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MONITORING INDUSTRIAL EFFLUENTS DISCHARGE ALONG GUJARAT COAST BY BIO-ASSAY TEST AND PHYSICO CHEMICAL PARAMETERS

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ABSTRACT

GFASRI in consultation with Gujarat Pollution Control Board and on its own undertook studies on chemical parameters of effluents of a few factories in the Saurashtra region and their effects on fish through bio-assay tests.

In the case of M/s Tata Chemicals, LC-50 value ranges 0.4 to 5% conc vol; temperature 86.0 to 91.0°F; Ammonia 21.84 to 48 98 ppm and total solids from 184 to 234 g/litre.

In the case of M/s Saurashtra Chemicals, Porbandar, LC-50 value varied 2-100%. In the case of M/s Indian Rayon, Veraval, pH was between 2 to 10.5 and LC-50 value was from 20% to 100% conc/vol. For Billeshwar Sugar Factory, Kodinar pH was between 4.0 - 5.5, BOD was 450 to 1600 ppm and LC-50 value was 0.5 to 7.

Results of investigations in general, factory-wise comments and impact of these studies in monitoring the effluents on the Gujarat coastline are discussed.

INTRODUCTION

Gujarat has five major rivers of 1,000 km stretch, 6,14,000 hactare area of ponds, lakes, reseviors & swamps available for fish culture, and 1,92,000 sq. km area of continental shelf for marine fisheries resources.

With 472 fishing villages, 1,65,000 fishermen population 6,000 non machanised boats, 5,000 mechanised boats, 3.3 lakhs tonnes annual fish production and export of fish/fish products worth Rs. 26 crores; the fisheries in Gujarat is not a small sector.

But Gujarat's major thrust has been on the industrial side, specially on chemical based industries. Increasing number of industries on coastal belt as well as on river banks has started creating problems of pollution in aquatic systems by releasing effluents. These have ultimate effects on fisheries resource too.

The Gujarat Pollution Control Board is concerned with protection of environment in the state. In consultation with them GFASRI initiated a small programme of studying effluents released by certain industries.

GFASRI has been registered in the INFORTERRA International Directory and has been recognised as an environmental laboratory by the Department of environment, Government of India. Thus the institute is previlaged to take samples for analysis directly from factories on charge levied basis and it also examines sample from aquatic environment for study purposes and the obtained information are passed on to the concerned.

The present communication deals with the results of observations made on effluents from various factories in Saurashtra.

MATERIALS AND METHODS

Bio-assay tests and other parameters like pH, total solids, dissolved oxygen, suspended solids, carbon dioxides chemical oxygen demand dissolved solids, bio chemical oxygen demand, ammonia, salinity, acidity, etc. were carried out as per methods recommended by pH standard methods for waste water examination as well as methods by Indian Standard Institute through different publications.

M/s TATA CHEMICALS, MITHAPUR

This factory releases two types of effluents at the mouth of Gulf of Kutch. Nature of the effluents are as in Table 1.

TABLE 1 *Nature of effluents of Tata Chemicals*

	A-Ammonia stell	B-Thermal power
Quantity	17740 M^3/day	1360 M^3/day
Temperature	86° C to 91°C	22° C to 39° C
pH.	10 to 11	8 to 9
Ammonia	21.84 to 48.98 ppm	0.64 to 43.6 ppm
L. C. 50. value	0.4 to 5% Conc/Volume	11 to 20% Conc/vol
Total solids	184 to 234 g/l	84 to 405 g/l
Dissolved Solids	171 to 210 g/l	46 to 122/l
Salinity	194 to 203 ppt	45 to 50 ppt
Suspended Solids	13.2 to 29.6 g/l	38 to 24.0 g/l

The above values are not in agreement with the ISI standards.

The factory excavated 9 ponds, each of 1 to 2 hectares. These ponds were used in series of three for settling suspended solids in the effluents. The ponds came into use from June-'85. Thereafter temperature of the effluents from Ammonia stell plant came down to 26° to 29°C, and Amonia to NIL. The lethal-50 value improved at 5 to 17% Conc/Vol and there was some improvement in suspended and total solids too. However, there was no appreciable improvement in the effluent and as all the ponds got filled in within one year with solids this could not be a permanent solution. Thereafter in order to decide a safe dilution point at releasing end, experiments on bio-assay tests were conducted. Both effluents were allowed to run togather for 100 m and then sample was collected. This sample was diluted to 20 to 25 and 30X and each dilution was studied separately to find out the lethal concertration value and the same is given below.

Dilution	LC-50 Value	
	Maximum	Minimum.
20 X	97	80
25 X	100	91.5
30 X	100	99

From the logarithmic plottings it was decided that 32X dilution was non toxic to fish and was safe for releasing to the Gulf of Kutch.

