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Address:-Ashok Yakkaldevi 258/34, Raviwar Peth, Solapur - 413 005 Maharashtra, India
Cell : 9595 359 435, Ph No: 02172372010 Email: ayisrj@yahoo.in Website: www.aygrt.isrj.net

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TOXICITY EVALUATION OF DIMETHOATE ON ALBINO RATS

Penchalamma. R , Devi Sri lakshmikala and Jacob Doss. P

Division of Toxicology, Dept. of Zoology, S.V. University, Tirupati

Abstract:-This article deals with the evaluation of Dimethoate on albino rats. Mortality was observed with 300, 315,330,345,360,375,390 mg/kg body weight. The observations indicated that the animals exposed to different concentrations of Dimethoate showed 100% mortality at 390 mg/kg body weight.

Keywords: Dimethoate, Albino rats, Ld50.

INTRODUCTION:

The adjustment of the living organisms in their ecosystems is a dynamic process of continuous changes, which is possible because of the greater plasticity of behavioral and biochemical processes. The development of behavioral tolerance to OP toxicity is one such process. Tolerance to a chemical compound may be defined as the disappearance of behavioral signs and symptoms characteristic of the toxicity of the compound with time, when the chemical is chronically administered, despite the persistence of the biochemical and physiological lesions caused by the compound. The phenomenon of tolerance was first reported by Barnes and Denz in 1951. In the course of these studies on tolerance, another interesting feature, i.e., cross tolerance was observed by Brodeur and Du Bois (1964). In all these experiments it has been demonstrated that tolerance to organophosphate toxicity can be induced in mammals. This tolerance to OP's after chronic treatment is a reproducible phenomenon and does not depend upon the organophosphates used the route of administration or animal species (Costa et al., 1982).

Toxicity is defined as the capacity of a substance to cause injury to a living organism, (NAS/NRC, 1970: Cartson, 1962). A highly toxic substance will damage an organism even in a low quantity of administration and substance with low toxicity will not produce an effect unless the amount is very large.Thus toxicity can't be defined without reference to the quantity is administrated, the type and severity of the injury and the time needed to produce that injury.Amajor purpose of the toxicological investigations to provide a basic for estimating the maximum dose that may be tolerated by animals throughout their life time without manifesting any adverse effect (Gralla, 1981). The choice the animal model to be used in toxicity studies appears critical as different tissues may be the target of the drug's toxic effect in different animal species.An approximate estimation of the toxicity based on the chemical structure and the physical and chemical properties of the substance and known correlations of these variables with biological activity. (Andreyeshchave, 1976: WHO, 1976a). These considerations may be of value for decisions on safety measures to be taken during initial laboratory work. Toxicological evaluation may also help in the selection of an alternative technological process, less hazardous to health.

Toxicity testing and design is a complicated phenomenon. It is customary to drive lethal dose (LD) values for mammals before commercializing any pesticide (NTP, 1982). However, because of their indiscriminate use, pesticides indult the environment by becoming residues in the eco- web. Hence, it is necessary to complete toxicological data of pesticides on non- target species too, so as to assess the ecological health system.The toxicity of a pesticide to terrestrial organisms is usually expressed in terms of lethal dose 50 (LD50). This value represents the amount of pesticide required to kill the 50% of the test species. In case of aquatic animals it is expressed as lethal concentration 50 (LC50). It is well established that there is a direct relationship between the weight of the test species and the dose of the pesticide. So the LD50 is commonly expressed as mg/kg body weight or mg/ body weight and LC50 as parts per billion (PPB). The toxicity of the pesticide is also dependenton the time of exposure. Lethal time represents the time required to kill 50% of the animals at a certain dose. In most of the cases the LD50 is the statically obtained virtual value. It is the calculated value, which represents the best estimation of the dose – mortality relation and is therefore always occupied by same means of estimation of the error of the value such as the probability range.

The most commonly used method of calculated of LD 50 are the graphical method, regression analysis and estimation of confidence limits as proposed by Finney (1971), graphical method by Litch Field and Wilcoxo (

1949).Biological assay occupies an important position in the toxicity evaluation. It consists of a set of techniques relevant to compare between the strength of a alterative but similar biological stimuli (Finney, 1971). It refers to response produced when doses of toxicant are given to experimental animals. The dose response relationship is an important way of measuring the toxicity. The degree of lethality is any toxic chemical to a particular animal species is represented in the form of dose- mortality for specific period.

MATERIALS AND METHODS

Healthy wistar strain rats were selected as experimental animals for the present study. Rats of the same age group of 80± 10 days weight 175± 10 grams were taken in this study. Animals were kept four per cage with free access to food and water ad libitum. The animals were maintained in the animal house at 25± 20C with a photoperiod of 24 hours darkness and 24 hours light. All the hygienic practices were followed during the hygienic practices were followed during the maintance of animals. The albino rats were collected from IISc, Bangalore. Technical trade Dimethoate with 94%. Purity has been collected from Hyderabad Chemicals Ltd, Hyderabad.

Lethal dose of Dimethoate was determined by probit method of Finney (1964). Rats were treated with different concentration of Dimethoate by oral intubation. Mortality in each dose was noted at a graph was plotted between Dimethoate concentration and probit kill. 50% mortality has taken as index for the calculation of median lethal dose (LD50). LD50 was the dose at which 50% of the test animals were killed. The control and experimental animals after the stipulated period (i.e., on 9th day) were sacrificed and the tissues were isolated, cleaned in physiological saline and processed immediately for microscopic analysis. The tissue were also quickly isolated under ice cold conditions and stored in deep freezer at -800C for biochemical analysis.

