was found to be maximum in ground water sample with maximum value 0.72 to 0.6  $\mu\text{g/l}$  and 0.78  $\mu\text{g/l}$  in Bhandara, Amravati and Yavatmal region. Where as Organophosphate, Dichlorovos and Chloropyrifos as 0.25  $\mu\text{g/l}$  at Bhandara region. (Summajiya Z lari, Noor Khan and others, Comparison of Pesticides residues in surface water and ground water of Agriculture intensive area, Journal of Environmental Health Science and Engineering 2014, 12:11).

In India Organochlorine insecticide such as DDT and HCH constitute more of more than 70% of the pesticides used at present. Report form Delhi, Bhopal and other cities and some rural areas have indicates presence of significant level of pesticides in fresh water systems as well as bottled drinking mineral water samples. (Anju Agrawal, Ravi S. Pandey et al., Water Pollution with special Reference of pesticides contamination in India, Journal of water Recourses and Protection 2010, 2, 432-448).

Maharashtra is a state in western region of India. It has population of 114 million (2012). Maharashtra is divided into 36 districts, which are grouped into six divisions. The total agriculture are in the state is about 225.56 lakh hector, out of which the net irrigated agricultural is about 33,500 square kilometer. Vidarbha is the eastern region of Maharashtra, it has 11 districts.

Akola district is situated in the middle east of Maharashtra state. This district is situated between North 20.17 to 21.16 latitude and East 76.7 to 77.4 longitude. There are ranges of Gavilgad hills on the north of the district. Anjangaon, Daryapur and Nandgaon khandeshwar tehsils of Amravati district and Karanja tehsil of Washim district are on the east.

Washim district is on the south side and Buldhana district on the west. Total area of Akola district is 5428 sq. Km. Which is 1.76% of the total area of the state . In the district area wise largest tahsil is Akola tahasil. It consists area of 1134.13 sq.km. Telhara tehsil has the lowest area of 628 sq. Km.

There are 7 tehsils in Akola District Akola, Balapur, Patur, Barshitakali, Murtizapur, Akot and Telhara. Washim district was formed by dividing the district in 1998 . Akola city corporation was established on 1 October 2001.

There is 1 Municipal corporation, 5 Municipal councils, 1 Nagar panchayat in district. The headquarter of the district is at Akola and the divisional headquarter is in Amravati.

The Purna River forms the part of north boundary of the district, and the top north portion of the district lies within its watershed along with Aas River and Shahnur River. The Vaan River forms the part of northwest boundary of the district after entering from the Amravati district.

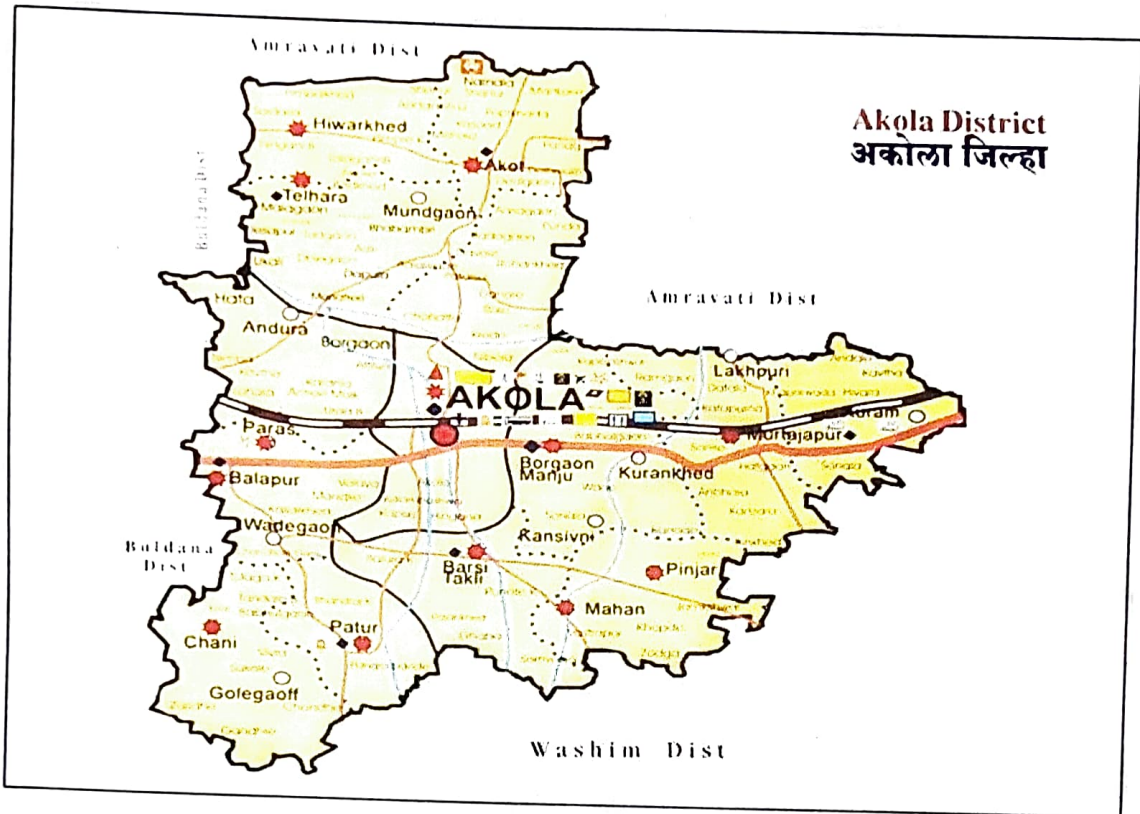
The Mun River drains the southwestern portion of the district, Morna River drains the midsouth portion of the district, while the southeast is drained by the Katepurna River and Uma River.

