

Toxic Impact of Waste Water Effluent in Aquatic System

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Abstract

The study is conducted on untreated waste water effluent for Beverage industries to evaluate the toxic impact in Aquatic system through bioassay. The discharge of untreated waste water effluent through bias path in aquatic system is a serious concern, as it has number of contaminants in the form of physical, chemical and microbiological. In the form of physical contaminants it has a lot of organic and inorganic matters. It has high load of BOD (Biological oxygen Demand), COD (Chemical oxygen Demand), Oil , Grease, Total Suspended Solids(TSS), Total dissolved solids (TDS) and pH .As result it create adverse impact on aquatic system as well as on aquatic animals(Fishes) .It needs to be improved on the aspects, particularly those linked to: long term toxicity assessment on target organisms (bioaccumulation of pollutants, genotoxicity, etc.); Eco toxicological interactions between pollutants of untreated waste water pollutants and in the aquatic ecosystem.

Key words: Biological oxygen Demand, Chemical Oxygen Demand, Total suspended solids, Total dissolved solids, whole effluent toxicity.

1.0 Introduction: The industries are discharging untreated wastewater effluent in aquatic system using by unfair means. These have been reported the status of water bodies after receiving various kinds of pollutants altering water quality characteristics (physical, chemical and biological). All living organisms have tolerable limits of water quality parameters in which they perform optimally. A sharp drop or an increase of waste water effluent has adverse effects on functions of living aquatic animals. So, good water quality is very essential for survival and growth of fish. As we know fish is an important protein rich food resource and there has been sharp increase in demand of fish products due to increasing population pressure in this century. Thus to meet the demand of present food supply, water quality management in fish ponds is a necessary. There are sufficient evidences available related with the mismanagement of industrial wastes[4,9]. But this is not the case with small scale industries only , which cannot afford enormous investments in pollution control equipment as their profit margin stands lower side, the large scale industries are also behaving in similar pattern. There are sufficient evidences available related with the mismanagement of industrial wastes. There are several industries other than Beverage industries these are petrochemical industries, sugar mills, distilleries, leather processing industries, paper mill, agrochemicals and pesticides manufacturing industries and pharmaceutical industries.

In the field of prevention and control of water pollution bioassay tests were developed as a tool to evaluate possible harmful effects of effluents discharged into water bodies. These are also called whole

effluent toxicity (WET) tests. WET tests are a method of bio monitoring wastewater toxicity. Although quantities of pollutants can be analytically determined in samples, these measurements may fall short of actually identifying toxic discharges. In these tests, carefully chosen organisms are exposed to whole effluent and/or effluent dilutions for a pre-determined time period in order to observe the effluent's effect on the organisms, and thereby, approximate it's potential to effect organisms within the receiving water. Acute tests measure how well organisms survive, while chronic tests measure survival and sub-lethal effects, such as a sample's effect on organism growth & reproduction[10]

The untreated and Economically motivated industrial effluents and sewage water contains variable higher amounts of Biological Oxygen Demand and (BOD) , Chemical Oxygen Demand (COD), Total suspended solids (TSS), Total Dissolved solids (TDS), Oil and Grease[7]. The higher concentration of these contaminants load create adverse impact on the aquatic animals (Fishes) living in the aquatic system. Since all natural water waste contain bacteria and nutrients, almost any waste compound introduced into such water waste contain bacteria and nutrients will initiate biochemical reactions. These biochemical reactions are measured as BOD and COD in laboratory .Both the BOD and COD tests are measure of relative oxygen-depletion effect of waste contaminant. Both have been widely adopted as a measure of pollution effect. The BOD test measures the oxygen demand biodegradable pollutants whereas the COD tests measure the oxygen demand of oxidizable pollutants. Chemically, waste water is composed of organic and inorganic components as well as various gases. Organic components may consist of carbohydrates, proteins, fats and greases, surfactants, oils, pesticides, phenols etc[5,6].

