Meta Analysis of Heavy Metal Contaminated Industrial Effluent from South Gujarat

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Abstract: **Meta analysis of heavy metal contaminated industrial sample has been done by various approaches. viz, Physical, chemical,and sophicated. Results obtained showed the following range of physico-chemical parameters pH (1.32-6.26), TS (40-170 mg/l),TDS (29-168 mg/l), TSS (2-20 mg/l), Acidity(68-154 mg/l) ,DO(1.32 -2.54 mg/l),BOD(9-44 mg/l), COD(534-1984 mg/l), Chloride(2314-8167 mg/l).The samples were subjected to laboratory analysis using Atomic Absorption Spectrophotometer (AAS) to assess the levels of heavy metal pollution such as mercury (Hg), Arsinate (As) and Nickel (Ni). The pollution levels from these industries were found to be very high and alarming and hence proper care must be taken for the treatment of these effluents before they are released to the sewage.**

Keywords: Meta analysis, Heavy metals, Effluent, pollution level.

I. INTRODUCTION

South Gujarat is industrial hub whereas No of GIDC,SEZ & Parks.These zone having number of chemical,pesticides dye,textile industries.All these industries produce various effluents that discharge in environment (Malik G.M et al,2012). It has been realized that discharges of untreated or incompletely treated wastes containing algal nutrients, non-biodegradable organics, heavy metals and other toxicants will hasten the deterioration of receiving water bodies.There has been growing awareness of the need for effective treatment of various effluents before discharging into any public water body. In this way, water is heavily polluted and water, which should be a blessing to life, becomes a carrier of poisons, toxicants and pathogens leading to dreadful diseases that cause death. Many diseases and premature deaths can be prevented by adequate care of our environment(Segun Akanmu et al,2011). Therefore, this study was carried out to ascertain the pollution load or processing industry and to compare the concentrations of each pollutant with national and international wastewater or effluent standards and emission guidelines.

II. METHADOLOGY

2.1 collection of sample

The samples of effluent were collected from industrial area near south Gujarat. Samples were collected in pre-cleaned plastic bottles with screw caps bottle sample and store at 4◦c for 30 day before analysis.

2.2 Physical parameters

The pH was measured by pH meter . The colour concentration was determined using COD plus colorimeter (model: La-motte, code-1922/1922-EX-2).Total solid, Total suspended solid and Total dissolved solid determined by Gravimetric Method described by APHA (1998).

2.3 Chemical parameters

The dissolved oxygen and Biological oxygen demand were determined using iodometric Titration Winkler method described by APHA (1998). chemical oxygen demand determined by using open reflux method as described by APHA(1998). Determination of chloride was done using argentiometric method by APHA (1998).

2.4 Metal concentration Determination

A total of 3 metallic elements (Mercury,Arsinate,Nickel) were determined in the pre-treated samples of water using Atomic Absorption Spectrophotometry as described by (Gregg, 1989).

2.5 statistical analysis of parameter

Study of correlation reduces the range of uncertainty associated with decision making. The correlation coefficient 'r' was calculated using the equation

$$Correl(X,Y) = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sqrt{\sum (x-\bar{x})^2 \sum (y-\bar{y})^2}}$$

Significance of the observed correlation coefficient has been tested by using't' test.

III. RESULT AND DISCUSSION

The data of different physical ,and chemical parameters are presented in (Table-1)and (Table-2).metal concentration by AAS presented in (Table-3) and stastistical value and correlation matrix are presented in (Table-4) and (Table-5).

Table-1 Physical parameter of Effluent

parameter										
	1	2	3	4	5	6	7	8	9	10
colour	Light yellow	Light yellow	white	Dark black	Light green	Light yellow	Light yellow	colorless	Drak black	Dark red
PH	1.56	1.61	1.96	1.32	2.06	2.15	1.96	6.26	2.56	1.82
Total solids (mg/l)	70	90	40	160	110	50	40	60	170	100
Total dissolved solids (mg/l)	50	81	32	140	98	43	29	56	168	97
Total suspended solids (mg/l)	20	09	08	20	12	07	11	04	02	03

Physical parameters

In present investigation sample-1,sample-2,sample-6 and sample-7 all four effluent sample has light yellowish colour and sample-4 &9 also has dark black colour. All other samples have different colour like sample-3 white,sample-5 light green,sample-8 colourless,sample-10 dark red. .Disagreeable odor and taste in water maybe because of presence of decaying vegetation, Inorganic constituents / organic substances,discharge of wastewater in water bodies. (BIS limit: unobjectionable / agreeable due to aesthetic consideration)(. N.P. MOHABANSI et al,2011). the pH value of. effluents was ranging between 1.32-6.26, that is very differ than (BIS limit: 6.5 to 8.5;). On estimation for the industrial effluentsTotal solid ranged between 400-1700 mg/l, TSS ranging between 20-200 mg/l, TDS between 290-1680 mg/l,that is lower than permissible limit of BIS and WHO.

Table-2 Chemical Parameter of Effluent

parameter	Sample number									
	1	2	3	4	5	6	7	8	9	10
Dissolved oxygen(mg/l)	2.18	1.76	1.88	2.54	1.22	2.71	2.80	1.28	1.60	1.51
Biological oxygen demand(mg/l)	27	12	17	29	17	24	27	09	44	23
Chemical oxygen demand (mg/l)	1984	534	1144	1984	915	1908	763	764	4197	534
Chloride (mg/l)	3539	5172	3130	8167	2314	5445	4900	3947	7623	5174

Chemical Parameter of Effluent

Study Dissolved oxygen of sample ranging between 1.22-2.54 mg/l that is lower than BIS standard limit-4-6 mg/l .Dissolved oxygen levels are found to be very low and hence a lot of oxygen has been used up. It shows the increased concentration of organic matter. BOD were ranging between 9-44 mg/l , This implies that it is harmful to discharge untreated effluent into water bodies, as high BOD like that obtained for this study result in the depletion of dissolved oxygen, which perhaps is detrimental to aquatic lives. COD of all sample were ranging between 534-1984 mg/l. chloride concentration varied from 2314-8167 mg/l,that is higher than permissible limit. The fear of high level of chloride causing threat to all forms of biotic life. its availability in small amount is beneficial to both plants and animals (Hodgson and Manus, 2006).

