International Journal of Engineering Research & Management Technology ISSN: 2348-4039
July-2017 Volume 4, Issue-4
Email: editor@ijermt.org www.ijermt.org

FISH *CHANNA PUNCTATUS* EXPOSURE WITH CADMIUM, DETERGENT AND ENDOSULFAN

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ABSTRACT:
Environmental problems have always existed throughout human history but widespread recognition has come, understandably, only belatedly, after many years of steadily accumulating pollution. This concern is surprisingly recent and localized phenomenon beginning only in the late 1960's and largely confined to economically advanced countries. Addition of effluents to the aquatic system is a world wide problem and is more acute in industrialized countries where millions of tones of pollutants are discharged into the rivers and streams and also directly into the sea. Aquatic life is seriously affected and threatened out of existence. In turn, it affects human life through consumption of fish and other edible aquatic animals.

KEY WORDS: Environmental problems, effluents

INTRODUCTION

Chemically, cadmium is very similar to zinc and these two metals frequently undergo geochemical processes together. Both metals are found in water in the +2 oxidative states. The effects of acute cadmium poisoning in humans are very serious. Acute symptoms include severe abdominal pain associated with nausea, vomiting, diarrhea, headache and vertigo. Chronic symptoms include high blood pressure, kidney damage, destruction of testicular tissue, and destruction of red blood cells. It is believed that much of the physiological action of cadmium arises from its chemical similarity to zinc. Specifically, cadmium may replace zinc in some enzymes, thereby altering the stereo structure of the enzyme and impairing its catalytic activity. Thus cadmium is certainly a dangerous water pollutant, causing major water quality problems.

Ever since man adopted agriculture as a profession, he has put in lot of efforts to protect his crops-discovering, innovating, experimenting with means and methods. *Pesticides* occupy a special place in his armory, possibly being the most effective. But today so wide spread and so great is the worked by pesticides in large parts of the country that their entry and presence in the food chain is now an admonished fact.

Organochlorine pesticides to which endosulfan belongs to tends to dissolve in the fatty membrane surrounding nerve fibers, and interferes with the transport of ions in and out of the fiber. This later process gets involved in the transmission of electrical impulses along the fiber. The effects are tremors and convulsions. It can be absorbed following ingestion, inhalation and skin contact. Sign of acute intoxication include neurological manifestations, such as hyperactivity, muscular twitching and convulsions, sometimes followed by death. Several cases of accidental and suicidal poisoning have been reported. Sign of poisoning include vomiting, restlessness, irritability, convulsins, pulmonary oedema and cyanosis. Fish are extremely sensitive to endosulfan and fish kills have been reported as a result of the discharge of endosulfan into rivers.

Detergents are among the most widely used substances in modern civilization and there are few, if any, individuals who do not come in regular contact with detergents in some form or the other during washing and cleaning processes carried out practically in all households and therefore, they are called household detergents. These days detergents have attracted special attention in many countries because of a variety of water pollution problems involving their constituents. How do they get into the water supply? They enter the ground from cesspools sewage plant outlets and waste water spreading beds and readily percolate into the underground water supply. If water wells are in the vicinity or within range of the underground flow, the

water that is pumped from the wells is found to be contaminated with detergents.

Detergents generally consist of a *Surfactant* or surface active agent and a number of builders. The surfactant lowers the surface tension of the liquid in which it is dissolved by concentrating at surfaces and interfaces, and its cleaning properties arise from its ability to replace dirt on surfaces by being preferentially absorbed at surfaces and by helping the dirt to be carried away as a stabilized emulsion or suspension. The builder sequesters calcium and magnesium ions that would interfere with they also maintain a proper level of alkalinity in the solution and help keep dirt in suspension.

ENZYMOLOGICAL AND BIOCHEMICAL STUDIES

Enzymes catalyze virtually all biologically important reactions. It is therefore essential to understand variations in enzyme activities if they are to be employed in diagnostic procedures. Enzyme activity may be high in some diseases or low or lacking in others. Also, tissue enzymes are distributed in a highly organized fashion; that is, cells are not "loose sacks". of enzyme products of an enzyme reaction in one tissue component may have significant effects on a separate enzyme process in another component of the given tissue or even in an entirely different tissue. Keeping all this in mind, enzymes representing different important metabolite cycles in tissues of liver and muscle were selected.

REVIEW OF LITERATURE:

The enzymological changes in fish induced by exposure to heavy metals have received attention by some workers. Heavy metals, including cadmium, are known to inhibit enzymes requiring sulphydryl groups in the expression of activity (Hewitt and Nicholas, 1963). Toxic effects of cadmium on the digestive system of *Heteropneustus fossilis* has been examined by Sastry and Gupta (1979). Phosphatase, aminotripeptidase and glycylglycyl dipeptidase showed inhibition in liver and intestine while elevation in pepsin activity was recorded in the stomach. Alterations in the activities of LDH, PDH and SDH in the brain, gills, intestine, kidney, liver and muscle have been examined in *Channa punctatus* after exposure to sublethal concentration of mercuric chloride by Sastry and Rao (1981). All the three dehydrogenases were inhibited significantly after 60 days of treatment except for lactate dehydeogenases in liver. Gills and muscles showed weak activity of the three dehydrogenases, the percentage of inhibition was more marked in these tissues than in others. Sastry ad Subhadra (2014) reported elevation in the activities of LDH and SDH in liver and muscle of *Heteropneustus fossilis* exposed to sublethal concentration of cadmium for 15 and 30 days. The chronic toxic effects of chromium on the carbohydrate metabolism of a teleost fish. *Channa punctatus* were examined after 60 and 120 days of Sastry and Sunita (1983). The activity of LDH was inhibited in liver and kidney. PDH and SDH activities were also inhibited in all the tissues except muscle. Further, Sastry and Subhadra (1985) reported decrease in the activities of acid phosphatase, alkaline phosphatase, hexokinase, xanthine oxidase and glutamate dehydrogenase in liver of *Heteropenustes fossilis* exposed to Cd (0.26 ppm) for 15, 30 and 60 days.