Akola district shows a little variation in its climate along the north–south direction. Akola district mainly features Tropical Savannah Climate. But the Northern parts of the district consisting of hills and mountains that are raised to about 950 to 1000 meters shows a subtropical climate featuring cool winters. The summers are extremely hot while the winters are dry and mild to cool as the temperature may drop to or below 2 °C. The district has recorded a minimum temperature of 2 °C while a maximum of 47.7 °C. Akola has recorded a minimum temperature of 11.9 °C in the month of May which is considered to be the hottest month in the state of Maharashtra.

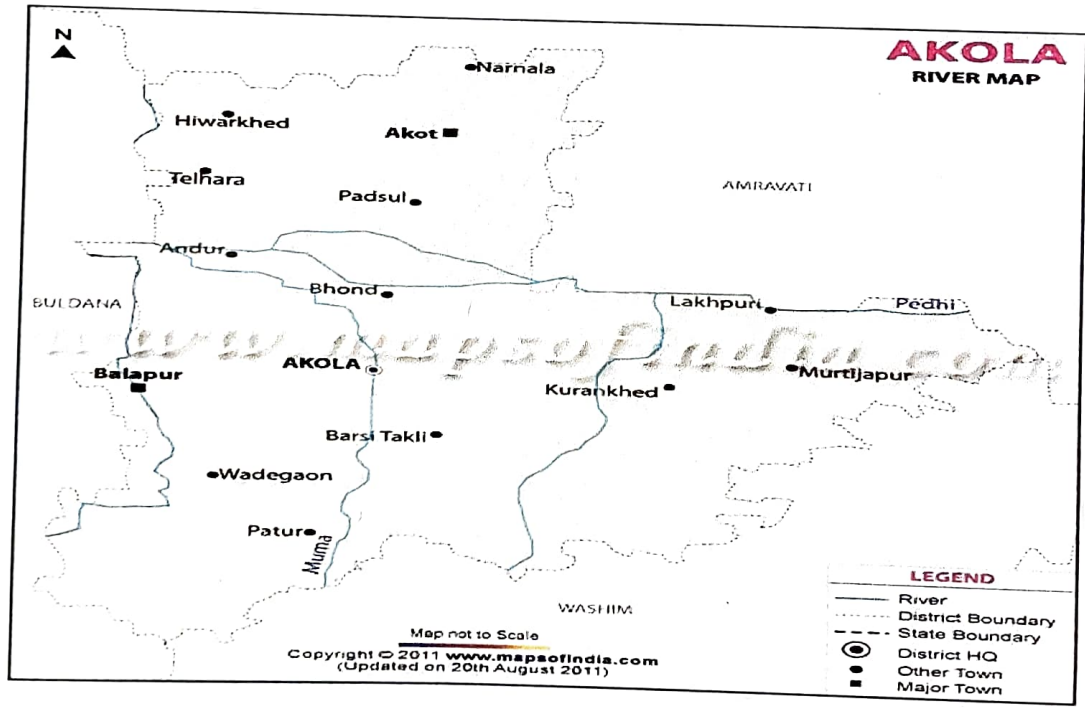
Akola is district of Vidharbha region of Maharashtra. Major agriculture produce is Cotton, Jawar, Red gram. This district is a top grower of Soybean. Eventually, the farmers in this area use huge amounts of pesticides in their cotton and Soybean fields. It results into percolation of large quantities of these hazardous chemicals in natural water reservoirs as well as milk producing animals like cow, buffalo etc.

