

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.910.189>

Impact of Treated Effluents of PSPD, Bhadrachalam on the Survivability and Growth of the Juvenile Snake Head: *Channa striatus*

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ABSTRACT

Keywords

Godavari water,
Treated effluents,
PSPD
Bhadrachalam,
Impact assessment,
Survivability,
Growth,
cannibalism –
Channa striatus

Article Info

Accepted:
12 September 2020
Available Online:
10 October 2020

ITC paper boards and speciality papers division located at Sarapaka, Bhadrachalam, Khammam, Telangana is among the leading names in the business worldwide and largest manufacturer of paper, paper boards and bleached pulp in south Asia. The waste water generated in the process is treated chemically and biologically before discharge for irrigation. The survivability, Growth and cannibalism, of the juvenile snakehead *Channa striatus* was evaluated in the waters of Godavari river and treated effluents, PSPD, Bhadrachalam. An enhancement in survivability, growth and reduction in cannibalism was noticed in treated effluent waters, exhibiting their nutritive nature. This investigation infers preliminary information on impact of effluents on aquatic life and also indicates that the juveniles feed mainly on plankton (zooplankton).

Introduction

Industrial untreated wastewater represents a heavy source of environmental pollution. It affects both the water quality as well as the microbial and aquatic flora. Industrial effluents are characterized by their abnormal water quality. Process water in paper and board mills contains a lot of sugars and lignocelluloses, which support the growth of bacteria, mold and some yeast. Effluents from fertilizer plants contain a higher concentration

of potentially toxic wastes rich in Ammonia – nitrogen, urea, nitrate-nitrogen orthophosphate – phosphorous which support the growth of algae, yeast and cyanobacteria, cellulolyte bacteria such as *Klebsiella pneumoniae* and *Enterobacter* have been isolated from spent water from the paper and pulp industries. The occurrence of these microbes in the effluents lead to excessive oxygen demand loading and also disturb the ecological equilibrium of the receiving waters with much loss of aquatic life and ecosystem.

Industrialization is the index of modernization, which leads to alteration in the physical, chemical and biological properties of environment. Waste water from industries has been tried by several researchers for irrigation. Irrigation of paper mills effluents has shown encouraging results on Oats and Orchard grass (Hashimoto and Yokato, 1965) on paddy, wheat and groundnut (Khambatta and Ketkar, 1969) Hansen *et al.*, (1980) observed that irrigation with effluent is superior than the freshwater in respect of yield of sugarcane and plant characters. Whereas Somashekar *et al.*, (1984) stated that the effluents not only contain nutrients that enhance the growth of crop plant but also have other toxic materials that reduces crop growth and have inhibiting soil characteristics.

In Maize and Mungbean cultivation with paper mill waste water, the root growth and modulation were not affected significantly (Rukhsana Bajwa, 2001). But earlier, Mishra and Sahoo (1989) in comparable studies have reported that paper mill effluents do not induce any inhibitory effects on growth and production of paddy. Similarly field experiments conducted by Vercher *et al.*, (1965) indicate that the production of corn, oats, cowpeas and paddy in soil irrigated with paper mills waste water was at par with well irrigated soil. Yakushenko *et al.*, (1971) successfully utilized paper mill waste water on crops like cucumber, squash and feed grass on sandy soils. Though much of the work is carried in Agriculture but no trails were carried in Aquaculture. Hence a study was carried out on the treated effluents of paper board and speciality paper division, Bhadrachalam, Telangana, to assess the suitability of effluents on Aquaculture, in particular the air breathing fish, *Channa striatus*.

Materials and Methods

Fry of 3.5 cm and 0.8 gms were stocked at the rate of 3000 / acre in Godavari water (control) and treated effluents in ponds at PSPD, ITC, Bhadrachalam and reared for three months (Fig. 2 and 3).

Depth of water was maintained 50-75 cm. Fertilization of ponds (0.085 ha) was not done. Boiled and minced chicken offal is served as feed as per the body weight. The elemental analysis and water quality parameters of the treated effluents are done by standard methods as per the Manuel of MITCON, 2003, Shinde *et al.*, 1997 and recorded regularly. The qualitative plankton analysis and growth performance are recorded fortnightly. The rate of survivality and cannibalism are recorded periodically and harvested after 3 months.

Results and Discussion

The analytical results such as physico chemical, biological and elemental analysis of the treated effluents are as follows:

The color of effluent was dark brown and it smelt like rotten egg (sulphurous) (Fig. 1). The pH of effluent ranged from 7.2 – 8.1. The effluent was slightly alkaline with TDS and Sulphate contents. The remaining parameters were present in optimum levels (Table 1). The elements, Na, K, Ca, Mg, and Mn were in lower concentrations where as, heavy metals like Cd, Pb, Ni, Hg, Cr, Co and Ag were not detectable (Table 2).

Blue green algae and green algae are predominantly seen in phytoplankton. Where as Clado cerans and rotifers are dominating in zooplankton (Table 3). The growth performance of juveniles reared in effluents is greater (Fig. 5a, 5b and 8) than that reared in Godavari waters (Fig. 5a, 5b and 7). The rate of survivality is higher in effluent treated waters than in juveniles reared in Godavari

waters (Fig. 4). The rate of cannibalism is declining in juveniles reared in treated effluent treated waters where as it is enhancing in juveniles reared in Godavari waters (Fig. 6).