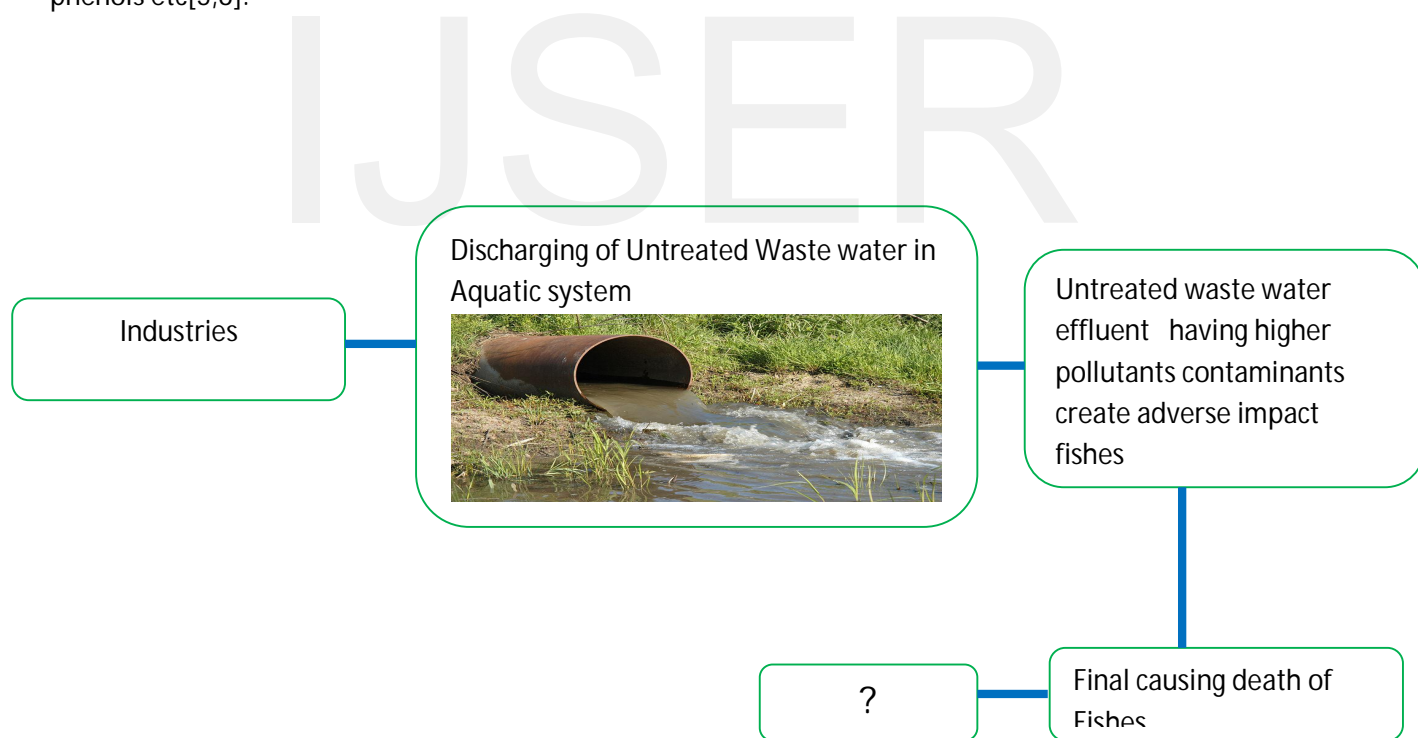


Fig. 1: Discharge of untreated waste water Effluent.

2.0 Area of study: The area (National Capital Region) was selected based on the survey where the untreated effluent water was discharged continuously in Aquatic system, through bypass system of industries. The accumulation of waste water effluent in Aquatic system create serious adverse impact .For the purpose of study pond having fishes was selected.

3.0 Sampling of untreated Effluent:

The sampling of untreated waste water effluent was collected randomly from the point of entry in aquatic system through "Beverage Industries". The samples were collected in HDPE containers having capacity of 15ltrx5 .The water from Aquatic system also sampled in 15ltrx5 containers.The adequate quality measures were taken during sampling of untreated waste water effluent so that quality waste water effluent could be maintained till completion of analysis. The 06 samples were studied during 2014-2015.The samples were collected at different interval and individual sample was taken for study of toxic impact on aquatic system [2].

