

Review Paper

## Effect of toxic materials on health

Harsha Kashyap

Research Scholar, Bioscience and Biotechnology Department, Banasthali Vidyapeeth, Rajasthan-304022

\*Corresponding author's e-mail: [harshakashyap.honey@gmail.com](mailto:harshakashyap.honey@gmail.com)

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### ABSTRACT

*Since mid-20<sup>th</sup> century industrialization and successful green revolution have introduced a large variety of chemicals into our environment. Increased industrialization and agricultural development are the main cause of all types of pollution such as air, water and land pollution. It also releases various toxic materials in environment and effect all lives on it adversely. These chemicals entering ecosystems affect man, animal life, plant life, and materials creating serious health and ecological problems. Such chemicals includes pesticides, used in agriculture, metals used in industry and monomers, plasticizers and stabilizers (for plastics replacing the traditional materials like wood, glass, metals in all spheres of life). Several of these are even biomagnified in organisms and sometimes biologically transformed into more toxic chemicals such as conversion of mercury into methyl mercury. Toxic elements are most hazardous among all the pollutant as it can remain in the environment for long time. National Institute for Occupational Safety and Health defines Toxic substance as "One which demonstrates the potential to induce cancer, produce long term disease or bodily injury; to effect health adversely; to produce acute discomfort; or to endanger the life of man or animals through exposure via the respiratory tract, skin, eyes, mouth or any other routes".*

### INTRODUCTION

The environment is complex and diverse. It consists of various ecosystems such as aquatic as well as terrestrial ecosystem within which exist many different biotic and abiotic components. The biotic component includes plants, animals and microorganisms. They make our biosphere and share a same niche in an ecosystem. Whereas abiotic component consist of physical and chemical environment such as atmosphere, hydrosphere and lithosphere sharing a common ecosystem. Each ecosystem is a result of interactions of these biotic and abiotic components. Since 20<sup>th</sup> century human life is degrading day by day due to increase in industrialization and agricultural development. Increase in the industrialization and agricultural development are the chief cause of pollution that influences our life deeply. These change in a life style is hazardous to human being as it also causes depletion of natural resources such as air, water and soil. Destruction of ecosystem and extinction of wildlife also damages our environment. As we know that each and every element of an ecosystem is interlinked and makes a chain.

Toxic materials are considered as one of the most environmental pollutants as it can persist in the environment for long periods. Although some metals are essential for plant growth in some quantities but their accumulation in large quantities is hazardous to human, animals as well as plants. On the basis of nature of its effect on organism there are four kind of toxic chemicals. First one is Teratogens causing birth defects during embryonic growth and development. Another one is Carcinogens inducing cancer. Third is mutagens causing change in genetic material. The last is estrogens which include xenobiotics that effect human reproductive system.

## RESULTS AND DISCUSSION

### Types of effect

An effect can be measured by an intensity directly dependent on dose. Its intensity also depends on time of exposure.

#### (A) Acute effect:

It occurs quickly after exposures to fairly high concentrations of hazardous substances in a short period of exposure and at a single dose of chemical. For example, fiberglass can immediately cause itchiness and skin irritation, an extremely loud noise can result in temporary or even permanent hearing loss, Skin rashes, red dry skin and dermatitis.

#### (B) Chronic effect:

It occurs slowly by a repeated or long term exposure. For example, if one breathe small amounts of asbestos fibers, One won't even notice them. There are no acute effects. But if one inhale asbestos month after month, year after year, one greatly increases ones chances of getting asbestos disease, like lung cancer. This is a chronic effect. It also include hearing loss and cumulative trauma disorder.

#### (C) Reversible effect:

The concentration of the chemical present at the site of action is the only determinant of toxic effect. An effect can be made reversible by regeneration of damaged tissue.

#### (D) Irreversible effect:

It is caused by a covalent binding of toxic chemicals to biological macromolecules. Under extreme conditions, the modified macromolecules is not repaired. It is a result of serious damage so it can also cause death.

#### (E) Local effect:

It occur at the primary site of contact, such as discoloration, inflammation or erosion.

#### (F) Systemic effect:

Chemicals are absorbed and distributed to the site away from primary site or site of origin, such as nervous system.