Table.1 Physico chemical analysis of PSPD treated effluents

Sl. No.	Factor	Values
1.	Colour	Dark brown
2.	Odour	Sulphurous / smelling like rotten egg.
3.	Temperature °C	24 – 36 °C
4.	pH	7.2 – 8.2
5.	Conductivity (dsm ⁻¹ / cm)	2.1
6.	Alkalinity (mg L ⁻¹)	256
7.	Total hardness (mg L ⁻¹)	352
8.	Total suspended solids (mg L ⁻¹)	81
9.	Total Dissolved solids (Mg L ⁻¹)	1052
10.	Dissolved Oxygen (Mg ⁻¹)	1.9 – 4.5
11.	COD (Mg L ⁻¹)	152
12.	BOD (Mg L ⁻¹)	23
13.	Chlorides as CL (Mg L ⁻¹)	158
14.	Sulphates as So ₄ (Mg L ⁻¹)	580
15.	Phosphorous (Mg L ⁻¹)	1.8

Table.2 Elemental analysis of PSPD treated effluents

Sl. No.	Element	Concentrations (Mg ML ⁻¹)
1.	K	23.81
2.	Ca	127.05
3.	Mg	21.53
4.	Fe	1.14
5.	Mn	0.19
6.	Zn	0.37
7.	Cu	0.14
8.	Na	175.3
9.	Cd	ND
10.	Pb	ND
11.	Ni	ND
12.	Hg	ND
13.	Cr	ND
14.	Co	ND
15.	Ag	ND

Table.3 Biological analysis of PSPD treated effluents

Sl. No.	Plankton	Zooplankton
1.	Diatoms	Protozoa – No existence
2.	Blue green algae	Rotifers – appreciable in number
3.	Green algae	Cladocerens – extra ordinary rise in population of moina.
4.	Euglenoids	Copepods – Fairly good

Fig.1 Effluent water



Fig.2 Experimental ponds



Fig.3 Fry for stocking



Fig.4 Rate of survival

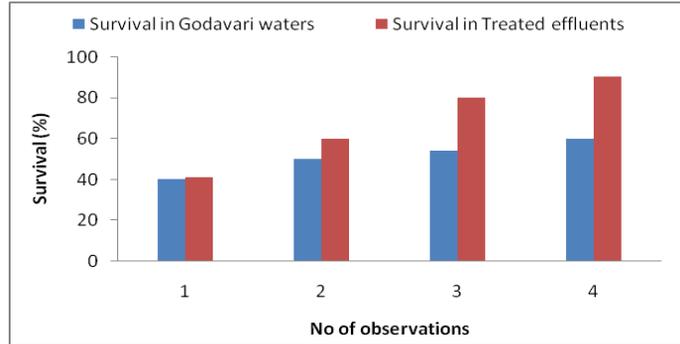


Fig.5a Growth performance: Variance in length

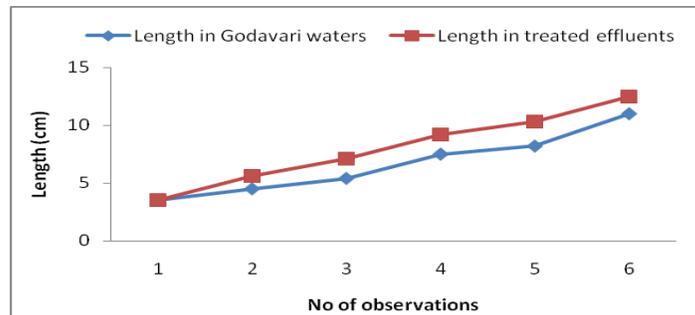


Fig.5b Growth performance: Variance in weight

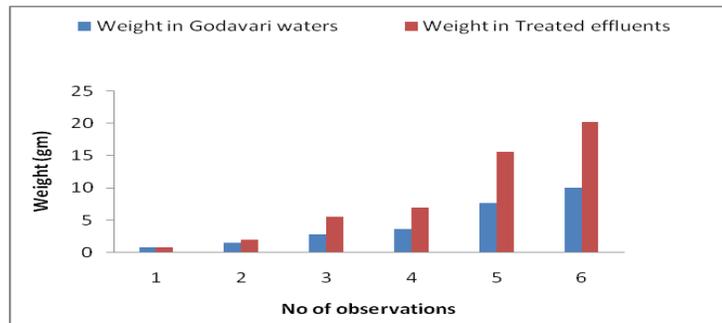


Fig.6 Rate of cannibalism

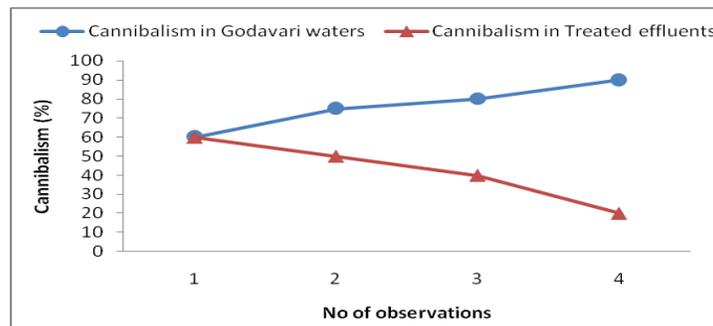


Fig.7 Harvested fingerlings (control)



Fig.8 Harvested fingerlings (effluents)



In view of the encouraging results obtained, it infers that the plankton (phytoplankton and zooplankton) are fairly high in treated effluents which speaks of possible use of effluents as important resource for rearing of fish, as effluents are providing live fish food organisms. It is needless to mention that plankton are the choice fish food organisms (Fig. 7 and 8).

Hence it can be concluded that the treated effluents from PSPD, Bhadrachalam, industry are nutritious and encouraged the growth of juvenile, snakehead *Channa striatus*.

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How to cite this article:

Suguna, T. 2020. Impact of Treated Effluents of PSPD, Bhadrachalam on the Survivality and Growth of the Juvenile Snake Head: *Channa striatus*. *Int.J.Curr.Microbiol.App.Sci.* 9(10): 1585-1591. doi: <https://doi.org/10.20546/ijcmas.2020.910.189>