a) It has been observed that the Maharashtra state is the third largest consumer of Pesticides and highest consumption is due to the cotton crop in Vidharbha region. In this context it is become very important to make aware the Farmers about usage, the preventive and control measure of pesticides residues in environment.

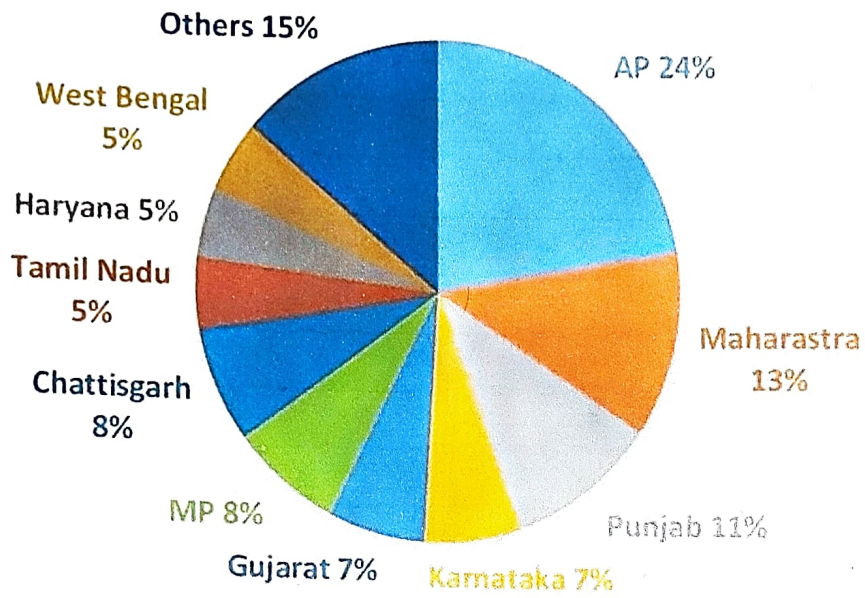




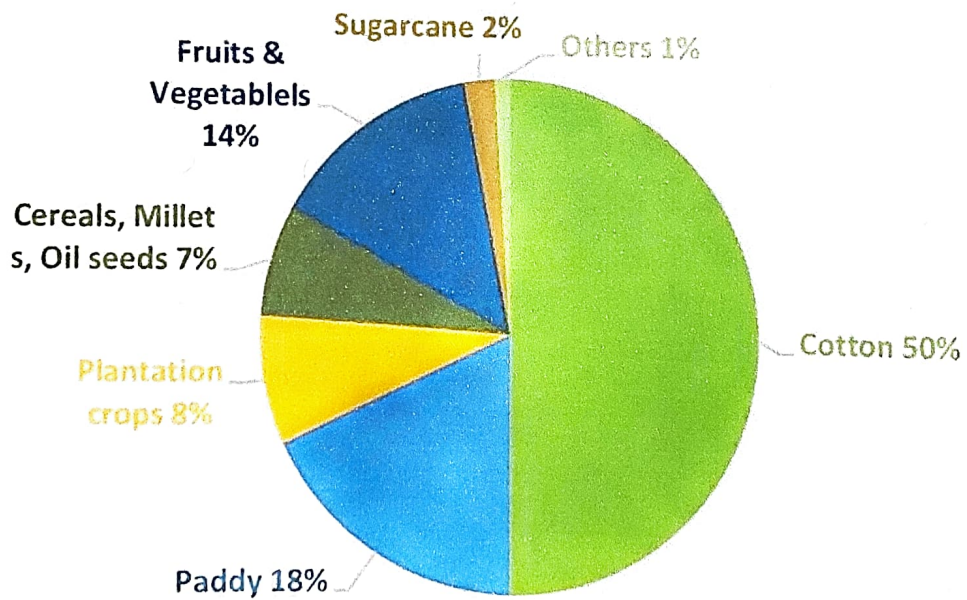
**Akola District Map**



**River Map of Akola District**



**State wise Consumption of Pesticides in India**



**Crop wise Consumption of Pesticides in India**

**BIS Permissible Limits for Pesticides Residues in water.**

<b>Sr.No.</b>	<b>Pesticide</b>	<b>BIS Permissible Limits (in µg/l)</b>
1	Alachlor	20
2	Atrazine	2
3	Aldrin/ Dieldrin	0.03
4	Alpha HCH	0.01
5	Beta HCH	0.04
6	Butachlor	125
7	Chlorpyrifos	30
8	Delta HCH	0.04
9	2,4- Dichlorophenoxyacetic acid	30
10	DDT ( <i>o, p</i> and <i>p, p</i> – Isomers of DDT,DDE and DDD)	1
11	Endosulfan (alpha, beta, and sulphate)	0.04
12	Ethion	3
13	Gamma — HCH (Lindane)	2
14	Isoproturon	9
15	Malathion	190
16	Methyl parathion	0.3
17	Monocrotophos	1
18	Phorate	2

### **The objective of research project:-**

- b) To detect presence of pesticides residues in natural water reservoirs in Akola district of Vidarbha during seasons of two successive years.
- c) To determine the extent of these insecticides residues in natural water reservoirs.
- d) To investigate the probable sources of these residues.
- e) To aware the population of the district about the preventive and control measure of pesticides residues in environment.

