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ASSESSMENT OF PAPER INDUSTRY EFFLUENT WATER FOR ITS SUITABILITY TO IRRIGATION AND OTHER DOMESTIC PURPOSE

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ABSTRACT

The industrial waste have the greatest potential for polluting the sources of water. The treated effluent water of pulp and paper industry has an alkaline pH. Biological oxygen demand (BOD), Chemical oxygen demand (COD) Dissolved oxygen (DO) and other observed parameters indicate that it affects the aerobic respiration of organism and hence not suitable for aquaculture application. Residual sodium carbonate (RSC) values of the treated liquid effluent samples suggest its suitability for irrigation purpose.

Keywords- *Industria Waste, Effluent water of pulp, Paper Indistry etc.*

I. INTRODUCTION

The nature and the composition of industrial wastes widely vary according to different types of industries. It also depend on the raw materials, process and operational factors used in particular industry. Industrial waste may have pollutants of almost all types ranging from simple nutrients and organic matter to complex toxic substances.

Focusing our attention to paper industry, the chemicals employed in this industry include alum, talc, rosin, chlorine, caustic soda, soda ash, dyes, magnesium sulphite, sulphurous acid and clay. The characteristics of combined effluents from sulphite, and pulp and paper industry located on the banks of River Hoogly were reported (Kudesia 1998). A multiple regression analysis and mathematical models were described to define specific relations between cynobacteria and physico-chemical factors with respect to the effluent from paper mrtls discharged into the River Godavari (Sudhakar 1991).

Influence of treated paper mill effluent on hepatic morphology in male bullhead (Cottius gobio L.) revealed a marked depletion of glycogen, necrosis of single hepatocytes and higher degree of liver parasitization (Bucher et al. 1992). A study on the influence of paper mill effluent on the fish fauna of stoney shores of Lake Paijanne revealed the inhibiting effect of the reproduction activity of different species of fish (Bagge & Hakkari 1992). A comprehensive study (Lavella et al. 1993) on Quebec's pulp and paper mill effluent showed that rhe effluent is toxic to trout and other organisms. The effects of pulp mill effluent on two freshwater species, Oreochromis niloticus (Tilapia) and Geophagus brasciliensis (Acara) were investigated (Wilhelm et al. 1997). The impact of pulp and paper mill effluent on the composition of the humic fraction of aquatic organic matter was studied (Santosh et al. 1998).

The present work has been carried out to understand the nature of effluent discharqed from proper industry located at the bank of Hasdeo river in pithampur of Janjgir-champa district Chhattisgarh and to assess its suitatrility for land application and survival of life progresses.

II. MATERIALS AND METHODS

The effluent samples generated from a paper industry located Janjgir-Champa district of Chhattisgarh, India before and after treatment, and the process water from the Hasdeo river were collected for characterization. The analysis was made as per standard procedures and recommendations (Ramteke & Moghe 1998). The measured parameters included pH. electrical conductivity, total solids, chloride, sulphate, phosphate, fluoride, carbonate, bicarbonate, total hardness, calcium and magnesium hardness, metallic calcium and magnesium, residual sodium carbonate (RSC), dissolved Oxygen (DO), biochemical oxygen demand (BOD) and chemical oxygen demand (COD).

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III. RESULTS AND DISCUSSION

The quality of water of River Hasdeo employed for the manufacturing process of paper has been characterized and the details are presented in Table 1. Based on different constituents present, water is classified into three grades for irrigation purposes (Goel 2001) (Table 2).

Residual sodium carbonate (RSC) is an important parameter to assess the suitability of water for irrigation purposes. It can be calculated as per the following relation expressed in mg/L (Gupta 2004) and the results are given in Table 3.

$RSC = (CO_3^{-2} + HCO_3^{-}) - (Ca^{+2} + Mg^{+2})$

RSC Value < 1.25: Water can be safely used for irrigation.

RSC Value 1.25-2.50: Water to be used with due caution.

RSC Value > 2.50: Water suitable for irrigation.

Based on RSC values (0.58) the treated effluent can be considered for irrigation purposes. However, this needs to be examined further taking into account the other analytical parameters studied.

The characteristics of untreated and treated liquid effluents from paper industry are presented in Table 4.

