



Pesticides: Classification, Hazardous Effect On Human Health And Environment

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ABSTRACT:

A pesticide is any substance that has the tendency to kill or repel bugs. Pesticides include Ascaricides, Alogicides, Bactericides, Herbicides, Fungicides, Insecticides, and Nematocides. Pesticides can have acute, or short-term, negative health impacts, as well as chronic, or long-term, negative health impacts that can develop months or years after exposure. Cancers, birth abnormalities, neurological disorders as well as reproductive harm and toxicity, immunotoxicity and endocrine system disturbance are examples of documented chronic consequences. Pesticide exposure causes immediate irritation of the nose, throat, and skin, resulting in burning, stinging, and itching, as well as rashes and blisters. Nausea, dizziness, and diarrhea are frequent side effects. Pesticides are mostly released into the atmosphere during their preparation and application. Pesticides can be taken up by target creatures, degraded, or transferred to groundwater after application; they can also enter surface water bodies, volatilize to the atmosphere, or be ingested by non-target creatures. Photodecomposition, microbes, and many chemical and physical processes can all cause pesticides to degrade (break down into different chemical forms). Pesticides having a slow biodegradation rate are known as persistent pesticides because they can survive in the environment for a long time and these persistent pesticides have adverse effect on environments as well as human health. Pesticide definitions, classifications, toxicity, factors determining toxicity, pesticides in water resources, environmental fate, human health effects, and detection, disposal, and treatment methods are all examined in this research paper. This study article advises that alternate approaches for detecting pesticide residues and other very dangerous contaminants be explored further.

KEYWORDS: Pesticides, Hazardous effects of pesticides, Human health, persistent pesticides, biomagnification, toxicity, adverse effect, photodecomposition.

INTRODUCTION:

Pesticides are chemicals that are used to kill unwanted organisms in home gardens, agricultural land, and other public spaces. Pesticides are utilized in the world at a rate of around 5.2 billion pounds each year, according to estimates. Pesticides come into contact with many workers and people on a regular basis, especially in the rural sector, putting them at danger of poisoning. Pesticide residues have been discovered in ready-to-eat foods, wine, water, fruit juices, and animal feed. Pesticide suicide is frequent in several Asian and Latin American nations, according to data given by the World Health

Organization (WHO). Pesticides are frequently poorly regulated and freely available, especially in low- as well as in middle-income countries [42]. Pesticides used in agricultural activities can be absorbed by target organisms, destroyed, or carried to groundwater; they can also infiltrate surface water bodies, volatilize into the atmosphere, or be consumed by non-target creatures. Pesticide solubility impacts their movement in surface runoff and leaching into groundwater when it comes to their physical and chemical qualities. Pesticide volatility is affected by environmental factors such as temperature and humidity, and can occur in soil, plants, or surface water, and can last for days or weeks following pesticide application. In coarse-textured sands and gravels, which have high infiltration capacity in comparison to soil texture, water tends to percolate through the soil and subsequently reach groundwater. Bioaccumulation of a pesticide with a greater lipid solubility and a low clearance rate in organisms can result in the chemical being stored in fatty tissue, resulting in a final concentration level of pesticides in the organism that is higher than the concentration in the environment. As the bioaccumulated chemical moves through the food chain of trophic levels from lower to higher, pesticide concentrations in higher trophic level animals rise. The main chronic health impacts and current findings linked with exposure to same types of chemical pesticides, such as organophosphates, organochlorines, carbamates and neonicotinoids, are discussed in this research paper. The significant health consequences, as stated below, highlight the urgent need for alternative solutions to be implemented.