Table-3 metal concentration

Metals	Sample number									
	1	2	3	4	5	6	7	8	9	10
Mercury (PPB)	6.0603	4.5448	5.4930	4.5861	5.0189	3.3081	16.0254	11.6683	4.5964	21.3769
Arsenic (PPB)	37.996	27.1777	30.7092	38.7367	38.0439	14.7816	14.6421	9.306	5.632	8.068
Nickel	0.0417	0.0600	0.0028	0.110	0.2842	0.1197	0.1075	0.0077	1.2940	0.0953

Metal concentration

Mercury concentration in all sample ranging between 4.5448-21.3769 PPB. Major sources of mercury exposure include dental amalgams (vapor), fish (methylmercury), and vaccines (ethylmercury). Toxic effects, he suggests, spread across a broad spectrum of diseases including autism, Alzheimer's disease, ALS, multiplesclerosis, Parkinson's disease, neurodevelopmental diseases, nephrotoxicity, and cancer. Arsenic concentration in all sample ranging between between 5.632-38.0439 PPB. Nickel concentration in all sample ranging between 0.0077-1.2940 PPM. Nickel is a ubiquitous metal frequently responsible for allergic skin reactions and has been reported to be one of the most common causes of allergic contact dermatitis, as reflected by positive dermal patch tests.

Table-4 Descriptive statistics of wastewater analysis

Parameter	Mean	Standard deviation	Varriance	%coeficient Variation
pH	1.32	1.4247	2.029	107.87
TS	40	46.77	2187.77	116.92
TSS	29	46.79	2189.3	161.34
TDS	2	6.38	40.71	319
DO	1.22	0.5811	0.33	47.54
BOD	9.0	9.99	99.87	111
COD	534	1121.57	1257941.12	209.92
chloride	2314	1858.8	345533.7	8029
MERCURY	3.308	6.075	36.91	183.64
Arsinate	5.06	13.42	180.31	265.21
Nickel	0.0028	0.388	0.150	1940

Table 4 shows the descriptive statistics of wastewater samples. The pattern of relative variation of coefficient of variation shows that all the examined variables are heterogeneous except TS and TSS ,DO and Nickel were homologous parameters. coefficient covariation of Nickel (1940),TDS(319),chloride (8029) were very high.

Correlation is the mutual relationship between two variables. Direct correlation exists when increase or decrease in the value of one parameter is associated with a corresponding increase or decrease in the value of the other. The correlation is said to be positive when
increase in one parameter causes the increase in the other parameter and it is negative when increase in one parameter causes the decrease in the other parameter. The correlation coefficient (r) has a value between +1 and -1. Correlation is characterized as strong, when it is in the range of +0.8 to 1.0 and -0.8 to -1.0, moderate if it is in the range of +0.5 to 0.8 and -0.5 to -0.8 and weak when it is in the range17 of +0.0 to 0.5 and-0.0 to -0.5.(I.S. AKOTEYON and O. SOLADOYE et al,2011).

The correlation coefficients (r) among various wastewater quality parameters were calculated and the values of the correlation coefficients (r) are given in Table 4. There is strong positive correlation between most of the parameters. For instance, TS and TSS (0.99),TDS and Arsinate (0.853),COD and Nickel (0.833),BOD and COD (0.847). The correlation coefficients between TS and BOD (0.565),TS and COD (0.590),TS and Chloride (0.665),TS and Nickel (0.664),TSS and Nickel (0.752)were found to be moderate.Very weak correlation between pH and other parameters.

Table-5 Relationship between wastewater quality parameter

Parameter	pH	TS	TSS	TDS	Do	BOD	COD	Chloride	Mercury	Arsinate	Nickel
pH	1										
TS	- 0.20	1									
TSS	- 0.137	0.990	1								
TDS	- 0.471	0.065	-0.070	1							
DO	- 0.450	-0.243	-0.307	0.465	1						
BOD	-0.380	0.5654	0.558	0.048	0.335	1					
COD	-0.10	0.590	0.594	-0.035	0.117	0.847	1				
Chloride	-0.186	0.665	0.667	-0.021	0.365	0.648	0.576	1			
Mercury	0.1799	-0.232	-0.186	-0.333	- 0.105	-0.09	-0.475	-0.08	1		
Arsinate	-0.482	0.058	-0.057	0.853	0.126	-0.201	- 0.150	-0.280	-0.5168	1	
Nickel	-0.007	0.664	0.715	-0.378	-0.225	0.752	0.833	0.477	-0.203	-0.382	1

IV. CONLUSION

The result obtained from this study showed that most of the physicochemical parameters studied were all has Higher value than desirable limit for effluent disposal on surface waters recommended by WHo and BIS . Results of the correlation analysis show that TS and TSS ,TDS and Arsinate ,COD and Nickel ,BOD and COD had high correlation with most of the other parameters. In view of this, there is need for routine monitoring of the effluents wastewater in the area and also the need for appropriate treatment of wastewater effluents before it is discharged unto the surrounding aquatic environment using best available technique (BAT).

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