

## **Pesticide Contamination in India and its Health Effects**

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**Abstract**—The pesticides are the group of chemicals used everywhere on earth as herbicides, insecticides, fungicides, and plant growth controls wild plant, pests and diseases or infections in crops and also it cares for the well-being of humans and animals. The positive feature of using pesticides is that it improves the crop production and decreases the indirect transmission or genetic diseases. Pesticides are the maximum profitable resources of weed and pest control. It permits the preservation of existing crop and also contributes to financial feasibility. The pesticide and soil bond depends upon that how strongly they both are bounded together and also depends upon the surrounding situations at that particular period like water content in soil. Using pesticide endlessly and non-judiciously has increased the contamination due to pesticide in environment. On the other hand, application of uncontrolled and not selective pesticides is extremely affecting the whole environment, the well-being of wildlife and individuals and also creating ecological and health problems. If pesticides are not applied with appropriate knowledge of its toxic effect, then it may be promptly hazardous. Work-related contact with pesticides happens in situation of workers in pesticide industry or with agricultural workers in open field. At present, in India more than 70% of insecticides are used such as DDT and HCH. Cities like Delhi, Bhopal and some other rural areas reports have showed the existence of notable pesticide level in system of fresh water sample and in mineral drinking bottled water sample. So, in this paper different types of pesticides, their transportation mode in environment and the pollution effect are discussed.

**Keywords**—*Pesticide; Air; Soil; Water; Environmental contamination; Pollution; Health.*

### **I. INTRODUCTION**

Any chemical that ends the lifespan of insect pest, unnaturally or naturally is called as pesticide. These chemicals are highly toxic in nature. It can affect the organisms and humans both. Pesticides spread diseases, causes irritation, and also it can destroy the land area wherever it is applied. As water is necessary for lifecycle. On this planet Earth no one can live without it. Therefore, water quality is essential to be alive because it maintains biological happenings. The contamination in water bodies which affect the environment by addition of pollutant into water bodies directly or indirectly can be defined as water pollution. Water bodies such as lakes, rivers, oceans, and groundwater by human activities which can be affected by contamination. Water quality may also get disturbed due to natural phenomenon such as algae bloom, earthquakes, storms or volcanoes etc., except from addition of pesticides. Water becomes harmful because of the presence of toxins and it changes the quality of water. Toxic chemicals are found in many water bodies. So, pesticides are made to kill the insects-pests and not specific species.

### **II. CLASSIFICATION OF PESTICIDES**

Pesticides are categorized as –

2.1 On the basis of toxicity –

<b>Toxicity</b>	<b>LD<sub>50</sub></b>
Relatively harmless	>15,000 ppm
Practically non-toxic	5000-15,0000 ppm
Slightly	500-5000 ppm
Moderately	50-500 ppm
Highly	5-50 ppm
Extremely	<5 ppm

Table.1 Pesticides categorised based on toxicity

2.2 On the basis of Mode of entry -

- Contact poisons – In this, the pesticides gets in contact through epidermis in body of the pest which causes death.
- Stomach poisons – Through mouth the pesticides goes to the digestive system which causes pain in stomach and it also can cause death.
- Systemic poisons – In this, pesticide are used up by the host organism and then it gets into the fluid of body. Due to the pesticide in the body fluid, can kill the human by poisoning.
- Fumigants – These pesticides are in form of gases which can be entered in body by respiration.

2.3 On the basis of mode of action

- Respiratory poison – Due to this poison, cellular respiration is blocked by obstructing the catalytic stroke of cytochrome oxidase. HCN is the example of respiratory poison.
- Physical poison – Physical effect like dehydration can kill the insects by these chemicals. Diatomaceous earth is the example of physical poison.
- Nerve poison – By blocking the nervous system, the insects are killed by these pesticides. Carbamates and Organophosphates are the examples of nerve poison.
- Protoplasmic poison – By protoplasmic damage, the insects are killed by these chemicals. Arsenic compounds are the example of protoplasmic poison.
- Chitin inhibitors - In this chitin synthesis is affected by obstructing chitin synthetase. Diflubenzuron is the example of chitin inhibitors.

