



## Pesticides and Drinking Water

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### ABSTRACT

Pesticides are internationally used harmful chemicals that are used to control pest attack on crops. Commonly pesticides are used to kill insects (insecticides), weeds (herbicides), fungus (fungicides), rodents (rodenticides) and some others. They pollute water bodies and agricultural products in different ways and consuming their residues by drinking water or eating foods may lead to serious health complications. Modern agriculture practices based on pesticide use are the lead cause of water contamination. There is needed to take serious steps to minimize water pollution caused by pesticides to achieve healthy life style. Due to extensive use of pesticides there is need of more research to modify the pesticide chemistry leading to the minimization of health risks and the introduction of nature friendly, less hazardous alternatives. This review highlight uses of pesticides and there acute and chronic side effects on human health and their role in water pollution.

**Keyword:** Pesticides, hazardous, acute, chronic, water contamination.

### INTRODUCTION

All forms of life need water to survive. Clean water is essential for human healthy life style, wildlife, and stable environment. As surface of water (rivers, lakes, streams, bays, and oceans) and underground water supplies (wells, ground water, and aquifers) are polluted due to pesticides, nutrients, metals, and other harmful substances apply to get rid of undesirable insects and plants, pesticides are mostly used in lawns and sceneries, play grounds and parks, homes and schools, gardens, fields and farms, and sprayed over communities. The pesticides then overflow or get mixed into surface water or pass through soil (leach) into groundwater. Rain and snow melt washing pesticides into streets and gutters.

The pesticide contaminated water makes its way to drains, which mixed into water bodies. When pesticides pollute drinking water it may lead to cancer, reproductive system damages, birth problems, nervous and immune system disorders, and at major level wildlife impacts [2].

Water, is the most important factor for sustainable agriculture as it plays a very vital role in sustainability of life. Water deficiency is one of the major environmental stresses that limit the growth and yield of plants as plants respond to this deficiency at their cellular and molecular levels [16]. Its deficiency leads to affect negatively on the physiology, morphology and anatomy of plants [37].

About 3 million cases are enlisted from all over the world every year that happens due to acute pesticides poisoning. Out of these 3 million pesticide poisoning cases, 2 million are suicide tries and the rest of these are industrial or accidental poisoning cases [35].

According to [5] the concentration of pesticides in water differs greatly, both geographically and seasonally, based on

land use and pesticide use. In agricultural lands, herbicides are the most commonly used pesticides in lakes, streams and groundwater. In urban areas, there is a greater occurrence of insecticides in streams than in agricultural areas. Pesticides quantity also differs yearly, based on rainfall, seasonally, based on agricultural practices.

### PESTICIDE IMPACT ON HEALTH

#### Acute Pesticide Hazards

Pesticides are hazardous to humans health and their exposure may lead to acute pesticide poisoning resulting in fatigue, headaches and body aches, skin discomfort, skin rashes, poor concentration, feelings of weakness, circulatory problems, dizziness, nausea, vomiting, excessive sweating, impaired vision, tremors, panic attacks, cramps, etc., and in severe cases coma and death [3].

#### Chronic Pesticide Hazards

As pesticide cause acute poisoning, pesticides can also cause long-lasting disorders acute illness if the exposure is over a longer period, even if the quantities taken up are comparatively small. Symptoms are often rambling or do not become apparent for a long time, which then points to late effects. Farm workers are especially at risk, but the general population is also affected, for example due to contaminated food or consumer goods or pesticide drift from fields. Knowledge about the effects of long-term pesticide exposure is limited to date but rich late effects are described in the research papers. Many pesticides that are commonly used today have been classified on the basis of animal testing as possibly or possibly carcinogenic for humans [28].

A statistical estimation on workers (N=356) in four units manufacturing HCH in India shown that neurological

symptoms (21%) which were related to the intensity of pesticides exposure [26]. Data on reproductive toxicity was collected by [32] from 1,106 couples when the males were associated with the spraying of pesticides (OC, OP and carbamates) in cotton fields.

A similar study by [29] reveals that no increase in all cause and all cancer mortality. However, the results support the notion that dioxin is carcinogenic to humans and corroborate the suggestions of its association with cardiovascular and endocrine-related disorders.

Almost 3 million Americans assisted in the armed forces in Vietnam during the Vietnam War. Some of them (as well as some Vietnamese soldiers and citizens, and associates of the armed forces of other nations) were exposed to defoliant mixtures, including Agent Orange. There was proof on cancer risk of Vietnam veterans, workers occupationally exposed to pesticides specially dioxins (since dioxins contaminated the herbicide mixtures used in Vietnam), and of the Vietnamese population [13].

