Research Article

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TOXICITY TESTING OF THE DISTILLERY EFFLUENT (UNTREATED AND TREATED) THROUGH *POECILIA VELIFERA*

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ABSTRACT:

Distillery industry is one of the largest polluter in India; it is mainly due to the presence of variety of organic and inorganic pollutants in assessing the efficiency of the applied wastewater treatment system and in establishing the discharge standards. The present study the toxic effects of distillery wastewater before and after phycoremediation treatment on fish *Poecilia velifera* (Silver molly) were studied under laboratory conditions. Results indicated that untreated wastewater being very strong in terms of colour, COD and BOD is found to be very toxic to the fish *P.velifera*. The LC_{50} values for untreated wastewater and after phycoremediation treatment with microalgae for 24, 48, 72 and 96 hours ranged between, 25%, 50%, 75% and 100%. It was evident from the studies that the reduction in toxicity in the distillery effluent after treatment with microalgae (*Chroococcus minutus* and *Chlorella saccharophila*).

KEYWORDS:

Distillery effluent, *Chroococcus minutus*, *Chlorella saccharophila* and *Poecilia velifera*

INTRODUCTION

Water pollution is a global issue, as the rising population leads to a number of industries. Distillery industry is one of the major pollutants in India. Effluent from distilleries is highly toxic and also a major source of aquatic pollution. Many organic and inorganic compounds have been identified in effluent which is produced at different stages of beer making. Their toxic nature is derived from the presence of compounds and xenobiotic compounds which are formed and released during various stages[6]. The major problem of the wastewater is high organic content, dark brown colouration and toxic pollutants. Salts, acids and alkalis are present in effluent discharged from distillery industries and also the heavy metals such as copper, zinc, chromium are present in effluent that ultimately released into aquatic environment and causes water pollution[7]. Effluent is hardly biodegradable because it is mainly due to their complex chemical structure or due to their toxic nature are resistant to biodegradation. Organic, inorganic and toxic substances present in the wastewater have direct impact on the aquatic life and hence, have high ecological relevance. The economic viability to grow fish in polluted and also treated wastewater with microalgae has been receiving the attention of workers for the last few years. Industrial effluents contain an array of components and when discharged into surface waters, give varying impacts depending on components, quantities of individual components and reaction potential in the face of other environmental factors[3]. In recent years more attention is being given to acute toxicity evaluation for industrial effluent due to the imposition of stringent laws on discharge standards[4]. The present work is an endeavour to study the effect of distillery effluent (untreated and treated) on the survival of a fish *Poecilia velifera*.

MATERIALS AND METHODS

Effluent samples were collected from Midas Golden Distillery industry situated in Padappai, Tamil Nadu, India. The physico-chemical properties of the untreated and microalgae treated effluent were analyzed following the procedure of APHA[2]. Silver molly fishes (*Poecilia velifera*, R.) were collected from the Karasangal fish

farm, Padappai using cast net and they were maintained in the laboratory in a glass aquarium tank and acclimated in aerated tap water (temperature 28 ± 1˚C; pH 8.0; DO 7.0 ± 0.3 mg/L) with continuous aeration for two weeks prior to the experimentation. During this period, fishes were fed with a known amount of fish feed. The water in the aquarium tank was siphoned off every day to remove of the feed and faecal matter remains and made up with fresh aerated water.

RESULTS AND DISCUSSION

Poecilia velifera is commonly known as Silver molly was selected for control animal (survival rate) distillery effluent and the treated distillery effluent with microalgae such as *C.minutus* and *C.saccharophila* (**Table.1**). Fishes were exposed to lethal concentration of the distillery effluent for short-term period. It was observed that the general behaviour, survival rate and mortality of fishes. The fishes were died immediately after releasing in the concentrated distillery effluent. In control as well as the distillery effluent treated with microalgae the survival rate of fishes extended up to 96 hours. In control all the fishes survived (100 percent survival) whereas the effluent treated with 25% concentration the survival rate was 50%; 48 hrs 80% while 72 hrs 100%. Hence, for the present study, 25% of the untreated distillery effluent was considered as the sub lethal concentration.

