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Physico-chemical Characterization of Water Body with Special Reference to Battery, Power Sources and Metal Plating Effluents

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ABSTRACT

The World is facing a tremendous set of environmental problems which are due to the contaminated ground water and hazardous waste effluents coming out of process industries due to advanced industrialization in different field. Thus, it is essential to rectify this problem.

Key words: Water bodies, Battery, power sources, Metal plating effluents.

INTRODUCTION

The life on the earth depends on the water. Everything originated in the water and sustain by water. It is most common abundant, indispensable, inorganic component of the earth's environment, constitutes living matter predominantly. It is a prime resource and physiological necessity to mankind.

This work include the sample collection technique, collection, preservation and handling of collected sample. The collected samples were analyzed for the determination of Physico-chemical parameter i.e. colour, temperature, Eh, pH, specific conductivity, total solid, dissolved solids, acidity total hardness, alkalinity, TDIC, TOC, DO, BOD, COD & Phenols[1-2].

Analysis of cadmium, chromium, nickel, copper, iron, lead, zinc, manganese, magnesium, arsenic, calcium & vanadium ions performed with the help of Flame Atomic Absorption spectroscopy[13-14].

Carbonates, bicarbonates, sulphide, sulphate, phosphate, total-N, nitrate-N, nitrite-N, organic nitrogen and chlorides are analyzed using standard method.

EXPERIMENTAL

The samples collected from the effluents at the time of mixing into the river khan were analyzed to determine various physico-chemical parameter and to study the preserve of cations and anione. As there are no. of different resourced which are discharging continuously their effluents in the river. Due to this a separate study was carried out on the effluents of each source at the function point and tabulized accordingly work is performed on the effluents discharge by,

i. Battery and power sourced effluents.
ii. Metal plating effluents.

For the determinants of undertaken parameters, a set of four sample from each source on each data as given in the table were analyzed for the year 2005-06 and results are summarized in the subsequent tables.

RESULTS AND DISCUSSION

Battery & power sources

The effluent contains toxic cations viz. Vi, Cd, Zn, Pb & traces of v. The major fractions constituted from this industry is lead it's highest concentration was found in March and April. The

Table 1:Battery and Power Sources : Analysis of physico chemical characteristics of effluents