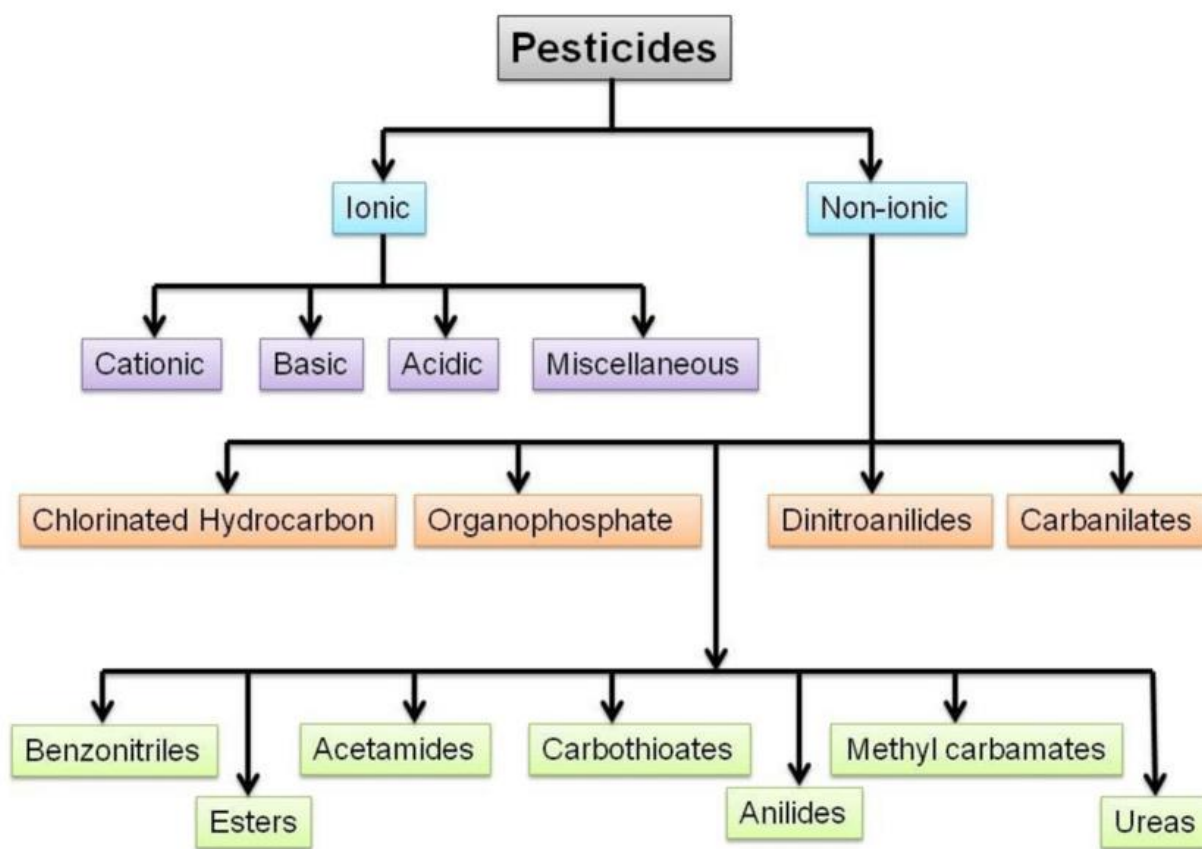
This paper will focus on following objectives:

- Classification of pesticides
- Sources of pesticides
- Mode of action of pesticides
- Hazardous effects of pesticides
- Alternative solutions for pesticides
- Safer agricultural practices

Pesticides known for their capacity to induce harmful health consequences in humans and wildlife, as well as destroy the natural environment, are widely produced and used in current agricultural methods. As a result, an immediate strategic strategy is required to reduce the usage of agrochemicals and promote sustainable practices.

Classification of pesticides:

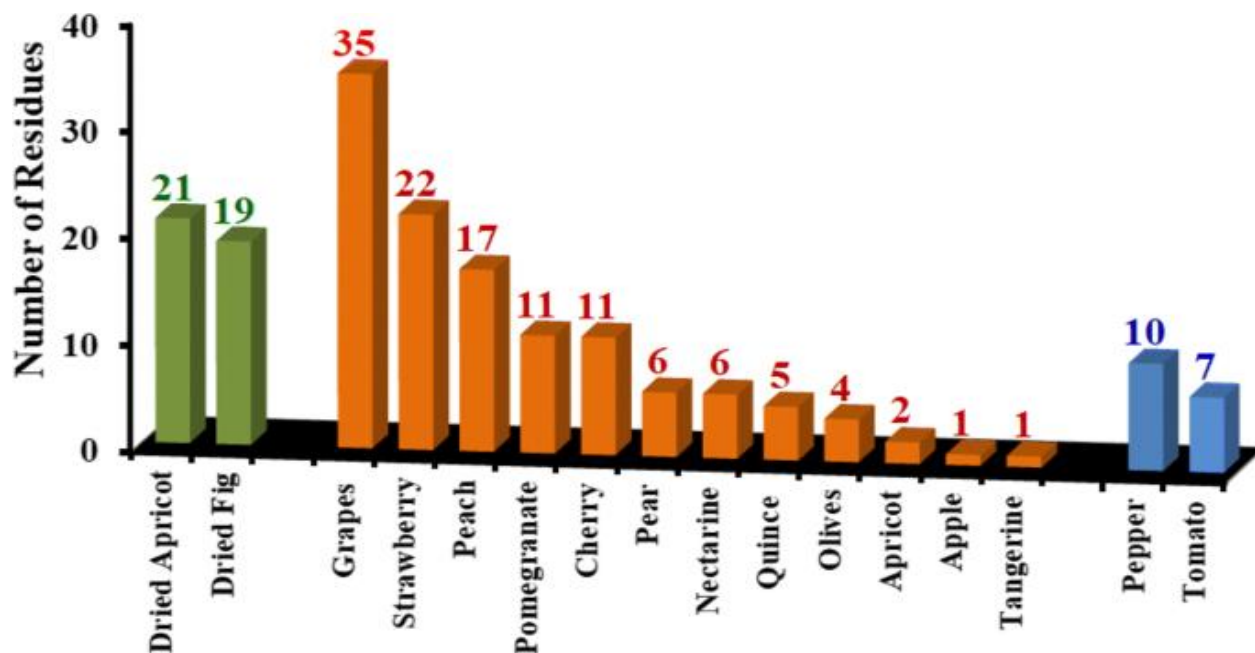
Pesticides are divided into a variety of categories based on their intended application. Herbicides, insecticides, fungicides, rodenticides, molluscides, Nematocides, and plant growth regulators are only a few examples of these types of chemicals. Pesticide use that is unregulated has had terrible implications for the environment. These pesticides have different physical and chemical properties depending on which class they belong to.



Mode of entry in food chain:

Pesticides enter our bodies by the food chain in the following ways: To protect crop plants from pest assault, pesticides are sprayed on them. After being washed out into the soil or water bodies, these pesticides are absorbed by plants. Pesticides enter the food chain when plants are eaten by humans or other animals. Because pesticides are non-biodegradable, they collect over time and eventually enter our bodies. The most prevalent methods of pesticide exposure for farmers are through the dermal and inhalation pathways. During routine pesticide handling, dermal exposure occurs in body parts that are not covered by protective equipment, such as the face and hands.

The Evaluation of pesticides in fruits and vegetables from the Aegean region of Turkey and assessment of risk to consumer:



When pesticides are used in excess to manage pests, illnesses, and weeds in agriculture fields, they can pose a risk to human health. In the current investigation, which was conducted in Turkey's Aegean region from 2012 to 2016, 3044 samples of 16 various vegetables and fruits were evaluated for pesticide residues and the health risk to consumers created by such residues. According to the findings, 354 of the total samples had higher maximum residue limits (MRLs), while 473 samples had lower MRLs. The samples with a high MRL level among the total samples was as follows:

The total samples with a high MRL level among the total samples was as follows: 74 % for chlorpyrifos (2.43 %), 145 % for azoxystrobin (3.8 %), 112 % for triadimenol (3.8 %), 103 % for carbendazim (3.4 %), 98 % for chlorpyrifos (3.2 %), 94 % for pyrimethanil (3.10 %), 90 % for cyprodinil (2.9 percent), 76 % for fludioxonil (2.50 %), 75 (1.90%).