### Sources and causes of Toxic Materials

Toxic materials are substances that may cause harm to an individual if it enters the body. Toxic materials may enter the body in different ways. These ways are called the route of exposure. The most common route of exposure is through inhalation (breathing it into the lungs). Another common route of entry is through skin contact. Some materials can easily pass through unprotected skin and enter the body. Ingestion is another, less common, route of exposure in the workplace. Ingestion often occurs accidentally through poor hygiene practices (e.g. eating food or smoking a cigarette using contaminated hands).

#### (A) Pesticides:

It is designed to control pests. They all are toxic to some level, otherwise they would not kill pests. They can also be toxic to non-target organisms such as plants, animals or humans. Exposure to a sufficient amount of almost any pesticide can affect a person either through illness, eye exposure or skin sensitivity. Measurable amount of DDT, BHC and PCBs residues may be found in air, soil and water. All of these pesticides are used in agriculture. From agricultural land if DDT enters a pond or lake, it is taken up by plants and also to

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several other producers of pond. From there it is passed to other consumers such as plant feeder zooplanktons. From there these pesticides pass to fish and finally to the body of top consumers such as the fish eating birds. Threatening is that DDT concentration continuously increases in the trophic level of food chain. In birds DDT causes thinning of egg shells and loss of reproductive capacity. It also depresses the activities of estrogen and testosterone. Altered estrogen causes thinning of shells and cracked eggs. Fish die because of eating DDT killed insects, turtles die due to eating DDT killed fish, and so on. DDT deposited in fat of milk causes danger to infants. Pesticides can be classified according to their mechanisms of action. For example, organochlorine, organophosphate, and carbamate insecticides act primarily by disrupting nervous system function, while herbicides target mainly photosynthesis pathways. Fluometuron is a herbicide with two independent mechanisms of action. As a substituted phenylurea compound, it inhibits photosynthesis. In addition, it inhibits carotene biosynthesis, a process known as bleaching. Amiprofos-methyl, like dinitroanilines, affects flagellar regeneration. The *p*-nitrophenol is primarily used in the manufacture of the organophosphate insecticide parathion. The *p*-aminophenol is a degradation product of *p*-nitrophenol. These nitrosubstituents of phenol, but not phenol itself, were found to inhibit the production of chlorophyll *a*, protein, and carbohydrate in the cyanobacterium *Nostoc linckia*. Chlorophenols are often used as broad-spectrum biocides. They are potent uncouplers of oxidative photophosphorylation. The mechanism by which tributyltin affects algae as well as higher organisms is the inhibition of respiratory function]. The trialkyl tins are thought to act on mitochondria by inhibiting the adenosine triphosphase responsible for adenosine triphosphate synthesis. The DDT-induced shift in metabolism from an efficient to a nonefficient pathway was most likely through disruption of cyclic photophosphorylation.

### (B) Metals:

Metals such as lead, mercury and copper also show biomagnification in a food chain. Toxic metals to a large extent, are dispersed in the environment through industrial effluents, organic wastes, refuse burning, transport and power generation. The immediate symptoms of acute arsenic poisoning include vomiting, abdominal pain and diarrhoea. These are followed by numbness and tingling of the extremities, muscle cramping and death, in extreme cases. The first symptoms of long-term exposure to high levels of inorganic arsenic (e.g. through drinking-water and food) are usually observed in the skin, and include pigmentation changes, skin lesions and hard patches on the palms and soles of the feet (hyperkeratosis). These occur after a minimum exposure of approximately five years and may be a precursor to skin cancer.

In addition to skin cancer, long-term exposure to arsenic may also cause cancers of the bladder and lungs. The International Agency for Research on Cancer (IARC) has classified arsenic and arsenic compounds as carcinogenic to humans, and has also stated that arsenic in drinking-water is carcinogenic to humans. Other adverse health effects that may be associated with long-term ingestion of inorganic arsenic include developmental effects, neurotoxicity, diabetes, pulmonary disease and cardiovascular disease. Arsenic-induced myocardial infarction, in particular, can be a significant cause of excess mortality. Cadmium causes increased salivation and severe nausea and vomiting. In more severe cases, it may lead to collapse with signs of shock, hematemesis, diarrhea and tetanus. Chronic exposure may lead to *Itai- Itai* disease which leads to skeletal deformation, weight loss, cough and pulmonary emphysema. Lead causes abdominal pain, vomiting, diarrhea, oliguria, collapse and coma. In chronic stage it may also lead to encephalopathy, peripheral neuropathy or anemia. Mercury in any form is poisonous, with mercury toxicity most commonly affecting the neurologic, gastrointestinal (GI) and renal organ systems. Poisoning can result from

