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Physico-Chemical Analysis of Industrial Effluents Obtained from Taloja Industrial Estate (Maharashtra)

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The physico-chemical analysis of the industiral effluencts collected from Taloja MIDC (Maharashtra) has been analysed. It is observed that the industrial effluent contains high concentration of the metal ions, quite higher than the permissible limits indicating high degree of pollution in that industrial zone.

INTRODUCTION

Taloja MIDC is one of the biggest industrial areas consisting of about 600 industrial units. It is consisting of big industries, small scale industries of various types like engineering units, pharmaceutical units, chemical units, pre-proceess-ing units, polymer units, etc. Because of heavy work and continuous processes it has become the most polluted area now. Various types of pollutants are also poured out of the industries polluting the environment. These industrial effluents are then added to the water resources making fresh water polluted. The effluents from different sampling stations are monitored throughout the year for pH, temperature, TS, TDS, TSS, chloride, oil and grease and a few heavy metals like Cr, Cd, Ni, Zn, Cu, Pb and Fe. It is observed that all metal contents available in the effluent give higher values than the permissible standards.

Taloja industrial area is situated on the Thane-Pune highway and is alongside the Diva-Panvel railway-line of central railway. The nearest railway station is Navde Road which is about 9 km before Panvel as one travels from Diva to Panvel. The industrial area is also accessible by road from Dadar (42 km), Vashi (20 kms). Panvel (9 km) and Mumbai (15 km). The area is a part of New Mumbai and falls within the Thane Police Commissioner's jurisdiction.

This industrial area is spread over 953 hectares of land. Almost 50% of the total available land has already been allotted to various industrial units namely engineering and chemical units and a mélange of large scale, medium scale and small scale, totally numbering approximately 600 units. In the last 10 years the growth has been particularly rapid and development and growth have led this area much more to the pollution problem.

EXPERIMENTAL

Industrial effluent samples were collected a from few types of industries like pharmaceutical manufacturing, engineering work processing, print and printing ink manufacturing, chemical processing and manufacturing and miscellaneous types of other industries. From each type of industry 3 representative units were selected. The sampling was carried out throughout the year 1999 in the morning from 7.00 a.m. to 9.00 a.m., in the afternoon from 2.00 p.m. to 4.00 p.m. and in the evening from 7.00 p.m. to 9.00 p.m. The samples were collected in wide mouth polyethylene bottles and preserved properly. The sampling stations are as follows:

S-1: Nearby Powerica; **S-2:** nearby Transpower Engineering Ltd.; **S-3:** nearby Sunil Forging and Steel Industry; **S-4:** nearby HMTD Engineering; **S-5:** nearby Flat Products Equipments Ltd., MITA Engineers of Metal Processing; **S-6:** nearby Karpex Chemicals, Hindustan Lever; **S-7:** nearby Ballal Chemical and Metal Pvt. Ltd., Vasudha Chemicals Pvt. Ltd., Choksey Chemicals; **S-8:** nearby Aryavrat Chemicals, Enva Chem. India Ltd.; **S-9:** River; **S-10:** nearby Twincity Organics, LSR Specialty Oils Pvt. Ltd.; **S-11:** River; **S-12:** nearby Pushak Hosiery; Utkarsh Chemicals; Apte Amalgamations Ltd., Columbia Petrochemicals Pvt. Ltd.,

For physico-chemical aspects the measurements are taken for colour, temperature, pH, TS, TDS, TSS, chloride and oil grease contained. Heavy metals were analysed by using ASS-280 Perkin-Elmer instrument. pH study was carried out employing Li-120 digital pH meter pretreatment procedure.

The analysis was carried out in three seasons including twice in winter and once in summer and also in rainy season. The results included in the present investigation are the mean of the results obtained by independent experiments and also from three different units.

All standard methods of sampling, storage and analysis were adopted as per APHA methods.

