Acta Ciencia Indica, Vol. XLII C, No. 2, 95 (2016)

PESTICIDE CREATED WATER POLLUTION IN JAUNPUR (U.P.) INDIA

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RECEIVED : 14 May, 2016

The pesticides belong to a category of chemicals used worldwide as herbicides, insecticides, fungicides, rodenticides and plant growth regulators in order to control weeds, pests and diseases in crops as well as health care of humans and animals. The positive aspect of application of pesticides renders enhanced crop productivity and drastic reduction of vector bone diseases. Despite ban of application of some of the environmentally persistent and least bio-degradable pesticides (organochlorides) in our country, their use is however rise. Even at low concentration, pesticides may exerts several adverse effects, which could be monitored at biochemical, molecular or behavioural levels. The factor affecting water pollution in Jaunpur with pesticides and their residues including drainage, rainfall, microbial activity, soil temperature, treatment surface, application rate as well as the solubility, mobility and half-life of pesticides. Pesticide contamination is higher in wheat field area whereas pH is higher in millet field TDS as well as BOD is higher in millet field. The Suspended Solids is higher in wheat field whereas chlorides and phosphates (210 & 2.7) is higher in millet field.

KEYWORDS : Pesticides, Insecticides, Ingredient, Suspended Solids.

INTRODUCTION

Ground water contamination is nearly always the result of human activity. In areas where population density is high and human use of the land is intensive, ground water is especially vulnerable. Virtually any activity hereby chemicals or wastes may be released to the environment, either intentionally or accidentally, has the potential to pollute ground water [1].

Depending on its physical, chemical and biological properties, a contaminant that has been released into the environment may move within an aquifer in the same manner that ground water moves. Just as ground water generally moves slowly, so do contaminants in ground water. Because of this slow movement, contaminants tend to remain concentrated in the form of a plume that flows along the same path as the ground water. The size and speed of the plume depend on the amount and type of contaminant, its solubility and density, and the velocity of the surrounding ground water [2].

Ground water can become contaminated from natural sources or numerous types of human activities. Residential, municipal, commercial, industrial and agricultural activities can

all affect ground water quality. Contaminants may reach ground water from activities on the land surface, such as release or spills from stored industrial wastes; from sources below the land surface but above the water table, such as septic systems or leaking underground petroleum storage systems; from structures beneath the water table, such as wells; or from contaminated recharge water [3].

All water pollution affects organisms and plants that live in these water bodies and in almost all cases the effect is damaging not only to the individual species and populations but also to the natural biological communities. It occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful constituents [4].

Many water pollutants are reported to act as toxic chemicals. The pesticides are designed and developed keeping in view killing the insects-pests in general and thus they are not species specific. Their application methodologies are designed to ensure that these chemicals come in contact with the target pests to kill them avoiding the non-target organisms. An herbicides a substance used to kill unwanted plants. Selective herbicides kill specific targets while leaving the desired crop relatively unharmed. Some of these act by interfering with the growth of the weed and are often synthetic "imitations" of plant hormones [5]. Herbicides used to clear waste ground, industrial sites, railways and railway embankments are non-selective and kill all plant material with which they come into contact.

Pesticides are those chemicals (such as insecticides, fungicides, herbicides, rodenticides, molluscicides, nematocides, plant growth etc.), which have been widely used throughout the world to increase crop yield and to kill the insect-pests responsible for transmitting various diseases to humans and animals. However, according to several reports, these chemicals have been proved to inflict adverse impacts on the health of living beings and their environment [6].

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 ecosystem. After the death of about 100 people in India due to consumption of parathion contaminated wheat flour[5], 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 [6].

Properties of pesticides

The role of pesticides is to kill the insect-pests, but this property of pesticides makes them a poison to other organisms including different birds, fish species, animals and humans. Pesticides are not target specific. The constant exposure of pesticides to non-target species may lead to induce toxicity once it crosses the threshold limit in the system [7].