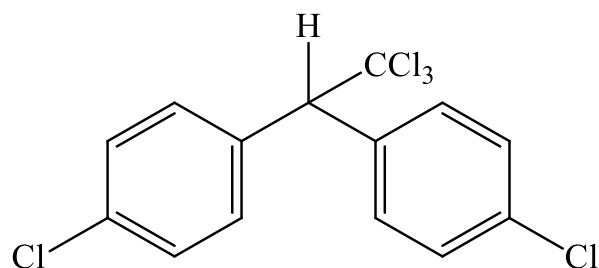
Some Pesticides and their harmful effects on Human well-being and Environment:

Organochlorine insecticides:

Organochlorines are a class of chlorinated chemicals that are commonly employed as pesticides. These substances are classified as persistent organic pollutants (POPs) because of their long-term environmental persistence. They exist in the environment without undergoing chemical alteration due to their long-term environmental durability. Due to their high persistence, low aqueous solubility, low polarity and lipid solubility, organochlorine pesticides are more dangerous to human and the atmosphere. They are volatile and stable; some can attach to soil and air, increasing the likelihood of long-term persistence in the environment, and have been identified as chronic exposure agents for animals and humans.

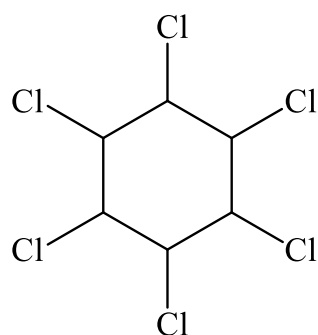
Examples of major organochlorine pesticides with their structure chemical name and toxicity:

1. Dichlorodiphenyltrichloroethane (DDT) $C_{14}H_9Cl_5$



Technical grade exposure DDT exposure was linked to a higher incidence of pancreatic cancer. The risk increased as the time spent in the environment grew longer. It also inhibits neuronal repolarization. Perioral and lingual paresthesia, fear, hypersensitivity to stimuli, agitation, dizziness, vertigo, tremor, and convulsions are all symptoms of poisoning. DDT is a highly contaminating threat due to insolubility in water and persists in the environment. It has a half-life of 2 to 15 years, according to reports. After prolonged contact with soil, DDT degrades into two compounds, DDE and DDD, which have very similar qualities and the same high persistence as the original DDT. This metabolite, known as DDE, is hypothesized to be responsible for the thinning of eggshells observed in birds. It has a higher rate of bioaccumulation in water due to its low solubility, and so poses a serious long-term hazard to aquatic life.

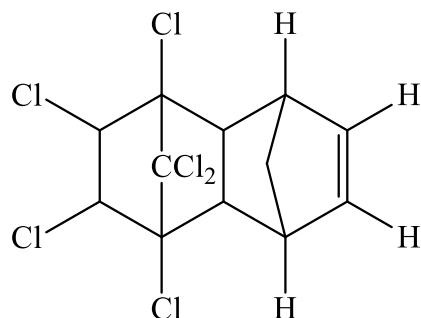
2. BHC (Benzene Hexachloride $C_6H_6Cl_6$)



There has been speculation that BHC may cause cancer or mutations, but there isn't enough evidence to make a determination. If exposed to BHC for an extended period of time, it can cause substantial harm. Long-term exposure to high dust concentrations can lead to lung function alterations, such as pneumoconiosis, which is caused by particles smaller than 0.5 micron penetrating and residing in the lungs. Breathlessness is the common symptom, and X-rays reveal lung shadows. Micro pathological alterations in the kidneys as well as liver may occur as a result of long-term exposure.