2. SAURASHTRA CHEMICALS : PORBANDAR

This factory produces soda ash, caustic soda and soda bicarbe. Raw materials used are salt, lime stone, liquid ammonia, cock, coal, sulpher. It releases the sludge of $Ca\ Co_3$. Mg (OH)2, NaCl, and $Na_2\ So_4$ in liquid form at the rate of 8,400 kilo litres per day.

The temp. of the effluent ranged from 31°C to 40°C, PH 7.5 to 9.7, ammonia 6.44 to 6.77 ppm., total sulphate as ($Na_2\ SO_4$) 20 ppm. total chloride as NaCl 90 ppm.

Lethal concentration on fish *Aphinus dispar* was below 20% Conc/Vol. Between April-'84 and June-'84. It showed appriciable improvement by remaining between 32% to 60% Conc/Vol. upto April-'85; thereafter there was further improvement and it ranged between 60 to 100% (non toxic) Physicochemical parameters were always in approximation to ISI stds. The moniter-ing was suspended from February '86. The improvement on the effluent was largely through additional dilution.

3. BILLESHWAR SUGAR FACTORY, KODINAR

This factory uses melasses, lime, sulpher and sugarcane as raw material and produces rectified spirit and crystal white sugar. The waste is being released to the sea at the rate of 850 Kl/day near Mul-Dwarka fishing village.

The effluent had pH between 4 and 5.5, Dissolved Oxygen NIL total solids 13.6 to 44 g/l chemical oxygen demand 14,000 and 42,000 mg/l biochemical oxygen demand between 450 and 1,600 ppm activity 1,200 mg/l and LC-50 value ranged between 0.5 and 7. None of these parameters match with ISI standard.

There has been complaints from fishermen of Muldwarka for this effluent and further monitoring/improvement is necessary for this effluent.

4. INDIAN RAYON, VERAVAL

Using wood pulp, Caustic, Sulphuric Acid and Carbon disulphide this factory produces Rayon Fibre, zinc and vanadium pentoxide are used as catasysts. Factory releases effluent to the tune of 3,600 to 3,700 M^3/day through open channel in Jaleshwar (Veraval) creek.

During 1980 the effluent was highly toxic and very few physico chemical parameters matched with ISI (Ruparellia et al. 1980).

The factory has installed lime addition, mixing plant as well Zinc settling/filtration plant and there was gradual improvement in the effluent quality. Temp was found between 25°C to 31°C pH from 2 to 10.5 BOD from 200 to 360 ppm and LC-50 value from 20% to 100% Conc/Vol (non toxic). But during surprise check, lime treatment plant was found unoperative, pH was found drasticallty low between 2 to 3 and LC-50 value was found very low between 20 to 26 Conc/Vol.

The effluent requires periodical monitoring.

6. M/S EXCEL INDUSTRIES, BHAVANAGAR

This factory produces yellow phosphorous, red phosphorous and sulfar and ammonium phosphides and use Rock phosphate, cock silica Urea, Wax, Ammonium carbonate, Thionyl chloride, Butene diet and Hexa chlore cyclo pentadiene.

The effluent quantity released is 2 to 3 lakhs litres/day the effluent has pH betwen 6 to 7, COD between 100 to 300 ppm and suspend solid between 5 to 200 ppm the LC-50 value was found 2% in 1984 it was 16,5% in February-'85.

The treatment to the effluent is given mainly through neutralization. The factory has installed activated carbon treatment plant, solar evaporation plant and filtration screens for solid wastes. However samples have not been tested thereafter.

The factory deals with highly toxic chemicals and hence periodical monitoring of effluent is necessary.

6. BHADAR RIVER (JETPUR NEAR RAJKOT)

There are around 1,500 printing industries in Jetpur and Navagadh which are on the bank of river Bhadar and releases 8.26 million litre of effluent per day in the river the effluent is highly coloured (Red) with high COD, low BOD and high suspended and dissolved solids.

The L.C-50 value was found around 13% Conc/Vol.

IMPACTS OF THE WORK UNDERTAKEN BY GFASRI

1. GFASRI is getting recognition as an agency to shoulder responsibility to protect aquatic environment.
2. Earlier industrial units were either not aware of or never worried about that they were causing damages to near by flora, fauna and in all aquatic ecosystems by releasing their effluents and hence never bothered to treat their effluents. from the sequential experiences it can be informed that now an awarness is created among factory authorities about the damage caused to aquatic systems through release of untreated effluents. Many factories have installed treatment plants and have started putting efforts towards improvement of their effluents. Few factories have created special squads to look after their effluents.

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