The potentially active ingredient of any pesticides is the chemical compound that brings about the desired effect. In the case of pesticide, the active ingredient is the material intended to kill the target pest and has the potential to be dangerous to other animals. The other substances in a pesticide are usually inert (not reactive) and are used to carry to toxin (active ingredient) while making its application easier. The active ingredient is usually a very small percentage of the total ingredients in a pesticide.

According to Cook *et al*. [7], the LD_{50} is a measure of a substance's toxicity. LD_{50} stands for the dose of a substance, such as a pesticide, that kills one-half of the animals tested. The LD_{50} for a specified animal is the amount that must be in or on the body of that type of animal to kill half of the affected population within a given amount of time. When the LD_{50} of

chemicals in animals is compared it gives a relative ranking of the toxicity to each animal. LD_{50}'s are often calculated using rats, because humans cannot be tested in a way that will test how many are killed, given a certain dose. This information from LD_{50} is calculated for rats and can be used to estimate the LD_{50} for humans by multiplying by 70 (the average kilogram mass of humans). Substances that are toxic to one mammal are often toxic to another. This conversion is an estimate that might not accurately calculate limits for human exposure.

The main purpose of pesticide formulation is to manufacture a product which has optimum biological efficiency, is convenient to use, and minimizes environmental impacts. Active ingredients are mixed with solvents, adjuvants (boosters), and fillers as necessary to achieve the desired formulation. Pesticides may be in several physical forms or formulations[8]. They may be water dispersible granules, dusts, aerosols, emulsifiable concentrates, flow able concentrates, solutions, solid baits, or liquid baits. They are sold in these forms because of advantages they offer to their application. Formulations influence the deposition on the soil or plant surface. In turn, they may regulate or influence its uptake by the plant or its movement into the upper soil profile. Formulations also determine the wash off or runoff characteristics of a pesticide in rain or irrigation water.

The half-life is the measurement of the persistence of a chemical. The half-life of a substance is the time required for that substance to degrade to one-half its previous concentration. In other words, if a pesticide has a half-life of 10 days, half of the pesticide normally breaks down by 10 days after application. After this time, the pesticide continues to break down at the same rate. In general, the longer the half-life, the greater the potential for movement, simply because it is present in the environment for a longer time. However, the half-life of a material such as a pesticide is not an absolute factor. Soil moisture, temperature, available oxygen, microbial populations, soil pH, photo degradation and other factors may cause the half-life of a substance to vary [9].

This term refers to toxic chemicals regulated as contaminants under the Safe Drinking Water Act (SDWA). Although MCLs do not apply to pesticides specifically, they apply in a general sense. Under SDWA, pesticides are grouped with a larger collection of toxic chemicals that can affect human health when found at certain specific concentrations above established MCLs in drinking water. The Safe Drinking Water Act and the associated regulations try to prevent contamination of drinking water from reaching MCLs through continuous monitoring of water supplies. Regulations under the SDWA establish MCLs in much the same way as FIFRA, FDCA, and the Food Quality Protection Act of 1996 establish pesticide tolerances with negligible residues [10].

Site Selection

Gomati river divide Jaunpur city in two parts starting from Lucknow. It pass through thousands hectare agricultural lands where pesticides used in huge amounts. For study purpose four site taken and water sample collected on the basis of agriculture productivity.

Site No.	Site Name	Agricultural Productivity
1	Kalichabad Ghat	Wheat field
2	Gular Ghat	Jwar Field
3	Suraj Ghat	Mustard field
4	Kund Ghat	Millet field

Agriculture and Water Quality Conflicts

Water quality problems, thought to be caused in part by cropland runoff on non-point source pollution, affect drinking water and the nation's lakes, streams, and estuaries. Action

taken by public officials to protect our water resources may change the diversity, quality, and quantity of farm products, production systems, and ultimately the prices consumers pay. Losses from impaired water quality can cost billions of dollars, not just to agriculture but also to recreation, commercial fishing, municipal water treatment, and river navigation [11].

Nutrients, particularly nitrogen and phosphorus from fertilizers, promote algae growth and premature aging of lakes, streams and estuaries (a process called eutrophication). Suspended sediment impairs aquatic life by reducing sunlight, damaging spawning grounds, and may be toxic to aquatic organisms. Pesticide residues that reach surface water systems may also affect the health and vigor of freshwater and marine organisms.