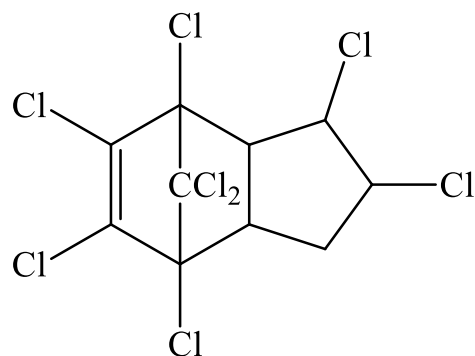
3. Aldrin: (C₁₂H₈Cl₆):

1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-dimethanonaphthalene HHDN



Major motor convulsions are a symptom of aldrin and dieldrin intoxication in humans. Malaise, incoordination, headache, dizziness, and gastrointestinal disorders are some of the other side effects. In humans and animals, oral exposure to aldrin can have a variety of negative systemic, genotoxic, neurological, reproductive or developmental, immunological and tumorigenic effects. Long time exposure to high concentrations of aldrin in humans causes toxicity to the central nervous system, with symptoms such as hyperirritability, coma and seizures, as well as cardiovascular complications such as tachycardia and increased blood pressure. Neurotoxic symptoms have included headache, dizziness, general malaise, nausea, vomiting, and muscular twitching or myoclonic jerks when individuals were exposed to lower dosages of these substances over longer periods of time.

4. Chlordane (C₁₀H₄Cl₈):



Headache, blurred vision, dizziness, minor involuntary muscular movements, tremor, sweating, sleeplessness, nausea, and overall malaise are all symptoms of acute cyclodienes poisoning caused by spraying, manufacturing, or unintentional intake. Involuntary muscle contractions and epileptiform convulsions characterize more severe sickness, which includes loss of consciousness, urine and faecal incontinence, disorientation, personality changes, psychological disorders, and memory loss. Chlordane can be harmful when absorbed via the skin. Chlordane may stay on the skin of those who use it for a long time. On the grounds of the concentration of oxychlordane retained in tissue, Nisbet (1976)

calculated total daily chlordane consumption. A daily intake of 9 g of chlordane was computed.

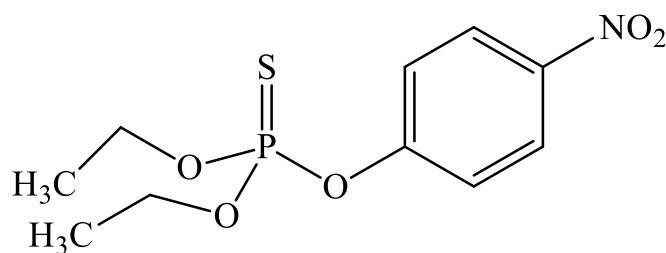
Organo Phosphorous Insecticides:

The organic phosphorous or phosphate insecticides that belong to this group are also known as phosphate insecticides. They are derivatives of phosphoric acid. The Organo Phosphorous Insecticides can be divided into phosphorothioates, phosphates, phosphoramidates, and phosphonates based on differences in their general structure. These insecticides can form reversible or irreversible covalent interactions with the serine residue in the active site of acetyl cholinesterase, preventing the enzyme's natural activity in neurotransmitter catabolism.

Examples of major Organo Phosphorous Insecticides with their structure chemical name and toxicity:

1. Parathion:

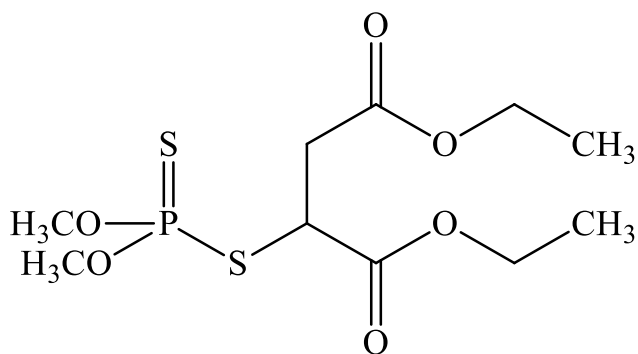
(-O,O- diethyl O-4-nitrophenyl phosphoro thionate)[C₁₀H₁₄NO₅PS]



Cotton, apples, apples, wheat, soybeans, rice, peaches, sunflower, and sweet corn are among the crops treated with methyl parathion, also known as "cotton poison". One hour after exposure to methyl parathion, a high concentration of the pesticide was discovered in adipose tissue, whereas higher quantities were found in the kidney and liver. The tissues having the greatest concentrations of methyl parathion within 12 hours following a one dermal dose of 10 mg/kg of this pesticide were adipose tissue (67,532 ng/g), kidney (1571 ng/g), spleen (1004 ng/g), heart (729 ng/g), liver (706 ng/g), brain (546 ng/g), placenta (389 ng/g), and fetus. The study also revealed that methyl parathion's principal mechanism of toxicity is storage in adipose tissue, from which it can cause toxicity through delayed release into circulation and then into the nervous system.