In a study of farm occupants in northeastern Colorado, exposure of pesticide poisoning was directly associated with a number of respiratory problems with cough, allergy, wheeze, and organic dust toxic syndrome (ODTS) among non-smokers [6].

A number of reviews have suggested that the use of pesticides in occupational exposure is linked with decreased lung function. For example, in a patient reported as a case of occupational asthma related to chronic exposure to the fungicide captofol showed a substantial and persistent decrease [31].

### **Environmental Impact of Pesticides**

Pesticides hazards have been reviewed in different aspects as pesticides have contributed in serious health problems to man and his ecosystem. There are now clear proofs that such of these chemicals have a great risk to humans and other life forms and unexpected side effects to the environment [17].

Pesticides can pollute the tissues of almost every life form on the earth, the air, the lakes and the oceans, the aquatic life that live in them and the birds that feed on the aquatic life specially fish [6].

### **Human Exposure To Pesticide Through Water**

Drinking water comes from different water sources, usually surface water and groundwater, as well as public water and private well systems. There are also massive geographic and seasonal changes in quality of drinking water and quantity of pesticide residues. Because of these factors and a limited amount of available data, hazard evaluations on experience to pesticides by drinking water and the special health effects of that contact are currently inaccessible. Despite unknown knowledge about experience and hazards, the National Academy of Sciences (NAS), in its 1993 review *Pesticides in the Diets of Infants and Children*, noted that since pesticide residues in water generally tend to be low, in ingested food prepared by using water is expected to be low, except in areas where the water is polluted by pesticides at above-average levels.

Pesticides can enter surface water through overflow from treated plants and soil. Detoxification of water by pesticides is common. The results of collected data set of studies by the U.S. Geological Survey (USGS) on major river basins from the

country in the early to mid- 90s bring in amazing results. More than 90 percent of water and fish samples from all streams contained one or several pesticides [20]. Pesticides were found in all samples from main rivers with mixed agricultural and urban land use influences and 99 percent of samples of urban streams [9].

All means of water pollution, i.e. industrial and domestic wastes and agricultural practices, not only lead to toxic chemicals in water but they also cause many bacteriological infection which results in common existence of water-borne diseases. In addition, they also result in an increase in factors like biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), total suspended solids (TSS), salinity and countries typhoid fever has been almost abolished, in developing countries like Pakistan it is still a common disease and a major cause of disease and mortality due to lack of sewage and water treatment facilities [1]. Such pollution changed the water quality and makes it unfit for drinking and other purposes.

Study shows that major threat to public health is the presence of pesticides in drinking water of Pakistan. Few studies have been conducted in the Pakistan related to pesticides exposure and human health. Studies revealed the presence of great amount of pesticides in blood and their hostile effects on various enzyme activities in the body and biochemical parameters of blood in Pakistani residents bareto pesticides [4].

Clinical issues like headache, dizziness, vomiting, problems of breath, muscle weakness, skin rash and burning sensation in the urinary tract due to pesticide exposure have been reported in the country [4]. Although the majority of studies regarding pesticide effects on public health have been conducted in populations wide-open to pesticides either as workers or as farmers, the adverse hazards can be expected in people exposed to pesticides by drinking water.

Pesticides cause extensive damage to biota, and many countries have acted against pesticide usage through their Biodiversity Action Plans. Animals may be infected by pesticide residues that persist in food after spraying, for example when animals enter sprayed fields or nearby areas just after spraying [27].

Mostly pesticides which are in common practice for stopping or abolishing pest and have greater negative effect on ecological system when related to its specific action. Pesticides are spreads by wind to other places and make them pollute. Pesticides are major reason of water pollution and some pesticides are common organic contaminants which contribute to soil contamination [31].

Pesticides can enter the human body through inhalation of aerosols, dust and water vapor that contain pesticides residues; through oral contact by taking food and water; and through dermal exposure by direct contact of pesticides with skin. (Department of Pesticides Regulation, 2008) Exposure to pesticides may leads to mild skin irritation problems, birth defects, tumors, genetic mutations in cells, blood and nerve disorders, hormonal abnormalities and even coma or death [22].

### **Pesticides and Crop Production**

Increase in food production is the primary objective of all countries, because world population is likely to increase to

almost 10 billion by 2050. Considering on indication, world population is growing by an expected to be 97 million per year [34].

The Food and Agricultural Organization (FAO) of the United Nations has in-fact issued a fact that world food demand needs to increase by 70%, in order to fulfill food for growing population. So, increase in food production is challenged with the ever growing challenges that how can be increased for cultivation of crops when space is very limited [34].