Factors Affecting Pesticides Toxicity in Aquatic systems

Mammalian and non-mammalian toxicity is usually expressed as LD_{50}: The lower the LD50, the greater the toxicity; values of 0-10 are extremely toxic. Drinking water and food guidelines are determined using a risk-based assessment. Generally, Risk = Exposure (amount and/or duration) × Toxicity. Toxic response (effect) can be acute (death) or chronic (an effect that does not cause death over the test period but which causes observable effects in the test organism such as cancers and tumours, reproductive failure, growth inhibition, teratogenic effects, etc. [12])

Material and methods

For pesticides contamination and human health study divide experiment in two way. We collected different four site soil and study their pH, E.C., percentage of O.C., percentage of total Nitrogen were studied with standard specific parameters[13]. Physico-chemical characterization of pesticides contaminated water collected in different season in steroid bottle. There pH, Temperature, BOD, DO, TDS, Chlorides, Phosphates, Suspended Solids were studied with standard chemical method [14].

Results and discussion

The pesticides used in different crops consume according to composition of soil and nature of crops. For detailed study residual pesticides which contaminant water we study pH, EC, percentage of OC, percentage of total N, P & K. The pH vary in different soil field according to presence of alkali. The organic fertilizers used highly in wheat field which so higher pH of wheat field soil (7.80) whereas least in millet field (pH-7.70).

Table 1. Chemical study of different field soil

Site of sample collection	pH	E.C.	% of O.C.	% of total N	% of availble P in kg/hect.	% of availble K in kg/hect.
Water from Wheat field	7.80	0.60	0.25	27.00	4.20	2.72
Water from Jwar field	7.76	0.56	0.26	27.50	4.15	2.74
Water from Mustard field	7.72	0.58	0.27	27.40	4.12	2.76
Water from Millet field	7.70	0.29	0.29	26.90	4.10	2.75

The EC is very least in millet field increase gradually in jwar, mustard and wheat field. The soil oxygen is higher in millet field and least in wheat field. The degradation of pesticides yield nitrogen, phosphorus and potassium etc vary soil composition of the elements. These all elements composition are higher in wheat field and minimum in jwar field.

The water come from different field vary the composition of Gomati water river at their drain point. Total dissolved solid 1926 mg/l and suspended solid (1068) is higher in site-I (wheat field water) is higher in comparison to other sites.

Table 2. Physico-chemical Characterization of Gomati Ghat at four Sites

Parameters	Site I	Site II	Site III	Site IV
pH	9.0	7.5	9.3	9.8
Temperature ºC	27	26	26	28
BOD (mg/L)	400	460	340	466
D.O.	7.0	7.6	7.3	7.5
TDS (mg/L)	1926	1648	1980	2510
Chlorides	180	170	–	210
Phosphates	39	1.5	1.8	2.7
Suspended Solids	1068	1105	1200	1230

From this study we conclude that organo phosphorus treatment creates a large pollution in running with Gomati river. From this result following results are obtained:-

1. The pH levels are in the range 7.5 to 9.8 all the four sites. The water being alkaline during the study period possesses the high value of pH.

2. At the site IV waste water are polluted by organic pesticides, suffers from decline in the value of D.O. and the value of BOD is high.

3. The highest value of TDS are found at site IV. The higher values were attributed to the heavy influx of chemicals waste and also due to the activity of bottom dwelling trash fishes in the river.

4. The content of chloride at site IV is high whereas at site I, II, III an within the permissible limit of 1st standard.

5. The value of phosphate ranges from 1.5 to 3.9 are comparatively high as compared to ISI standard.

The persistence measured as half life is determined by biotic and abiotic degradational processes. Biotic processes are biodegradation and metabolism; abiotic processes are mainly hydrolysis, photolysis and oxidation. Modern pesticides tend to have short half lives that reflect the period over which the pest needs to be controlled.

The degradational process may lead to formation of "degradates" which may have greater, equal or lesser toxicity than the parent compound. As an example, DDT degrades to DDD and DDE, which exhibit varying patterns of toxicity profiles.

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