Date	9-Jan-05				15/4/2005				28-Jul-05				8-Nov-05			
SS→P↓	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
1	Bf	-	-	Bf	-	-	-	Bf	-	-	-	Bf	-	-	-	Bf
2	23	22	20.8	21.2	31	29	29.2	27	31	31	30.3	30.3	28.7	28.4	23	23.9
3	5.2	5.4	7.1	7.1	4.9	4.9	6.9	6.7	4.4	4.6	7.3	7.3	4.4	4.5	7	6.9
4	49	49	37	37	48	48	57	57	61	59	30	30	61	58	32	35
5	13.5	13.8	14.3	14.3	13.2	13.6	12.3	13.2	14.1	13.4	12.6	12.8	14	12.9	12.9	13.5
6	300	281	123	164	12.2	109	90	98	211	184	121	136	142	113	111	113
7	82	73	42	45	72	69	52	66	52	45	66	73	61	58	53	59
8	382	342	161	211	192	178	142	163	262	232	184	211	201	169	163	172
9	nd	-	-	-	nd	nd	-	-	nd	-	-	-	nd	-	-	-
10	-	-	-	-	nd	nd	-	-	nd	-	-	-	nd	-	-	-
11	610	559	200	241	702	663	212	242	601	579	163	221	542	511	142	181
12	13	9.6	1.6	2.1	3.9	3.5	1.3	1.5	18	12.4	1.6	3	2.1	1.69	1.4	2.8
13	nd	-	-	-	-	-	-	-	nd	-	-	-	-	-	-	-
14	19	2.2	2.6	2.3	3.3	3.3	2.9	2.9	2.6	2.8	3.3	4	3.1	3	3.2	3.2
15	581	532	301	322	642	611	361	415	512	470	282	293	483	478	288	306
16	341	320	158	173	411	386	141	159	353	340	166	160	301	304	152	148
17	390	362	162	181	260	253	140	149	470	449	138	162	456	429	134	161
18	321	301	162	178	342	318	181	192	311	302	136	152	262	242	146	158
19	nd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	38	26	19	15	41	34	30	25	26	12	9	12	36	30	14	19
21	nd	nd	-	-	-	-	-	-	-	-	-	-	36	30	14	19
22	132	109	61	85	52	46.9	42	47	161	149	53	66	111	91	56	65
23	6.2	4.2	-	0.7	4.2	3.2	nd	0.6	10	7.7	-	0.6	8.2	6.7	0.5	0.6
24	12	8	0.9	1.1	2	1.8	0.4	0.6	8.1	6	0.6	0.9	6.2	5.4	0.6	1
25	262	242	200	180	300	280	254	216	220	176	110	122	298	235	186	211
26	nd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	nd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	2.8	1.8	1.2	1.4	4.2	3.,9	2.6	1.9	2.9	1.9	1.4	1.2	4	3.6	2.8	1.2
29	1	0.7	0.46	nd	1.7	1.5	0.9	1	0.9	0.6	nd	0.11	1.3	1.2	0.8	0.9
30	nd	-	-	-	nd	-	-	-	nd	-	-	-	-	-	-	-
31	11	6.9	0.4	1.5	4.1	3.1	0.6	0.8	8.2	5.3	0.8	1.2	4.2	3.2	0.6	1.8
32	0.4	0.8	-	0.6	nd	-	-	-	nd	-	-	-	1.4	1	-	0.6
33	7.5	3.9	-	1.2	11	8.3	0.3	1.4	1.8	0.7	0.2	0.3	2.6	1.3	0.3	0.4
34	7.3	5.6	0.8	2.9	6.1	4.2	0.8	1.1	4.8	3.3	0.5	2.9	2.8	2.2	0.5	1.1
35	6.2	5.2	0.4	1	18	10	0.9	2.3	5.3	3.8	0.3	0.8	3.3	2.8	0.2	0.8
36	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
37	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
38	6.6	4.8	-	1.5	1.4	0.4	-	-	nd	-	-	-	4.3	3.3	-	-
39	1.3	4.1	2.8	2.9	13	11	8.1	11	11	6.6	3	3.6	4.2	2.8	1.9	2.1
40	0.6	0.03	0.9	nd	0.02	nd	-	-	nd	-	-	-	nd	-	-	-
41	nd		-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-

Table 2: Battery and Power Sources : Analysis of physico chemical characteristics of effluents