RESULTS AND DISCUSSION

The physico-chemical analysis of industrial effluents carried out is shown in Tables 1 to 6. Looking to the Table of the month of January 1999, it is seen that pH ranges from 4.1 to 9.4. Samples collected from sampling stations 1 and 7 show only 4.1 pH. Temperature is ranging from 27.3° to 35.1°C. Sample obtained from sample station 5 gives higher temperature indicating some operational factors. In all the samples TS, TDS and TSS are always higher. Chloride contained is observed to be in the range 105–259. However, oil and grease is observed to be higher at a few places only; that is, at sample station nos. 2, 4 and 5, it is observed to be about 35, 25, 22 respectively. Regarding the heavy metal content, the monitoring is carried out for Cr, Cd, Ni, Zn, Cu, Pb and Fe. All the heavy metals show higher concentration in the effuent. This increased concentration of heavy metal content available in the effluent is very difficult to ascribe for some particular reason.

Looking to the other observation of the month of March 1999, May 1999,

July 1999, September 1999 and November 1999 in general, it is seen that the heavy metal concentration was always higher than the prescribed value.

TABLE-1
PHYSICO-CHEMICAL ANALYSIS OF THE EFFLUENTS COLLECTED IN THE MONTH OF JANUARY 1999

Station	Colour	Temp. (°C)	pH	TS	TDS	TSS	Chloride	Oil and grease
S-1	Light Brown	31.2	4.10	525	307	218	128	6.9
S-2	Colourless	27.3	8.02	670	475	195	215	35.0
S-3	Brown	28.6	8.57	1225	1015	210	241	14.0
S-4	Yellow	32.4	8.26	2800	2182	618	142	25.0
S-5	Colourless	35.1	6.79	1570	1055	515	181	22.0
S-6	Blue	32.1	6.24	5425	4890	535	157	8.7
S-7	Bluish Black	29.3	4.13	4425	3908	517	253	3.0
S-8	Light Brown	30.2	4.79	2892	2300	592	228	1.9
S-9	Yellow	30.6	6.03	6910	5825	1085	213	9.0
S-10	White	32.5	6.46	1198	825	373	217	4.8
S-11	Colourless	27.4	9.40	3602	3302	300	219	6.1
S-12	Dark Yellow	27.0	7.21	12,725	10,285	2440	231	4.5

(Except colour and pH all the values are expressed in mg/L)

Station	Cr	Cd	Ni	Zn	Cu	Pb	Fe
S-1	37.2	35.3	25.3	34.1	24.2	29.7	6.9
S-2	35.5	23.7	22.5	37.3	29.1	20.5	8.4
S-3	25.1	24.5	18.7	25.3	22.7	10.1	6.1
S-4	37.3	22.1	19.9	27.3	35.3	16.3	6.5
S-5	29.2	39.2	34.2	31.1	19.6	27.4	7.2
S-6	15.0	41.6	24.6	43.5	22.5	14.3	4.9
S-7	63.3	55.9	60.5	67.9	29.7	38.7	8.7
S-8	38.9	40.2	37.7	37.1	18.4	18.3	11.3
S-9	24.1	21.4	11.8	22.0	47.8	29.2	8.1
S-10	27.3	27.3	21.9	9.1	33.5	7.8	5.1
S-11	38.6	17.9	12.3	21.2	8.5	9.1	12.0
S-12	36.1	40.1	25.1	31.3	15.6	25.2	13.9

(All values are expressed in mg/L)