Pesticides have become an essential part of our present life and used to increase agricultural products, stored of seeds, flower gardens as well as to get rid of pests spreading hazardous diseases of crops. It has been estimated that universally approximately \$38 billion are spent on pesticides each year [28].

Biorational pesticides may be called as biopesticides can said to third-generation pesticides that are getting approval to use in future. The most commonly used biopesticides include biofungicides (*Trichoderma* spp.), bioherbicides (*Phytophthora* spp.), bioinsecticides (spore forming bacteria, *Bacillus thuringiensis*, and *B. popilliae*, *Actinomycetes*), naturally occurring fungi (*Beauveria-abassiana*), microscopic roundworms (*Entomopathogenic nematodes*), Spinosad, insect hormones and insect growth regulators [35].

#### **Pesticides in Drinking Water Pakistan**

Drinking water in heavily inhabited cities like Karachi, Lahore, Rawalpindi, Peshawar, Faisalabad, Qasur, Sialkot and Gujrat is polluted due to various anthropogenic actions and cannot be suggested for human consumption [7].

Agriculture compounds like fertilizers and pesticides practiced to the crop lands mix with the irrigation water which leach through the soil and reach natural water properties. The problem is further polluted by toxic agriculture overflow and flooding during monsoon seasons. As discussed above, many pesticides have been checked in both surface and groundwater, especially in the areas of widespread agriculture practices. The various fertilizers applied are not entirely used by crops. Large quantities leach into water properties resulting in more concentrations of nitrates, nitrites, ammonia, sulphates and phosphates in the water. These nutrients support the growth of algae in surface water and cause eutrophication that cause direct and indirect threats to the environment. Some species of these algae produce toxins in water resources which are harmful to animals and humans (e.g. the cyanobacterium *Microcystis*, which produces the hepatotoxic microcystin). In addition, some fertilizers comprise heavy metals as by-product, and the extensive use of such fertilizers results in the accumulation of these toxic metals in soil and water [21].

Agricultural substances increase the overall pollution of the water resources, however less than the industrial and domestic wastes (MOE-PAK, 2005a).

At present an estimated quantity of 70 thousand tons of pesticides are applied every year in Pakistan with an increasing annual rate of about 6% (WWF, 2007). Of the total pesticides used, about 75% are applied to cotton crops and the remaining to others crops such as maize, tobacco, paddy rice, sugarcane, fruits and vegetable [15]. An estimated amount of only 0.1% of pesticides applied reach the target organisms and the remaining 99.9% disperse through air, soil and water, thus resulting in the

pollution of natural ecosystems and affecting human health and other biota [30]. In addition to field applications, pesticides are introduced to the environment during manufacturing, handling and transportation. In developing countries like Pakistan, the problem is further aggravated by improper storage, careless disposal of pesticides containers and usage of outdated pesticides [39].

#### **De-Registered Pesticides in Pakistan**

About de-registered pesticides in Pakistan reported by [23] are binaparycl, bromophosethyl, captafol, chlorodimeform, chlorothipose, cyhexatin, dalapon, DDT (Dichlorodiphenyltrichloroethane), dibromochloropropane, dibromochloropropene, dieldrin, disulfoton, endrin, ethylenedichloride, carbontetrachloride, HCH (Hexachlorocyclohexane) mixed isomer, heptachlore, leptophos, mercury compounds, mevinphos, propergite, toxaphene and zineb.

TABLE 01: Commonly used pesticides and their type

| S. No. | Pesticide Name                           | Usage (Type) |
|--------|--|--------------|
| 01     | DDT<br>(Dichlorodiphenyltrichloroethane) | Insecticide  |
| 02     | Binaparycl                               | Fungicide    |
| 03     | Bromophosethyl                           | Insecticide  |
| 04     | Captafol                                 | Fungicide    |
| 05     | Chlorodimeform                           | Insecticide  |
| 06     | Cyhexatin                                | Pesticide    |
| 07     | Dalapon                                  | Herbicide    |
| 08     | Dibromochloropropane,                    | Nematicide   |
| 09     | Zineb                                    | Fungicide    |
| 10     | Disulfoton                               | Insecticide  |

#### **CONCLUSION**

All pesticides have the ability to harm humans, animals, other living organisms and the environment if practiced imperfectly. Pesticides pollute drinking water all over the world and specially developing countries like Pakistan in different ways and harm human health adversely. The key to decreasing health hazards of using pesticides is to always limit your exposure by precautionary measures and use a low-toxicity pesticide if available. Proper knowledge about pesticides chemistry the mode of action and practicing safe work habits will minimize hazards for the use of pesticides.

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