RESULTS

Dose- response relationship

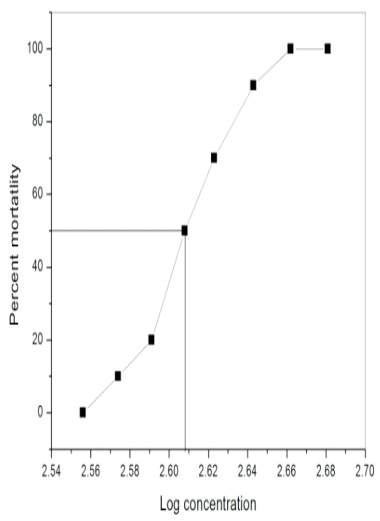
The dosage of any compound is always a decisive factor in determining its effects (Hayes, 1975). Hence it is important to measure the toxicity i.e., the determination of the dose or concentration or dose at which toxicant produces harmful response to target organism. Dose refers to a stated quantity or concentration of a substance to which an organism is exposed. It is most commonly expressed as the amount of test substance per unit weight of test animal (e.g. mg/kg body weight) (OECD, 2000).Dose-response relationship means the correlative existing between the dose administered and the response (effect) or spectrum of responses that is obtained. The concept expressed by this term is indispensable to the identification, evaluation, and interpretation of most pharmacological and toxicological responses to chemicals. The basic assumptions which underline and support the concept are: (a) The observed response is a function of the concentration at a site; (b) the concentration at a site is a function of the dose, and (c) response and dose are causally related. The existence of a dose-response relationship for a particular biological or toxicological response (effect) provides a defensible conclusion that the pressure is a result of exposure to a know substance. The purpose of an acute toxicity is to establish the degree of toxicity of a new chemical entry. Repeated-dose (sub acute) toxicity studies are designed to examine the adverse effects resulting from repeated exposure to a chemical at lower doses than used in acute studies. Repeated-dose studies to test the substance is often incorporated in to the diet or added to the drinking water.

The data was computed according to probit analysis (Finney, 1997). And LD50 value was determined. The animals are exposed to different concentrations of Dimethoate, showed no mortality up to 300 mg/kg body weight, 10 per cent mortality, at 315 mg/kg body weight, 30 per cent mortality, at 330 mg/kg body weight, 50 per cent mortality, at 345 mg/kg body weight, 70 per cent mortality, at 360 mg/kg body weight, 90 per cent mortality, at 375 mg/kg body weight, 100 per cent mortality, at390 mg/kg body weight observed(Table). The computation of perentmortality against different log concentrations of the pesticide yielded a typical sigmoid curve (Fig.1.1). The LD50 value obtained from the sigmoid curve is 345mg/kg body weight for 48 hours. The probit mortality of the albino rats were calculated from percent mortality when the probit mortality was plotted against log concentrations of the pesticide, a straight line was obtained (Fig.1.2). The LD50 value obtained from this straight line graph is 345mg/kg body weight.

Table 1: Morality of albino rats exposed to different Concentrations of Dimethoate at 48 hrs.

S.No	Concentration of Dose mg/kg body weight	Log Concentration	No.of Animals		Present Kill	Probit Kill
			Exposed	Died		
1.	300	2.4771	10	-	-	-
2.	315	2.4983	10	1	10	3.72
3.	330	2.5185	10	3	30	4.48
4.	345	2.5378	10	5	50	5.00
5.	360	2.5563	10	7	70	5.52
6.	375	2.5740	10	9	90	6.28
7.	390	2.5911	10	10	100	8.09

Mortality was expressed both in percent and probit kill.



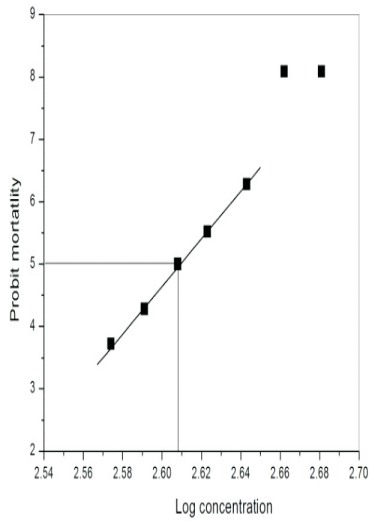


Fig. 1.1: Sigmoid "grade response" curveFig. 1.2:Probit regression line" curve Showing mortality of albino rats against log showing mortality of albino rats against log Concentration of Dimethoate for 48 hours Concentration of Dimethoate for 48 hours Exposure. Exposure.

DISCUSSION

The graphical representation of percent mortality versus log concentration and probit mortality versus log concentration of Dimethoate (Table 1)showed a typical sigmoid curve (Fig.1.1) and a straight line (Fig.1.2) respectively which are in agreement with the principle of probit analysis (Finney, 1971).In the present investigation, the obtained LD50 value is 300 mg/kgbody weight. This value is in agreement with LD50 value reported previously by Ritten House et al., 1979. The changes also appears if the percentage concentration of vehicle differs and the stock solution of Dimethoate concentration. So the differencences of LD50 values obtained in the present study from the reported LD50 values by other might to be one or many factors as listed above.

In general, the rats and mice are normally used for oral toxicity test because they have digestive system geared to the same sort of diet as man in many respects, has similar metabolic responses (McEwen and Stephenson,1979). Effects of Dimethoate on human health and environment depend on how much Dimethoate is present and the length and frequency of exposure. Effect also depends on the health of a person and certain environmental factors. It is considered that Dimethoate is non-phototoxic on many crop plants (Worthing, 1987).WHO has recommended Dimethoate as "slightly hazardous".The various organophosphate compounds have shown different levels of toxicity on animals. It is conclude that organophosphate compound Dimethoate is moderate compoundto mammalians.

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