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mercury vapor inhalation, mercury ingestion, mercury injection, and absorption of mercury through the skin. Mercury has 3 forms: elemental mercury, inorganic salts and organic compounds. The most deadly form of mercury is methylmercury. Minamata disease is an example of organic toxicity. In Minamata Bay, a factory discharged inorganic mercury into the water. Both acute and chronic toxicity of chromium are mainly caused by hexavalent compounds. The most important toxic effects, after contact, inhalation, or ingestion of hexavalent chromium compounds are the following: dermatitis, allergic and eczematous skin reactions, skin and mucous membrane ulcerations, perforation of the nasal septum, allergic asthmatic reactions, bronchial carcinomas, gastro-enteritis, hepatocellular deficiency, and renal oligo anuric deficiency. Prevention of occupational risks, biological monitoring of workers, and treatment of poisoning are also reported. Manganese causes manganism. It is neurotoxic and may lead to Parkinsonism and Psychosis. Toxicity of Nickel may lead to dermatitis, commonly called as "nickel itch" or severe pulmonary symptoms, cough, dyspnea, tachycardia, cyanosis and weakness. Death may occur due to intestinal pneumonitis, cerebral hemorrhage or edema. Tin also causes human poisoning. It may cause central nervous system disorders, visual defects or EEG change.

### **(C) Automobile Emissions:**

Automobiles are the major source of air pollution. It causes air pollution. It releases pollutant such as unburnt hydrocarbons, carbon monoxide and nitrogen oxides. Unburnt hydrocarbon causes photochemical smog which is a product of unburnt fuel. Incomplete combustion of hydrocarbons may lead to increase of carbon monoxide as well as carbon dioxide in our environment which is toxic to human as it causes greenhouse effect. Combustion of nitrogen and oxygen in air causes acid rain, damage to ozone layer and also contributes to photochemical smog. Combustion of sulfur or sulfur compounds also causes acid rain.

### **(D) Food additives:**

It is defined as substance or mixture of substance other than a food stuff which is present in food for its production, processing or packaging. Chemicals have been used to preserve food and to add colour and taste to food for centuries. Following the considerable increase in the use of food additives in processed foods from the mid-twentieth century, safety assessment of food additives has been conducted on a formal basis at national and international levels. Many of the additives such as diethyl-stilbestrol, cyclamates and safrole are banned. Whereas some are in serious investigations such as saccharin, monosodium, glutamate, nitrite, nitrate and BVO.

### **(E) Radioactive substances:**

Radioactive waste contains several radionuclides and isotopes of iron and other radioactive elements. There are also gaseous effluents like tritium. Most harmful of these are Sr-90, Cs-137 and I-131. Sr-90 gets deposited in bones and tissues in place of calcium. Cs-137 is taken up in the body instead of potassium. I-131 contaminates pastures and other plants, appearing later in milk and dairy products. Trace amount of these substances are released into the water bodies and air.

## **Health**

Today, people, with their growing age, are suffering from various kinds of diseases. The cliché "health is wealth" which points towards the importance of good health which is gradually losing its importance in the present age. We all are aware of the fact that a healthy

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mind resides in a healthy body. No luxuries can be enjoyed without a good health. Therefore, all of us must take care of our environment so that we can enjoy healthy life. Environmental degradation can effect our health adversely and can make our life worse. We must keep our mother earth free from any kind of pollution such as soil, water, air, land and *etc.*

### Remedies

For elimination of these toxic pollutants we must use various biomonitoring techniques for the identification of cause of that pollution, then only we can eradicate these toxic materials from our environment. The recognition of the hazards of most emissions from industries and agriculture realised the need of regular and frequent measurements of parameters to access the amount of toxic substances of the environment. After knowing about toxicity of the environment we should minimize the use of that toxic materials, or can use its substitute.

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