### **Method & Material:-**

#### **a) Extraction of pesticide residues from natural water reservoirs:**

One liter water will be taken from each of randomly selected natural water reservoirs from various Tahelis of the district during two seasons of the year. Each of the sample water flasks will be added with 10-15 gm of sodium chloride and the mixture will be stirred gently. The solution will be transfer in to a 2liter reparatory funnel followed by addition of 60ml methylene chloride. The funnel will be stoppard and shaken for three minutes, the lower dichloromethane layer will be separated from the upper water layer and the lower organic layer is drained through granular sodium sulphate (abiut 20g) into a 250ml conical flask. The extraction will be repeated twice more and the extracts will be combined. The dichloromethane will be evaporator under vacuum and the volume will be reduced to 1 ml. The mixture will transferred into a graduated tube using acetone (5ml) and the solvent will be evaporated just to dryness. The volume will be made up to 1 ml and will be stored into an auto sampler vial. Internal standard will be added and stored at 5<sup>o</sup>C in a freezer until analyzed.

#### **b) For HPLC –Fluorescence detection.**

##### **Result:-**

Results from the study have been shown in table which is carried out in the seasons Rainy 2013, Summer & Rainy 2014 from the various dams and rivers of different tahasil of Akola district viz. Akola, Akot, Telhara, Balapur, Murtizapur, Barshitakli and Patur. The results are related to the concentration of OC residues in water. The associated figure for mean concentration for pesticide DDT was in the range of

0.01-0.05 µg/L. The pesticides chlorodane, Lindane and heptachlor was not detected in the water samples showing that the farmers around the reservoir do not use them in their farming activities. Endosulfan, a broad spectrum contact insecticide and acaricide, is another pesticide used by many farmers. The associated figure for mean concentration of Endosulfan was in the range of 0.01-0.02 µg/L.