- Various parameters characterized as per standards (CPCB 1995) and IS: 3025-1904 except for BOD indicate that the other parameters are well within the permissible limits.

The lower value of D.O. of the treated effluent indicates that it affects the aerobic respiration of organism. The BOD value of 100 for liquid effluent after treatment is more suitable for irrigation purpose. It is marginally higher (36 mg/c) for aquaculture application other parameters are also not within limit which indicates that this treated effluent is not suitable for irrigation other domestic purpose. It should be treated properly before applying to land use.

IV. CONCLUSION

Taking in to consideration the physical parameters treated liquid effluent from paper industry is not suitable for irrigation, aquaculture and other domestic uses.

Table - 1 Analysis of Intake water employed the paper industry

Sl. No.	Parameter	Values
1	pH	8.30
2	Electrical Conductivity	285
3	Total Solids (T.S.)	122 mg/l
4	Total Dissolved Solid (TDS)	110 mg/l
5	Total Suspended Solid (TSS)	7.8 mg/l
6	Hardness	82 mg/l
7	Calcium Hardness	39 mg/l
8	Magnesium Hardness	43 mg/l
9	Ca++ ion concentration	15 mg/l
10	Mg++ ion concentration	8 mg/l
11	SO_4^{--} ion concentration	1.32 ppm
12	F^-	0.16 ppm
13	Cl^-	18.5 ppm

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14	PO_4^{---}	0.10 ppm
15	Carbonate as (CO_3^{--})	2.6 mg/l
16	Carbonate as Bicarbonate (HCO_3^-)	BDL mg/l
17	Residual Sodium Bicarbonate (RSC)	BDL mg/l
18	Dissolved oxygen (DO)	6.8 mg/l (max.)
19	Biochemical oxygen Demand (BOD)	1.25 mg/l (max.)
20	Chemical oxygen Demand (COD)	6.8 mg/l (max.)
BDL* Below Detectable Limit		

Table – 2 Water Classification for Irrigation Purpose

Class of water	TDS (ppm)	Chlorides (ppm)	Sulphates (ppm)	Electrical Conductivity	**Suitability for irrigation**
I	0-700	0-142	0-192	0-750	Excellent to good for irrigation
II	700-2000	142-355	192-480	750-2250	Good to injurious suitable only with permeable suit & moderate teaching. Harmful to sensitive crops
III	>2000	>355	>480	>2250	Unfit for irrigation

Table – 3 RSC content of liquid effluent before & after treatment

SNo.	Parameter	Paper industry Effluent	
		Before Treatment (mg/l)	After Treatment (mg/l)
1	CO_3^{--} Content	69	25
2	HCO_3^- Content	590	530
3	Ca^{++} ion concentration	200	124
4	Mg^{++} ion concentration	95.4	25.5
5	Residual Sodium Carbonate (RSC)	BDL*	0.60

Table – 4 Characterisation of Untreated and treated liquid effluent from paper & Pulp industry

SNo.	Parameter	Standards		Effluent	
		Irrigation	Aquaculture	Before treatment	after Treatment
1	pH	5.5 – 9.00	5.5-9.00	8.5	8.00
2	Electrical conductivity	Class – I 0-750 Class – II 750-2250 Class-III >2250		2600	2080
3	Total Solids (mg/l)	100	200	2410	1080

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4	Total Dissolved Solids (TDS) mg/l	Class-I 0-700 Class-II 700-2000 Class-III >2000	2100	1890	1310
5	Total Suspended Solids (TSS) mg/l (max.)	200	100	570	52
6	ion Concentration mg/l (max.)	-	2.00	0.96	0.82
7	ion Concentration mg/l	Class – I 0-142 Class-II 142-355 Class-III > 355	-	790.5	365
8	ion concentration mg/l	Class-I 0-192 Class-II 192-480 Class-III >480	-	59.4	36.2
9	ion concentration mg/l (max.)	-	5.0	0.88	0.50
10	Dissolved oxygen mg/l (IS : 3025-1964)	-	50	BDL	1.3
11	Biochemical oxygen Demand (BOD) mg/l (max.)	100	30	136	42
12	Chemical oxygen Demand (COD) mg/l (max.)	-	250	490.8	148

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