2.4 On the basis of chemical nature -

- Organic pesticides

<b>Organic pesticides</b>	<b>Examples</b>
Oils and soaps	a. Natural oil b. Crude oil c. Kerosene d. Diesel
Animal origin(nerve poison)	a. Lumbrineri-sheteropoda b. Nereistoxin (in marine annelid)
Plant origin pesticide	a. Nicotine (N.rustica and Nicotianatabacum leaves) b. Neem products (kernel extract and oil of seeds of neem) c. Pyrethrum (c.coccineum and chrysanthemum flowers) d. Rotenone (derris elliptica roots)

Table.2 Organic pesticides

- Inorganic pesticides

Inorganic pesticides	Example
Fluoride compounds	Sodium fluoride
Arsenicals	Lead arsenate
Others	Zinc phosphide. Sulphur

Table.3 Inorganic pesticides

- Synthetic pesticides

- a. Organochlorine Pesticides:

These are broad spectrum of pests. Also, these pesticides are chemically stable, which have extensive lasting stability, less toxicity relatively and very rigid to collapse in the natural surrounding or environment. This can pollute the environment; accumulate the mammal if there is a constant use of these pesticides in huge amount, which results in damage or increase poisoning. These pesticides are barred in general conditions. Examples of organ chlorine pesticide are DDT and Endosulfan.

- b. Organophosphate Pesticides:

These are nerve poisons which can be as fumigant, contact poison, and as stomach poison. These pesticides have the capability of regulating the broad spectrum pests, also these are categorized by its multiple functions. Most importantly, these pesticides causes lowest environmental pollution, also these pesticides are biodegradable and has very slow resistance. Example of organophosphate pesticide is DDVP.

- c. Organometal Pesticides:

Due to ingestion, inhalation or skin absorption, these pesticides have toxic effect. These pesticides are the metal salts of organic compounds. Example of organometal pesticide is Tetraethyl lead.

- d. Synthetic-pyrethroid:

These have long lasting effect and are more stable as compared to natural pyrethrins. Natural pyrethrins are the synthetic derivative of these pesticides. These are minor toxic to animals and extremely toxic to insects. Example of Synthetic-pyrethroid is Cypermethrin.

- e. Carbamates:

These can be used as contact poison, stomach poison and fumigant. Physostigmine is the synthetic derivative of carbamates. It affects the communication signal in nerves which causes death. These have less environmental pollution and these pesticides have similar assembly as natural organic material. Example of carbamates is propoxur.

- Miscellaneous compounds

Compounds	Example
Fumigants (extremely strong and weightier than air)	HCN
Phenyl pyrazoles (block chloride conduit of neuron)	Fipronil
Avermectins (inhibit transmission of neuromuscular junction)	Abamectin
Spinosuns (asct as stomach poison and fumigant)	Tracer

Neonicotinoids	Acetamiprid
Thionicotinyl compound (broad-spectrum insecticide)	Thiomethaxam
Oxadiazine compounds (sodium ion channel is affected which causes paralysis and death)	Indoxacarn

Table.4 Examples of miscellaneous compounds

### III. PESTICIDE CONTAMINATION

The most important element of the pesticides practically used in any region for a definite reason in which about 99% of the pesticide is not used, which then causes harm to the surroundings by contaminating water, air or soil. In these pesticides numerous of them are not recyclable which then remain in the surroundings or remains on the surface of soil which is known as contamination in soil or leakage into ground water through the soil t which is known as contamination in water, also from surface of soil these contaminant particles can get into the atmosphere through wind, which is known as contamination in air or atmosphere.