TABLE-2
PHYSICO-CHEMICAL ANALYSIS OF THE EFFLUENTS COLLECTED IN THE MONTH OF MARCH 1999

Station	Colour	Temp. (°C)	pH	TS	TDS	TSS	Chloride	Oil and grease
S-1	Light Brown	33.2	4.32	575	325	250	131	6.8
S-2	Colourless	28.8	7.93	690	502	188	209	49.0
S-3	Brown	29.1	8.64	1410	1120	290	248	15.0
S-4	Yellow	32.5	8.36	2995	2635	360	151	25.5
S-5	Colourless	34.2	6.81	3100	2885	215	180	27.0
S-6	Blue	32.7	6.19	6845	6110	735	158	9.9
S-7	Bluish Black	29.8	3.91	6725	6015	710	259	2.9
S-8	Light Brown	31.0	4.65	4434	3910	524	227	2.5
S-9	Yellow	31.5	5.77	7920	7225	695	210	8.0
S-10	White	33.1	6.33	4100	3885	215	219	3.7
S-11	Colourless	27.6	9.48	6830	6125	705	222	4.5
S-12	Dark Yellow	27.9	6.55	14,550	13,205	1345	235	3.8

(Except colour and pH all the values are expressed in mg/L)

Station	Cr	Cd	Ni	Zn	Cu	Pb	Fe
S-1	29.9	28.9	22.2	24.0	18.3	33.1	7.1
S-2	34.2	19.7	14.6	12.3	19.1	18.9	9.7
S-3	20.3	18.5	14.8	25.2	17.4	4.7	7.4
S-4	37.1	17.1	13.5	29.2	23.2	15.3	7.3
S-5	28.3	25.3	27.3	20.4	24.6	19.1	7.9
S-6	17.1	28.2	18.4	27.2	15.5	15.7	5.7
S-7	64.2	20.9	36.8	34.1	43.9	19.3	9.9
S-8	27.3	31.6	18.2	29.3	23.3	21.0	9.1
S-9	21.6	19.9	7.8	17.7	20.6	37.3	8.4
S-10	19.6	19.1	13.3	5.5	21.0	8.1	5.9
S-11	13.9	11.3	9.6	13.0	9.5	9.9	11.2
S-12	28.2	34.2	18.0	20.2	25.1	26.3	13.5

(All values are expressed in mg/L)

TABLE-3
PHYSICO-CHEMICAL ANALYSIS OF THE EFFLUENTS COLLECTED IN THE MONTH OF MAY 1999

Station	Colour	Temp. (°C)	pH	TS	TDS	TSS	Chloride	Oil and grease
S-1	Light Brown	34.8	3.91	610	490	120	137	9.3
S-2	Colourless	31.2	8.52	925	675	250	225	67.0
S-3	Brown	33.1	9.11	1429	1090	402	269	32.0
S-4	Yellow	35.1	8.87	4020	3910	110	155	39.0
S-5	Colourless	35.9	5.49	4510	4210	300	189	29.1
S-6	Blue	33.1	4.13	7920	7802	118	162	13.9
S-7	Bluish Black	32.2	3.30	7190	6910	280	259	5.3
S-8	Light Brown	31.4	4.11	4725	4208	517	237	3.0
S-9	Yellow	32.1	5.17	9520	9210	310	215	9.9
S-10	White	35.0	5.34	5010	4785	225	227	6.9
S-11	Colourless	28.3	9.90	8020	7912	108	225	8.1
S-12	Dark Yellow	28.7	6.91	16,852	16,004	848	245	6.2

(Except colour and pH all the values are expressed in mg/L)

Station	Cr	Cd	Ni	Zn	Cu	Pb	Fe
S-1	35.5	44.1	23.7	37.4	26.3	35.3	7.5
S-2	43.3	24.1	26.5	36.2	37.8	25.7	13.0
S-3	28.4	27.3	21.3	29.3	23.7	14.3	8.9
S-4	41.3	25.7	25.7	36.5	34.1	25.2	8.5
S-5	33.0	41.4	37.6	37.7	26.1	35.3	8.6
S-6	21.7	49.3	26.3	70.2	21.3	22.7	5.3
S-7	68.9	71.8	65.8	80.7	49.1	84.3	9.6
S-8	33.2	44.5	38.7	39.3	24.3	35.4	12.8
S-9	25.3	29.7	19.2	24.2	91.4	53.1	9.1
S-10	25.6	30.3	25.6	8.0	31.5	16.9	5.4
S-11	28.9	15.7	13.3	22.1	13.2	12.0	17.9
S-12	31.1	44.1	29.1	37.2	25.3	35.3	14.7