2. Malathion:

[O, O-dimethyl S-(1,2-dicarboethoxy ethyl) phosphorodithoate]

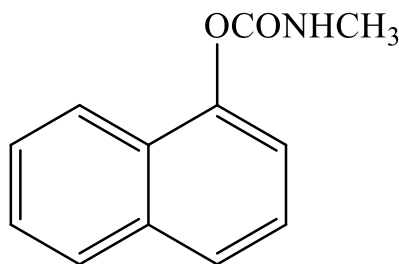


Malathion is a broad-spectrum insecticide that is used in both agricultural and residential settings to control a range of outdoor insects. Malathion affects the neurological system and passes to the kidneys and liver in both humans and animals. Malathion may be broken down in the soil by bacteria, and it can also be broken down in the air by sunshine. Malathion is water-soluble and moves fast through soil. Malathion also found in surface waters such as streams, and it can also be found in well water due to these qualities. Malathion takes roughly 17 days in soil to break down to half of its original amount, depending on the soil type. The half-life is a measurement of how long something lasts. Malathion has a half-life in water that ranges from 2 to 18 days, depending on temperature and pH. Malathion vapour can travel great distances in the air or fog.

Carbamates:

Pesticides containing carbamates cause clinical abnormalities and symptoms of cholinergic excess in the same way that organophosphate toxicity does, but the effects are more reversible and mild. Carbamates are easily absorbed by organisms via the gastrointestinal tract, lungs and skin.

1. Carbaryl:



Carbaryl, like all carbamate insecticides, operates on the neurological system of parasites (as well as mammals, birds, fish, and other organisms) as an acetylcholinesterase (also known as AchE) inhibitor, which inhibits the hydrolysis of acetylcholine (Ach). Ach is a substance that aids in the transmission of nerve signals between neurons in the brain and from nerves to muscles (neuromuscular junctions) (so-called cholinergic brain synapses). Intoxication with cuteness. Inhibition of acetylcholinesterase causes acetylcholine to accumulate in neuromuscular synapses (including in skeletal, smooth, and

cardiac muscles), neuroglandular connections, and the central nervous system (CNS) (Central Nervous System. Hyperexcitation of nicotinic cholinergic receptors and muscarinic occurs, causing the affected organs' normal functioning to be disrupted.

CONCLUSION:

Pesticides have shown to be a godsend to farmers and people all over the world, enhancing agricultural productivity and delivering many indirect benefits to society. However, the dangers that pesticides pose to human health as well as the environment have prompted questions about their safety. On the contrary, they have negative effects on the environment, such as pollution and ecosystem imbalance. Pesticides can affect human health in three ways: ingestion, inhalation, and skin contact, all of which occur as a result of pesticide product handling. We may not be able to totally eliminate the risks connected with pesticide use, but we can mitigate them in some way. Pesticide exposure, and hence its adverse repercussions and unwanted impacts, can be reduced by a variety of approaches, such as employing alternate cropping methods or using well-maintained spraying equipment. As a result, major health risks arise. Pesticides bring about an increase in water contamination, and also at low concentrations, these pesticides pose a major harm to the ecosystem. The majority of farmers are unaware of pesticides' potential toxicity. They have no knowledge of the different types of pesticides, their poisoning levels, risks, or precautions to take before using those pesticides.

Chemical pesticides may be utilized in the future in conjunction with natural therapies and remedies, resulting in more long-term pest and bug control. This combination not only ensures the environment's long-term viability. However, it has a extensive range of applications in the management of urban pests and exotic species. Pesticides' impacts are reduced by holding an awareness campaign among farmers and providing them with specialized training on the dangers of pesticides, as well as screening and monitoring procedures.

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