Date	**28-Nov-05**				**10-Mar-06**				**20-Jun-06**				**20-Sep-06**			
SS→P↓	**I**	**II**	**III**	**IV**	**I**	**II**	**III**	**IV**	**I**	**II**	**III**	**IV**	**I**	**II**	**III**	**IV**
1	bn	-	-	-	bf	-	-	-	bf	-	-	-	bf	-	-	-
2	26	24	22.6	22.2	27.1	26	26.2	25.9	38.5	36.9	33	33.3	38	37	30.8	30.9
3	4.7	4.9	7.1	6.9	5.1	5.2	6.8	6.7	4.8	4.9	6.9	6.9	4.8	4.8	7.1	6.9
4	54	50	58	55	50	49	52	56	54	62	58	55	62	61	58	55
5	14.1	14.5	13.2	13.6	13.6	13.5	13.8	13.9	14.2	12.1	13.2	13.9	12.1	12.1	13.2	13.9
6	241	216	131	145	145	133	96	102	156	143	98	108	192	168	128	129
7	71	63	39	58	58	49	38	72	66	62	33	43	79	66	39	42
8	311	283	162	201	201	180	133	172	221	239	129	43	268	256	158	176
9	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
10	562	540	242	284	641	610	262	232	654	642	282	292	512	484	211	239
11	17	13	2.3	3.2	12	9.3	2	2.5	16	12.8	2.4	3.2	21	16	2.7	3.4
12	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
13	2.4	2.8	3.6	3.4	3.2	3.6	2.8	2.8	3.4	3.4	3.2	3.2	2.8	2.9	3.1	3.1
14	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
15	312	297	177	189	419	407	166	161	393	381	161	169	328	314	179	192
16	573	563	373	391	711	681	390	456	581	577	381	412	543	521	332	356
17	342	328	173	192	282	261	163	172	372	356	155	172	400	376	163	188
18	312	310	182	189	362	341	214	131	372	346	212	229	402	373	186	201
19	nd	-	-	-	nd	nd	-	-	nd	-	-	-	nd	-	-	-
20	nd	-	-	-	nd	nd		-	nd	-	-	-	nd	-	-	-
21	nd	-	-	-	nd	nd	-	-	nd	-	-	-	nd	-	-	-
22	156	134	53	72	61	60	-	46	81	73	47	47	140	126	41	51
23	6	3.8	-	0.4	4	2.8	-	0.5	5.3	2.7	0.2	0.4	6.2	4.6	0.5	0.4
24	12	7	0.8	0.6	3.4	2.2		0.9	1.9	1.4	0.5	0.6	9.6	8.3	0.6	0.9
25	nd	-	-	-	nd	-	42	-	nd	-	-	-	nd	-	-	-
26	nd	-	-	-	nd	-	0.4	-	nd	-	-	-	nd	-	-	-
27	nd	-	-	-	nd	-	0.6	-	nd	-	-	-	nd	-	-	-
28	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
29	6.6	3	1.4	1.6	5.3	3	2.7	3	8	7.3	4.8	5	6	4.4	3.2	3.8
30	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
31	9	6.8	0.8	1.3	5.6	4.4	0.2	1.2	6.3	5.2	0.6	1.6	6.2	4.9	0.8	1.2
32	2.2	1.6	0.8	1	nd	-	-	-	nd	-	-	-	2.1	1.6	0.5	1
33	14	9.3	0.6	2.2	8.2	6.6	0.2	1	6.2	5.2	0.8	1.2	6.2	4.8	0.6	1.6
34	5.8	4.4	0.8	2.2	8.1	6.3	1.1	3.6	8.3	6.7	1.3	4	5.3	4.6	0.6	1.8
35	7.2	5.9	0.2	1.2	13	9.2	0.6	1.8	9.2	6.2	0.3	1.2	4.2	3.6	0.6	0.8
36	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
37	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
38	3.9	2.9	0.8	1.6	2	1.4	0.6	1.2	2.4	-	0.6	0.8	1.6	1.2	1	1.2
39	17	9	3.4	4.2	13	11	9	6.4	9	6.6	5	6.5	14	15	9	11
40	0.04	nd	-	-	-	-	-	-	0.1	-	-	-	nd	-	-	-
41	nd	-	-	-	-	-	-	-	nd	-	-	-	nd	-	-	-

Table 3 :Battery and Power Sources : Analysis of physico chemical characteristics of effluents