4.0 Analysis of untreated Waste Water Effluent:

The analysis of waste water effluent was conducted to determine the characteristics; contaminants level of in the water .The below table depicts the result of analysis:

S.No.	Parameters	Results
1	Colors(Hazen Units)	15
2	Odors	Foul Odour
3	Appearance	Blackish
4	pH value(at 25°C)	3.30
5	Total Suspended Solids(mg/l)	410
6	B.O.D(for 3 days at 27°C),mg/l	270
7	COD, mg/l	580
8	Oil & Grease, mg/l	16.8

Permissible limits as per "The Environment Protection Rules, 1986", Schedule Vi, General Standard for discharge of environmental Pollutants "pH value (at 25°C), 5.5-9.0, Total Suspended Solids (mg/l) 100 (max), B.O.D (for 3 days at 27°C), mg/l 30(max), COD, mg/l 250(max), Oil & Grease, mg/l, 10(max)

Table-1: Denotes the analysis results of untreated waste water effluent discharged in Aquatic system (2014-2015)

5.0 Preparation for Impact Study: The 04 Aquarium tanks were taken capacity up to 20 ltrs were taken .These tanks were cleaned properly internally as well as externally, using chemical rinsed with potable water. Two types of fishes were arranged from single source i.e. Golden Fish and Zebra Fish in adequate numbers required for experiment (40 Zebra Fishes having size of 5 to 7.5 cm).These fishes were brought from the source the day of experiment. The acclimatization and feeding system was established in the laboratory in advance to attain the room temperature and adequate aeration system was fitted to maintain the required DO (dissolved Oxygen level) i.e. NLT(Not less than) 4mg/l.

Decreased DO concentration causes harmful effects on fishes can be explained by the bio energetic principle proposed by Fry (1971), according to that, the DO concentration that can be explained as upper threshold below which oxygen causes direct mortality as shown in graph within the range, the potential magnitude of adverse effects increases with decreasing oxygen concentration and increasing

duration and frequency of exposure. The initial limiting level is important threshold below which the lack of available oxygen restricts the ability of fish to perform at maximum levels and increases physiological stress and expenditure of energy to meet oxygen demand [1]

6.0 Effect of waste water effluent on fishes at different concentrations:

6.1 Effect study-1: The First set of aquarium was taken having capacity of 20 ltr, followed by addition of 15 ltr untreated waste water effluent without any dilution from sampled Quantity. The DO was maintained more than 4mg/ltr using adequate aeration system. 10 zebra fishes were kept in the aquarium. Temperature was maintained 30-32 degree cel. The monitoring was started on every 04 hourly basis. After 24 hours of monitoring it was observed that all Zebra fishes are lying on the upper surface of aquarium and have been dead.

6.2 Effect study-2: The second set of aquarium was taken having capacity of 20 ltr. The aquarium was filled with 7.5 ltr water sampled from Aquatic system and followed by addition of 7.5 ltr untreated waste water effluent from sampled Quantity (50:50). The DO was maintained more than 4mg/ltr using adequate aeration system. 10 zebra fishes were kept in the aquarium. Temperature was maintained 30-32 degree cel. The monitoring was started on every 04 hourly basis. After 24 hours of monitoring it was observed that 07 Zebra fishes are lying on the upper surface of aquarium and have been dead. The survival of fishes reported in after 24 hrs 03. The dead Fishes were removed and monitoring was continued for the next 6 hrs. As a result of total exposure to the fishes for 30 hours i.e. 24 hours + 06 hrs extended, the fishes were found dead.

6.3 Effect study--3: In the third set of aquarium the ratio 60:40 was taken i.e. 60% sampled quantity was taken from Aquatic system and 40% from untreated waste water effluent. So aquarium was filled with 9.0 ltr water sampled from Aquatic system and followed by addition of 6.0 ltr untreated waste water. The DO was maintained more than 4mg/ltr using adequate aeration system. 10 zebra fishes were kept in the aquarium. Temperature was maintained 30-32 degree cel. The monitoring was started on every 04 hourly basis. After 24 hours of monitoring it was observed that 05 Zebra fishes are lying on the upper surface of aquarium and have been dead. The survival of fishes reported in after 24 hrs 05. The dead Fishes were removed and monitoring was continued for the next 12 hrs. As a result of total exposure to the fishes for 36 hours i.e. 24 hours + 12hrs extended, the fishes were found dead.