Gupta and Dalela (2012) examined toxicity of phenol at sublethal concentration and observed significant stimulation in the activity of transaminases in different tissues of a fresh water fish *Notopterus notopterus* and found it to be dose and duration dependent (Carpene *et al*. 1997) studied the Cd metallothionein and metalenzyme interaction in the gold fish *Carassius auratus.* Gold fish injected with Cd synthesized metallothionein and 10 days after the first injection, Cd reached a maximum in the metallothionein peak. Pyruvate kinase activity was inhibited from the beginning of the exposure after fourth day, the enzyme activity again started to increase but did not reach the control value. Alkaline phosphatase and fructose biphosphatase did not show any apparent inhibition. They suggested a detoxifying role of metallothionein from their results. Chand *et al*. (2015) reported stimulation of glutamate pyruvate transaminase and glutamate oxalacetate transaminase activities in kidney and brain of *Notopterus notopterus* after 96 hr exposure to Cd.

RESULTS

Glucose – Serum glucose level was observed to be 118.20 after 15 days. Table-1 shows the alteration in the level of biochemical parameters in *Channa punctatus* exposed to cadmium, detergent and endosulfan after 15 days post exposure.

Tissue	Para-meters	Control	Cadmium	Detergent	Endosulfan	Cadmium + Detergent	Cadmium + Endosulfan	Detergent + Endosulfan	Cadmium + Endo. + Detergent
Blood	Glucose	118.2±1.49	43.4±2.60	130.6±2.62	51.3±2.89	84.1±2.58	75.7±1.41	48.2±2.17	51.9±1.89
	Lactic Acid (mg/gm)	7.34±0.09	5.56±0.07	10.16±0.11	4.57±0.05	5.76±0.07	5.35±0.08	4.50±0.07	4.06±0.07
	Pyruvic acid	3.56±0.04	2.98±0.04	3.41±0.04	3.80±0.04	4.02±0.02	5.17±0.14	4.66±0.11	4.43±0.04
	Total Protein	5.00±0.01	0.86±0.09	1.25±0.01	3.37±0.01	1.54±0.02	4.06±0.02	4.38±0.05	3.01±0.02
Liver	Glycogen	40.06±0.17	37.79±0.19	38.88±0.15	34.29±0.10	30.36±0.09	31.78±0.13	34.97±0.08	29.82±0.14
	Lactic Acid (mg/gm)	2.34±0.08	1.31±0.06	4.64±0.63	0.91±0.11	1.12±0.10	0.62±0.07	0.89±0.92	0.61±0.10
	Pyruvic acid	2.13±0.04	1.29±0.04	1.54±0.04	2.60±0.07	2.36±0.04	3.06±0.04	2.78±0.04	2.91±0.04
	Total Protein	141.0±0.04	170.0±0.01	136.0±0.02	158.15±0.01	178.0±0.01	131.3±0.20	150.9±0.20	176.7±0.16
Muscle	Glycogen	15.15±0.31	11.08±0.34	19.65±0.14	8.61±0.14	10.32±0.16	9.79±0.19	11.33±0.11	11.87±0.10
	Lactic Acid (mg/gm)	16.37±0.07	13.16±0.70	17.88±0.09	13.83±0.06	11.38±0.09	12.12±0.08	9.91±0.12	9.56±0.04

	Pyruvic acid	0.61±0.01	0.77±0.01	0.86±0.01	0.26±0.01	1.01±0.01	1.14±0.03	0.54±0.01	0.62±0.01
	Total Protein	90.85±0.20	72.5±0.22	49.25±0.08	53.05±0.04	56.42±0.03	71.86±0.01	55.43±0.01	58.50±0.02

Values are mean ± SD; n= 6

*Significant, $p<0.05$, $p<0.01$, $p<0.001$

CONCLUSIONS

Present study revealed that cadmium, detergent and endosulfan are highly toxic to the fresh water teleost fish, *Channa punctatus*. This conclusion is drawn out from the fact that there were changes in hematological, physiological and biochemical parameters rendering the fish incapable of leading a normal life. The type of enzymological and biochemical alterations produced were neither specific to an exposure period nor to a tissue. Within the same tissue, the activities of some enzymes were elevated while others were inhibited. Alterations in biochemical constituents showed that carbohydrates, fats and amino acids are main source of energy. Which are affected by the pesticides and it creates imbalance in body and affect the viability of animals (fish).

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