Table.1 Physico-chemical parameters of distillery effluent in untreated and treated with *C.minutus* and *C.saccharophila*

S.No	Parameters	Untreated distillery effluent	Effluent treated with *C.minutus*	Effluent treated with *C.saccharophila*
1	Appearance	Brownish black	-	-
2	Odour	Offensive smell	-	-
3	Turbidity	132.7 ± 0.32	0.60 ± 0.01	9.80 ± 0.05
4	TSS	369.7 ± 0.25	10.26 ± 0.83	165.26 ± 0.92
5	TDS	2258.2 ± 0.72	170.10 ± 0.85	112.40 ± 0.87
6	Total solids	1846.1 ± 0.85	48.16 ± 0.76	151.80 ± 1.21
7	EC	3195.1 ± 0.76	667.26 ± 0.64	581.1 ± 0.86
8	pH	5.01 ± 0.01	7.06 ± 0.30	7.97 ± 0.07
9	Alkalinity	180.16 ± 0.76	31.96 ± 0.45	116.30 ± 1.08
10	Total hardness	1010.16 ± 0.76	410.1 ± 0.76	420.43 ± 1.11
11	Calcium	167.10 ± 0.36	88.30 ± 0.88	88.13 ± 0.70
12	Magnesium	92.10 ± 0.65	46.23 ± 0.68	47.96 ± 0.35
13	Sodium	200.1 ± 0.80	80.63 ± 1.45	68.33 ± 1.04
14	Potassium	19.96 ± 0.65	24.33 ± 0.75	5.87 ± 0.23
15	Chloride	890.2 ± 0.91	460.4 ± 1.44	46.26 ± 0.83
16	Phosphate	0.91 ± 0.01	0.41 ± 0.01	0.20 ± 0.01
17	COD	412.0 ± 1.0	12.20 ± 0.91	16.23 ± 0.58
18	BOD	417.0 ± 1.0	9.13 ± 0.90	18.0 ± 0.40

Chemical Examination is expressed in mg/L except pH. Electrical conductivity as EC µS/cm, Turbidity as NTU, Values are expressed as mean ± SD level of triplicates.

In the present study, the distillery effluent treated with *C.minutus*, the survival rate of the fishes was 90 percent within 24 hrs while it was 100% for 48 hrs. Likewise, the distillery effluent was treated with *C.saccharophila*, the survival percentage of the fishes were 100 percent for 24 hrs (**Table.2**). The present result was supported in paper mill effluent on the behavioural responses in *Mystus vittatus*[5]. Similar kind of observations was also carried out in *Lebistes reticulates* in drug industry wastewater[8].

Table.2 Toxicity study of untreated and treated distillery effluent to *P.velifera*

Exposure period (hrs)	No. of Fishes	Control	Untreated distillery effluent (25%)	Effluent treated with *C.minutus* (100%)	Effluent Treated with *C.saccharophila* (100%)
24	10	100	-	90	100
48	10	100	50	100	-
72	10	100	80	-	-
96	10	100	100	-	-

By conducting static bioassay tests, the LC_{50} value of the freshwater fish *P.velifera* exposed for 24, 48, 72 and 96 hrs has been recorded with 100%, 75%, 50% and 25% dilution of the effluent respectively. LC_{50} value was found to be 25% well-acclimated *P.velifera* for the untreated distillery effluent. Whereas, the LC_{50} values were found to be 100% of *C.minutus* and 100% for *C.saccharophila* were well-acclimated *P.velifera* for the treated distillery effluent (Table.2). During the estimation of the LC_{50} for the survival rate of fishes were decreased with increased concentration of the untreated distillery effluent. The estimation of LC_{50} value (25%) for a survival rate of *P.velifera* decreased with an increase in the concentration of the distillery effluent. Similar kinds of results were reported by Roopadevi and Somashekar stated that when test organisms stocked in higher effluent concentration for longer period. The homeostasis behaviour of the fish was disturbed; this eventually led to death or it may be some physiological stress, which is confirmed by the present results [1].

CONCLUSION

Based on the results, it could be concluded that the survival fishes (*P.velifera*) were seriously affected by the distillery effluent, even after dilution of the effluent from the freshwater. But the distillery effluent was treated with microalgae *C.minutus* and *C.saccharophila*; the fishes were survived for longer periods. The microalgae (*C.minutus* and *C.saccharophila*) in the distillery were able to detoxified the toxic pollutants were present in the distillery effluent. So, that we can use the treated distillery effluent for various commercial purposes especially aquaculture.

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