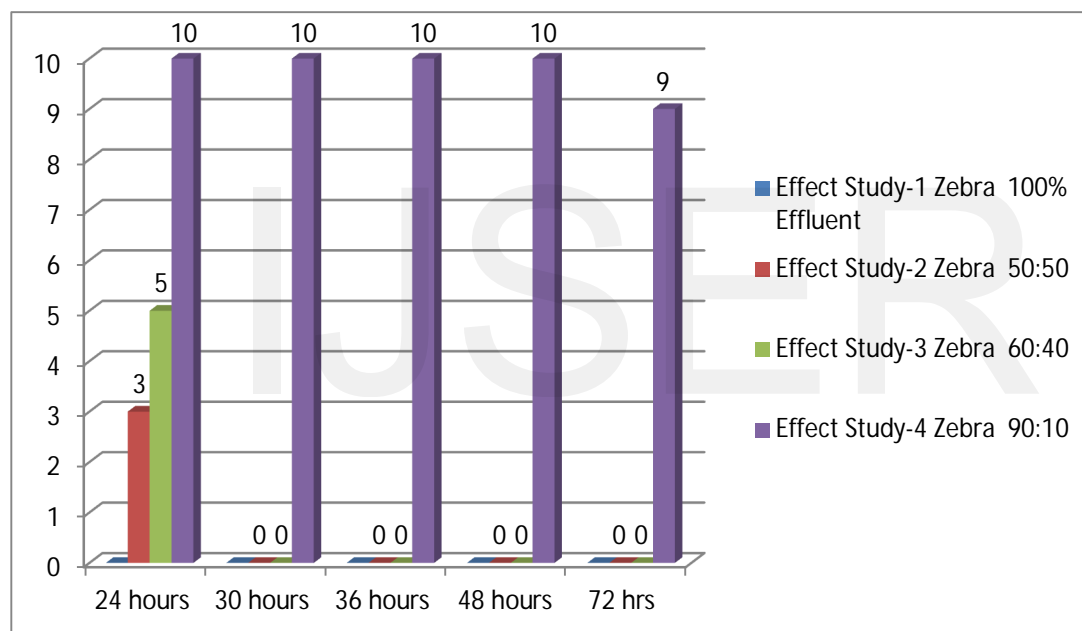
6.4 Effect study--4: In the third set of aquarium the ratio 90:10 was taken i.e. 90% sampled quantity was taken from Aquatic system and 10% from untreated waste water effluent. So aquarium was filled with 13.50 ltr water sampled from Aquatic system and followed by addition of 1.5 ltr untreated waste water. The DO was maintained more than 4mg/ltr using adequate aeration system. 10 zebra fishes were kept in the aquarium. Temperature was maintained 30-32 degree cel. The monitoring was started on every 04 hourly basis. After 24 hours of monitoring it was observed that Zebra fishes are alive. The survival of fishes reported in after 24 hrs 10. The monitoring was continued for the next 48 hrs. As a result of total exposure to the fishes for 72 one fish was found dead [2]

7.0 Discussion and conclusion:

Description	Fish	Ratio of dilution	Monitoring results (Fishes Survived)				
			24 hours	30 hours	36 hours	48 hours	72 hours
Effect Study-1	Zebra	100% Effluent	0	0	0	0	0
Effect Study-2	Zebra	50:50	3	0	0	0	0
Effect Study-3	Zebra	60:40	5	0	0	0	0
Effect Study-4	Zebra	90:10	10	10	10	10	9

Table-2: Denotes monitoring results of fishes survived

Untreated Effluents (100%) are showing higher Toxicity (TF value) due to presence of more toxic substances in the sample. The toxic chemicals are adsorbed through the epithelia of fish and affect the organs like gills, skin, and intestine, air bladder resulting in physiological mal-functioning and eventual death of the test organisms [2]



Graphic presentation on different concentration and survived fishes

The physiology certain aquatic species makes very good biological indicators of physical and chemical water quality. The study indicate that natural water quality is getting contaminated due to economically motivated discharge of untreated waste water effluent in aquatic system which is very hazardous for aquatic animals ,specifically for fishes. It evident from the study that as concentration of untreated waste water effluent is increasing in the aquatic system , toxicity of aquatic water is increasing and fishes are dying and at maximum concentration , there is no opportunity for survival of fishes.

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