(All values are expressed in mg/L)

TABLE-4
PHYSICO-CHEMICAL ANALYSIS OF THE EFFLUENTS COLLECTED IN THE MONTH OF JULY 1999

Station	Colour	Temp. (°C)	pH	TS	TDS	TSS	Chloride	Oil and grease
S-1	Light Brown	29.9	5.54	480	298	182	105	4.4
S-2	Colourless	28.7	6.89	598	310	288	190	47.0
S-3	Brown	30.0	7.69	1192	875	317	190	19.0
S-4	Yellow	31.1	7.19	2750	2012	738	121	16.0
S-5	Colourless	30.2	7.29	1130	985	145	163	15.1
S-6	Blue	28.9	6.95	4890	4225	665	132	5.9
S-7	Bluish Black	29.4	5.69	4010	3202	808	227	2.9
S-8	Light Brown	27.9	6.21	2105	1890	215	209	1.4
S-9	Yellow	27.2	6.93	4990	3921	1069	195	7.9
S-10	White	29.3	7.95	980	752	228	187	3.2
S-11	Colourless	26.0	7.59	2975	2150	825	202	5.8
S-12	Dark Yellow	26.1	7.04	9428	8940	488	216	3.9

(Except colour and pH all the values are expressed in mg/L)

Station	Cr	Cd	Ni	Zn	Cu	Pb	Fe
S-1	29.1	22.6	15.7	24.3	14.4	27.8	6.1
S-2	30.2	16.3	13.3	21.7	29.3	19.3	10.0
S-3	16.2	21.3	15.1	20.2	11.3	7.9	5.0
S-4	30.5	17.1	14.2	20.4	21.7	19.3	6.0
S-5	19.6	15.2	13.3	18.3	15.5	21.4	7.9
S-6	11.9	21.3	18.4	24.7	20.6	12.7	4.9
S-7	50.1	56.0	48.1	39.3	27.4	59.3	8.9
S-8	23.3	39.3	21.4	20.1	21.3	24.7	10.4
S-9	12.0	17.1	9.0	16.5	26.4	34.3	7.1
S-10	19.3	22.1	15.1	2.5	27.7	3.1	5.0
S-11	20.2	13.4	10.2	15.7	8.9	5.2	14.0
S-12	28.0	30.2	19.0	27.3	16.3	22.3	13.8

(All values are expressed in mg/L)

TABLE-5
PHYSICO-CHEMICAL ANALYSIS OF THE EFFLUENTS COLLECTED IN THE MONTH OF SEPTEMBER 1999

Station	Colour	Temp. (°C)	pH	TS	TDS	TSS	Chloride	Oil and grease
S-1	Light Brown	27.2	6.11	412	302	110	118	3.6
S-2	Colourless	26.7	6.93	608	328	280	200	41.0
S-3	Brown	27.0	7.33	1150	890	260	207	17.0
S-4	Yellow	28.7	7.29	2658	2015	643	132	10.0
S-5	Colourless	29.8	6.80	1095	905	190	169	11.7
S-6	Blue	27.0	7.34	4775	4015	760	133	4.3
S-7	Bluish Black	25.0	5.51	3890	2985	905	235	3.3
S-8	Light Brown	25.9	5.89	2094	1790	304	212	1.0
S-9	Yellow	26.0	7.40	4284	3495	789	197	7.3
S-10	White	28.0	7.79	790	556	234	188	2.5
S-11	Colourless	24.2	7.90	2885	2180	705	205	5.6
S-12	Dark Yellow	25.8	7.29	9628	8805	823	216	3.2

(Except colour and pH all the values are expressed in mg/L)