The toxicity and quantity of pesticide to be applied depends on the climate conditions. Climatic conditions and soil factors are the essential factors of pesticide contamination that have an effect on the surroundings. Pesticides contamination depend upon the relations among the physicochemical properties like solubility, vapor pressure, stability etc. of the pesticide, soil persistence and adsorption factors of soil like organic components, soil moisture, inorganic surfaces, pH etc.

### IV. CONTAMINATION IN SOIL

Contamination in soil occurs when the threshold limit of the use of chemical pesticide gets exceeded. It remains for decades in the soil and possess risk for soil conservation. Interaction between chemical pesticides and soil go through the following reactions:

- a) Chemicals can get evaporated and misplaced in the atmosphere without any change in chemical.
- b) Chemicals can get captivated by soil colloids.
- c) Chemicals can percolate throughout the soil.
- d) Chemicals can go through various chemical reactions.
- e) Using microorganisms in soil, chemicals can also go through microbial degradation.

Factor Affecting Soil Contamination

1. Increase in organic matter in soil, increases the contamination of pesticide.
2. Random Use of Fertilizer
3. Unsystematically using pesticides, insecticides and herbicides.

### V. CONTAMINATION IN WATER

There is no life on earth without water. No one can stay alive without water. But, quality of water is also important part because it takes part in supporting the physiological action of any living cells. Contaminated water is the deficiency in its intrinsic features by accumulation of pollutants to the high level that it cannot be served for the purpose of drinking and also cannot support the biotic group, like fishes. This contaminated water causes several disastrous diseases which is responsible for death of people and aquatic animals every day. It is the foremost reason of universal concern. The agency of Environment Protection i.e., EPA has stated that more than 50% of the water is getting polluted due to discharge or leakage from landfill sites, different types of industries ,etc., and also mixing of chemicals from the crop growing practices i.e., from agricultural lands. Below are the five main pathways through which pesticides can reach the water:

1. Leakage from the soil
2. Pesticide spillage
3. Pesticide mixing with runoff and reaches the source of water.

4. By soil erosion
5. While spraying pesticides on agricultural land, it may drift outside the projected zone.

#### 5.1 Water Pollution Source

Water pollution is the objectionable changes in the properties of water which is not good for living things those are using this water for their survival. Water for agriculture may contribute in pollution. Other major sources of water pollution may be petroleum drilling, mining and landfills. Other water pollution are storm sewers, sanitary sewers, industry etc. As per 1990 report of EPA more than 50% of pollution in water is due to mixing of chemicals and leaching in rivers and streams. Municipal sources take about 12% in water pollution. Water gets polluted from pesticides and fertilizers from the agricultural field and it is carried by surface runoff into streams. Pesticides are the chemicals commonly used all over the world for the growth of crop and to destroy the insect-pests which are responsible for spreading diseases to living beings.

#### 5.2 Entry of Pesticide into Water

Through leaching process and surface runoff, pesticides can be carried away. These are the two most important methods which are connected to the earth's hydrologic cycle. Pollutant which gets transported with the source of water may be natural, such as rainfall or by diversion of water which is done by humans. Contaminants can enter water bodies by airstreams or it can enter by their own reflexive actions.

When pesticides, fertilizers, animal wastes, insecticides, are applied to cropland, various deposits stay in top soil once it is accepted by the plant and then it can percolate from waters subsurface, or else the deposits may transport to water surface by liquefying in overflow. Pesticide deposits reach the surface of water which affects the human's health, marine organisms and the freshwater.