**Results:**

Area	Dams/Rivers	Season	DDT	DDE	Endosulfan	Chlorodane	Heptachlor
Akola	Borgaon Lake (Local Nallah)	Rainy 2013	0.02	0.05	0.01	ND	ND
		Summer 2014	0.04	0.04	0.01	ND	ND
		Rainy 2014	0.03	0.02	0.02	0.01	ND
	Masa Dam (Local Nallah)	Rainy 2013	0.03	0.05	0.01	ND	ND
		Summer 2014	0.05	0.04	0.02	ND	ND
		Rainy 2014	0.02	0.03	0.01	0.01	0.01
	Sisaudegaon Dam (Local Nallah)	Rainy 2013	0.04	0.04	0.01	ND	ND
		Summer 2014	0.03	0.02	ND	ND	ND
		Rainy 2014	0.05	0.02	0.01	0.01	ND
Akot	Popatkhed Dam (Dather River)	Rainy 2013	0.09	0.03	0.04	ND	ND
		Summer 2014	0.03	0.05	0.02	ND	ND
		Rainy 2014	0.02	0.01	0.04	0.01	ND
	Chinchpani Dam (Local Nallah)	Rainy 2013	0.05	0.04	0.03	ND	0.02
		Summer 2014	0.08	0.03	0.03	ND	0.01
		Rainy 2014	0.03	0.02	0.02	ND	ND
	Bhilkhed Dam (Local Nallah)	Rainy 2013	0.05	0.02	0.03	0.01	ND
		Summer 2014	0.04	0.01	0.03	ND	0.01
		Rainy 2014	0.06	0.03	0.05	0.01	ND
Balapur	Balapur dam (Mun River)	Rainy 2013	0.05	0.01	0.01	ND	0.01
		Summer 2014	0.04	0.03	0.03	0.01	0.01
		Rainy 2014	0.04	0.05	0.02	0.01	ND
Murtizapur	Shivankhurd	Rainy 2013	0.02	0.05	0.03	0.01	ND

<b>Barshitakli</b>	Dam (Local Nallah)	Summer 2014	0.01	0.02	0.05	ND	ND
		Rainy 2014	0.02	0.01	0.02	ND	ND
	Uma Dam (Uma River)	Rainy 2013	0.03	0.03	0.03	0.01	ND
		Summer 2014	0.01	0.04	0.02	0.02	ND
		Rainy 2014	0.05	0.02	0.01	0.02	0.01
	Katepurna Dam (Katepurna River)	Rainy 2013	0.06	0.04	0.03	ND	0.01
		Summer 2014	0.04	0.05	0.03	ND	ND
		Rainy 2014	0.02	0.02	0.02	0.01	ND
	Hatola Dam (Local Nallah)	Rainy 2013	0.05	0.05	0.01	ND	0.01
		Summer 2014	0.03	0.02	0.03	ND	0.01
		Rainy 2014	0.04	0.02	0.03	0.01	ND
	Januna Dam (Local Nallah)	Rainy 2013	0.02	0.03	0.03	ND	ND
		Summer 2014	0.03	0.02	0.03	ND	ND
		Rainy 2014	0.04	0.01	0.04	0.01	ND
	<b>Patur</b>	Tuljapur Dam (Local Nallah)	Rainy 2013	0.05	0.05	0.04	0.01
Summer 2014			0.06	0.06	0.02	0.02	ND
Rainy 2014			0.04	0.07	0.07	0.01	ND
Patur Dam (Local Nallah)		Rainy 2013	0.05	0.04	0.05	ND	ND
		Summer 2014	0.02	0.05	0.02	0.01	0.01
		Rainy 2014	0.04	0.07	0.05	ND	ND
Nirguna Dam (Nirguna River)		Rainy 2013	0.05	0.08	0.08	ND	ND
		Summer 2014	0.02	0.05	0.05	0.01	0.02
		Rainy 2014	0.06	0.02	0.06	0.01	ND
<b>Telhara</b>	Wan/Wari/ Hanuman Sagar (Wan River)	Rainy 2013	0.05	0.02	0.05	ND	ND
		Summer 2014	0.01	0.05	0.03	0.01	ND
		Rainy 2014	0.05	0.05	0.02	ND	0.01

**Conclusion:**

From the observed result we concluded that the water of all these areas of Akola district contains less amount of pesticide so water is suitable for domestic as well as agricultural purpose and also for drinking purpose after some treatment. Along with this pesticide analysis we also analyzed some physico-chemical parameters and this parameter in the limit of drinking water standards of BIS and WHO.



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