TOXICITY OF ORGANOPHOSPHORUS PESTICIDE MALATHION INFLUENCED BY pH AND TEMPERATURE ON THE FRESHWATER FISH *CYPRINUS CARPIO*

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ABSTRACT: **Organophosphorus pesticides are used in the agricultural field due to their rapid biodegradability and non-persistent nature to control the pest but their broad spectrum of harmful effects extends far beyond the pest. It is proved by the facts that are experimentally studied by numbers of investigators with the application of varying concentration of pesticides on the living organisms around the world. The influence of pH and temperature on the toxicity of organophosphate has been evaluated by using freshwater fishes. Both pH and temperature were found to affect significantly the toxicity of pesticide by altering the physiological responses of fishes resulting in mortality. The adverse effects of the pH and temperature were decreased oxygen consumption, acceleration of chemical reaction, impaired respiratory activities, insufficient energy liberation and so on. In general these environmental factors could lead to a higher level of bioaccumulation of the toxic chemicals, thus causing the chemical stress, which affecting the normal functioning of the body.**

KEWWORDS: *organophosphate*, pH, temperature and mortality.

I. INTRODUCTION

Pesticides, the biologically active chemicals are used to a great extent for pest control but their spectrum of activity often extends far beyond the pest. Malathion is reported to have a low toxicity to mammals and relatively high toxicity to fish. Malathion can reach the aquatic environment by the means of direct application, spray, drift, aerial spraying, and washing, from the atmosphere by precipitation, erosion and runoff from agricultural land, in factory effluents and in sewage reported contamination of farm wells by various pesticides including Malathion.

Organophosphate is one of the synthetic pyrithroid which are most extensively used for more than two decades as possible alternative to the organophosphate, organochloride and carbomate pesticides. The synthetic Pyrithroids are reported to more toxic than other pesticides and are widely used in crop protection, home pest control, forestry and in public health. But the pyrethroids are shown to produce toxic effects on biochemical, haematology of various aquatic animals [1], [2]. Among them organophosphate is very toxic to the fish population and aquatic invertebrates [3]. The toxic effect of pyrithroids in mammals, birds, fishes, amphibians and invertebrates have been reviewed by [4].

In aquatic ecosystems pH and temperature are important environmental variables which adversely affect the fish and fisheries [5], and [6] has recorded that the health of fishes is mostly influenced by the pH, which would affect the reproduction and growth of fishes. Temperature is one of the most fundamental stressors altering the biological systems. This is because the water quality is greatly affected by temperature, pH, hardness etc. which influence the rate of bioaccumulation of the pollutants Literature are available in plenty with reference to pH and hardness [7]. But limited reports are available on the toxicity of pollutants in relation to temperature, in aquatic organisms [8],[9]. The interaction of pH and temperature related to pesticides are seldom let known and the role of these influencing factors on pesticide toxicity is not elaborated. Therefore the present investigation has been made to evaluate the influence of PH and temperature with reference to organophosphate toxicity in the freshwater major carp fish *Cyprinus carpio.*

II. MATERIALS AND METHODS

The experimental fishes collected from local reservoir were acclimatized to the laboratory conditions for 7 days in chlorinated tap water contained in glass aquaria by using 0.5% acetone; the stock solution of 1% organophosphate was prepared. The stock solution was used to prepare different concentrations like 1%, 2%, 3%, 4% and 5%. In each concentration a group of 10 fishes having the same weight and size were introduced. The mortality of fish was recorded in each concentration of the pesticide at an interval of 24 hours up to 96 hrs (Table-1). From this the LC50 96 hrs concentration was used to study the effect of pH and temperature on the toxicity of pesticide.

A healthy fish of known weight and size was exposed to the pesticide contained in a rectangular jar. The time at which the fish died was recorded (survival time) at room temperature. Another test animal of the same size and weight was taken in the pesticide medium contained in a beaker which is kept in a water bath. The temperature of the pollutant medium was increased by 2°C above the room temperature by adding hot water to the water bath. Now the survival time of the animal was recorded. Another test animal was treated in the pesticide medium in a similar manner and its temperature was decreased by 2°C below the room temperature by adding ice cold water. The survival time of the animal in the reduced temperature also recorded.

In another set of experiments, the test animal was exposed to the pesticide medium to known pH and the survival time was recorded. Then the pH of the pesticides was decreased by using pH tablets and another test animal was introduced into it. Similarly the pH of the pesticide was increased and the survival time of the test animal in that pH was noted. The results were tabulated and discussed.

III. RESULTS AND DISCUSSION

Temperature is one of the important factors as it greatly affects the toxicity of xenobiotic chemicals (Table-2). The changing temperature may increase or decrease or cause an effect on the toxicity of the chemicals depending on the species and the chemical nature of the toxicant. The present study the pesticide exerted more toxic effect at high temperature. A high temperature of the pesticide medium could have decreased the oxygen content. So that the fishes died due to decrease in oxygen consumption at high temperatures also noticed by [10],[11] have found that the fishes were more susceptible to the metals at high temperature. [12] have observed that the heat death in animal is due to death of different tissues, sequentially at different temperature.

According to Processor and [13] the chemical reactions are accelerated as the temperature rises whereas the cardiac and respiratory activities are slowed down resulting in hypoxia in fishes at lower temperature. In *Cyprinus carpio* the lowered temperature of the pesticide medium exhibited mortality because the rate of energy liberation could be insufficient for the maintenance of metabolism when the temperature of the body lowered. In the present study the temperature could affect the nervous system directly altering the input of impulses of fishes through skin thermo receptors.

The pH of the medium also highly alters the toxicity of chemicals through the effect on physiological responses of the organisms, as pH causes a severe chemical stress (Table 3). Packer and [14] have reported that the elevation of PH will lead the acidosis in fishes which could decrease the oxygen carrying capacity of blood. Drummond [15] have shown that the metal accumulation has been increased at higher pH of the medium. On the other hand lowering of pH has also been shown to increase accumulation of metal in fishes [16]. In lower pH the present experimental fishes might have experienced enhanced bioaccumulation of the toxic substances by the uptake through gills. The same trend has also been noticed [17] in fishes exposed to toxicants. [18],[19] have reviewed the specific effect of PH on bioaccumulation in fresh water invertebrates under acidic condition more energy is found to be required to maintain normal functioning of animals [20] oxygen uptake is found to be impaired in organisms [21]. Thus from the present investigation it is evident that the pesticide toxicity has been highly influenced by the interaction between the PH and temperature in fishes under laboratory conditions. This laboratory experiments are highly useful to correlate and explain the dynamics of pollutants in normal environment under the influence of pH and temperature.

TABLE 1: Toxicity of various concentration pesticide Organophasphate Malathion various exposed periods.

CONCENTRATION OF THE PESTICIDE	MORTALITY % EXPOSURE PERIOD (HOURS)			
	24 Hrs	48 Hrs.	72 Hrs.	96 Hrs
Control	0	0	0	0
1	0	10	20	30
2	0	20	30	40
3	0	20	40	50
4	10	40	60	90
5	10	50	80	100

TABLE 2: EFFECT OF TEMPERATURE OF THE TOXICITY OF PESTICIDE

S.NO.	TEMPERATURE	SURVIVAL TIME (MINUTES)
1.	25°C	95
2.	30°C	55
3.	35°C	25

TABLE 3: EFFECT OF PH ON THE TOXICITY OF PESTICIDE

S.NO.	PH VALUES	SURVIVAL TIME (MINUTES)
1.	6.5	70
2.	7.0	65
3.	7.8	35

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