#### 5.3 Indian Case Study on Pesticide Pollution Entry in Water

In the middle of July and December 2002, Centre for Science and Environment (CSE) of New- Delhi came to know that the bottled water is contaminated with pesticide residue. It was the utmost distressing effect of pesticide contamination. The Pollution Monitoring Laboratory of CSE found this contamination. Then 17 bottled water brands of both packed natural mineral water and packed drinking water which are commonly sold in market and in some come areas like bus stand, railway stations and airports was analyzed by the CSE laboratory which shows that the mistake is done in treatment methods. These treatment plants use membrane method to filter fine suspended particles. But, to eliminate pesticides, granular activated charcoal methods and reverse osmosis processes should be used. After this, till 29 September 2000, no standards were made for bottled water in India. On 29 March 2001, it was made compulsory for bottled water to get BIS certification mark. Then on 18 July 2003, amendments were made which states that pesticide deposits must not go above 0.0001 mg/L individually, in addition, 0.0005 mg/L for total pesticide deposits. All these amendments came into force from 1 January 2004.

### **VII. CONTAMINATION IN AIR**

In atmosphere, many natural gases are present which are crucial for existence on Earth. Pesticide contamination in atmosphere is the characteristic of air pollution and the quality of air is the amount of impurities present in atmosphere. Generally, pesticides are used in farming and it has the capability of polluting the environment or the atmosphere which in a straight affects the living things on Earth. The most essential reason of air pollution is because of the use of pesticides. In atmosphere, these pesticides remains suspended, in which some stays for short period whereas some are suspended for a long period of time. As pesticides are suspended in the atmosphere, they affect the environment by dissolving the pesticides with the air, it is separated by the water and sunlight, and also it settles down on the ground. Climatic conditions like humidity, temperature, disturb the pesticide pollution in the atmosphere. Also, wind velocity plays a major role in the pesticide spray. Whereas as compared to the aerial spraying of pesticide, ground spraying is good because it gives a smaller amount pesticide drift.

### **VIII. EFFECT OF PESTICIDE ON HUMAN HEALTH**

Human health can get affected by pesticides in many ways:

1. Ingestion when contaminated food or water is consumed
2. Skin contact – by holding or carrying those products
3. Inhalation – by inhaling pesticide spray or dusts.

Farmers or the workers in those areas which are mostly affected. Though, major population is affected through ingestion because due to pesticides, food gets contaminated and through ingestion it affects the human health. Pesticides have some harmful effects such as cancers, deaths, destruction of immune system, hormonal disorders, DNA impairment, generative embarrassment etc.

#### 8.1 Path of pesticide contact:

1. Oral contact
2. Eye contact
3. Dermal contact
4. Inhalation contact

#### 8.2 Harmful effects of pesticides

1. Acute Effects: These could give the impression instantaneously or within 24 h after contact with pesticide. These effects are assessed more precisely and simply diagnosed. The acute effects can be easily noticeable and also they can be cured if medicinal action is taken on time. Below are some major acute effects:

##### A. Respiratory problems

###### a) Asthma:

- Severe disease of the lungs
- Cause breathing difficulty and coughing.
- Some pesticides show the sturdiest relation with asthma for domestic, work-related and environmental contacts.

###### b) Neurotoxic effect:

- These affect mammals.
- Sensitive indicator of nervous dysfunction

2. Chronic effects: These do not give immediate effect and these are those which do not give the impression within 24 h after contact with pesticide.

Various kinds of chronic effects are:

###### a) Carcinogenic effect:

- b) Bladder and colon cancer
- c) Brain cancer
- d) Breast cancer
- e) Leukemia
- f) Non-Hodgkin Lymphoma
- g) Teretogenic effect
- h) Prostate cancer
- i) Liver damage
- j) Neurotoxicity
- k) Alzheimer disease
- l) Parkinson disease:

#### 3. Allergic Effects

### IX. CONCLUSION

Pesticides are frequently used as fast, easy, and low-priced solution for regulating wild plant as well as pests in municipal sites. But, because of pesticides deposits found in soil, water and air, ground and everywhere around the nation which harm every portion of our environment. The greatest method to diminish this pesticide contamination from our environment is to use non – chemical pest control techniques and to safely use it. Additionally, to avoid any type of contamination, investigation of water and continuous monitoring should be done by suitable organizations.

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