Station	Cr	Cd	Ni	Zn	Cu	Pb	Fe
S-1	30.0	28.2	10.1	25.2	13.2	14.7	5.0
S-2	32.2	19.3	12.3	20.2	15.1	12.3	8.1
S-3	21.1	17.3	10.3	19.1	8.2	4.3	4.2
S-4	33.3	16.4	12.1	19.3	19.0	15.1	4.8
S-5	20.1	29.1	12.1	19.7	18.3	19.2	6.2
S-6	11.3	19.2	18.3	33.2	15.2	8.1	4.2
S-7	51.2	48.1	41.2	44.5	25.2	27.3	7.2
S-8	29.2	29.1	19.1	21.1	21.9	11.3	7.9
S-9	10.0	14.3	8.2	10.3	21.2	28.4	7.2
S-10	22.1	20.1	11.2	2.0	15.4	2.4	4.0
S-11	21.0	8.3	11.1	11.0	6.3	9.1	9.9
S-12	26.2	26.1	16.4	15.3	12.3	19.2	12.1

(All values are expressed in mg/L)

TABLE-6
PHYSICO-CHEMICAL ANALYSIS OF THE EFFLUENTS COLLECTED IN THE MONTH OF NOVEMBER 1999

Station	Colour	Temp. (°C)	pH	TS	TDS	TSS	Chloride	Oil and grease
S-1	Light Brown	28.3	4.77	510	380	130	130	5.8
S-2	Colourless	28.0	8.30	698	440	258	210	62.0
S-3	Brown	28.2	8.70	1204	910	294	214	21.0
S-4	Yellow	29.3	8.37	2806	2220	586	145	23.0
S-5	Colourless	33.1	6.13	1390	1025	365	171	23.1
S-6	Blue	30.3	6.51	5125	4412	713	148	8.4
S-7	Bluish Black	27.4	4.90	4228	3990	238	248	3.5
S-8	Light Brown	28.3	4.92	2790	2095	695	224	1.9
S-9	Yellow	28.1	6.11	5500	4385	1115	201	8.9
S-10	White	29.5	6.52	1120	715	405	192	5.1
S-11	Colourless	25.5	8.91	3302	2460	842	209	6.4
S-12	Dark Yellow	26.9	6.89	9980	9125	855	227	4.6

(Except colour and pH all the values are expressed in mg/L)

Station	Cr	Cd	Ni	Zn	Cu	Pb	Fe
S-1	38.2	32.3	29.0	31.3	20.1	21.5	6.2
S-2	36.3	23.3	20.2	32.1	24.3	18.1	8.7
S-3	24.3	19.1	17.3	26.4	14.6	8.3	4.9
S-4	34.1	20.3	21.7	20.4	28.2	16.1	6.4
S-5	25.7	31.7	25.9	22.7	23.1	24.1	7.6
S-6	18.4	33.3	26.5	41.3	21.2	13.4	4.1
S-7	64.3	52.5	47.4	59.2	34.3	41.6	7.0
S-8	34.1	37.8	30.5	31.4	19.3	16.7	7.5
S-9	19.9	20.2	12.3	16.4	28.7	31.6	8.3
S-10	27.2	24.4	17.9	7.5	21.2	3.2	4.4
S-11	21.1	13.3	8.3	17.2	7.0	8.2	10.6
S-12	30.1	27.0	20.1	24.2	16.2	23.1	12.8

(All values are expressed in mg/L)

It is seen from the results that the industrial effluent is highly polluted. It can be said that, although they may be treating water before sending it as an effluent, the water treatment procedures currently adopted by the industries are insufficient as compared to their waste generated. It is proposed that there should be an inbuilt effluent treatment plant for each industry and there also should be a common treatment plant for the common effluent. It may be that there is a water effluent treatment plant existing either common or separate in each industry, but the results obtained are indicative that the operations of these effluent treatment plants should be properly taken care of.

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