Date	09-Jan-05				15-Apr-05				28-Jul-05				08-Nov-05			
SS→P↓	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
1	G	-	-	-	G	-	-	-	T	-	-	-	G	-	-	-
2	21	20	20	21.1	25	26	28	28.1	29	27.9	27.4	27.2	27.4	26.6	25.6	26.3
3	3.9	4.8	6.8	6.8	5	5.8	6.8	6.8	4.8	5.8	8	8	5.1	5.6	6.6	7.3
4	67	49	56	57	47	38	58	55	43	37	57	58	48	40	54	54
5	15.2	13.2	13.2	13.4	13.6	15.6	13.2	12.9	13.8	14.7	12.8	12.6	13.3	15.3	13.4	12.8
6	999	901	316	482	2901	2631	1211	2051	661	606	291	436	796	719	291	462
7	236	201	126	222	701	472	392	242	331	304	181	294	251	261	141	305
8	1236	101	441	711	3601	3101	160	2291	990	910	471	730	1045	981	431	764
9	101	93	241	246	716	669	601	616	211	193	211	206	171	156	201	210
10	69	63	451	451	531	476	366	401	96	85	411	418	76	75	341	353
11	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
12	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
13	0.8	0.66	0.5	0.2	1.1	0.9	0.3	0.2	0.66	0.5	-	0.3	0.5	0.33	-	-
14	2.6	2.7	3.3	3.1	1.5	1.7	2.1	1.8	2.6	2.8	3.5	3.4	2.9	3.1	3.2	3.2
15	471	463	163	236	496	471	171	241	411	393	181	206	526	493	171	241
16	171	153	153	113	181	171	101	121	156	148	107	111	161	153	108	121
17	171	162	142	160	202	148	161	168	150	139	122	124	311	292	132	164
18	150	126	115	110	625	606	131	196	121	99	92	96	62	43	90	96
19	-	-	-	-	nd	nd	-	-	-	-	-	-	nd	-	-	-
20	-	-	0.2	-	-	1.5	4	1.3	-	-	-	-	nd	0.8	0.5	0.2
21	44	38	92	104	282	241	201	221	59	50	101	123	50	42	98	120
22	34	30	110	112	252	215	165	81	36	32	23	129	28	26	109	114
23	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
24	0.1	0.1	-	-	0.3	-	-	-	0.6	-	-	-	0.1	-	-	-
25	26	25.3	15	16	28	19	12	18	30	18.4	12	12.8	15	12.1	12.5	12.6
26	nd	-	-	-	9.2	6.2	5	5.4	nd	-	-	-	nd	-	-	-
27	7.1	6.3	4.5	5	-	-	-	-	8	7.2	4.8	5.3	6	5.1	3.2	4
28	13	10.8	4.2s	6.3	4.2	3.2	3.8	4	7.4	6.2	4.4	6	8	9	4.6	6.2
29	15	1.4	1.4	3.8	7	5.1	0.9	2	14	11	4.1	4.4	9.1	8	2.5	3.1
30	1	0.7	nd	0.3	1.3	1.2	-	1	0.6	0.5	0.2	0.26	0.5	0.3	0.2	0.2
31	5.3	3.3	0.4	1.2	16	9.3	-	4.1	5.8	5	0.6	2.1	7.6	6.1	0.3	2.8
32	nd	-	-	-	2.1	2.2	0.3	1	4.1	1.3	1.7	2.1	1.7	4.3	1.6	2.9
33	21	16.4	0.7	3.2	20	9	1.6	1.9	10	6	0.8	3.6	6	4.9	1.1	2.2
34	20.1	16.3	7	9.9	15	11.3	4.1	10	25	20	7.3	8.9	10.1	9.1	5	5.9
35	1.5	0.6	0.1	0.2	0.5	0.2	-	0.1	1	0.5	-	0.2	0.8	0.3	0.3	0.3
36	18	13	0.7	5.1	30	17	7.2	12	20	15.2	0.6	8.3	22	15	0.3	0.8
37	nd	-	-	-	nd		-	-	nd	-	-	-	nd	-	-	-
38	0.48	0.3	nd	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
39	101	81	75	79	101	83	41	63	181	121	103	95	221	197	141	163
40	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
41	nd	-	-	-	nd	-	-	-	nd	-	-	-	-	-	-	-

Table 4: Battery and Power Sources : Analysis of physico chemical characteristics of effluents

Date	28-Nov-05				10-Mar-06				20-Jun-06				20-Sep-06			
SS→P	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
1	G	-	-	-	T	-	-	-	T	-	-	-	G	-	-	-
2	27	25.5	24.2	25	28	26.2	26	26	40	40	39	38.9	31	30	28	27.6
3	4.8	5.4	7.2	7.1	4.9	5.2	6.9	6.8	4.9	6	6.5	6.6	4.6	6.2	7.9	7.9
4	62	46	59	58	49	49	58	55	49	49	53	52	53	-51	-40	-40
5	12.2	13.9	12.6	13.2	13.5	13.5	13.2	13.2	13.5	13.5	12.8	13.1	14.1	12.4	14.3	14.3
6	2001	1582	502	711	2402	2160	1002	1600	2604	2500	1201	1701	1601	1313	362	661
7	901	981	311	571	699	411	240	290	128	605	270	291	401	331	241	231
8	2901	2561	812	1281	3100	2561	1240	1893	2734	3100	1461	1990	2003	1640	602	992
9	302	272	392	405	606	578	411	465	732	501	285	312	316	284	410	428
10	nd	-	-	-	-	-	-	-	nd	-	-	-	nd	-	-	-
11	nd	-	0	-	-	-	-	-	nd	-	-	-	nd	-	-	-
12	171	161	311	327	427	416	382	392	492	470	384	397	211	196	340	372
13	2.7	2.9	3.3	3.3	1.8	2.1	2.4	1.9	2.1	1.8	2.8	2.4	3.1	3.2	3.7	3.7
14	nd	-	-	-	nd	-	-	-	nd	-	-	-	0.82	-	-	-
15	175	171	111	111	166	148	121	1239	152	138	116	127	186	176	109	122
16	471	460	189	189	601	566	185	266	560	520	181	271	511	495	185	244
17	201	192	156	173	181	136	173	175	186	164	171	178	162	153	146	148
18	216	201	85	104	401	380	110	136	445	210	151	165	162	149	89	92
19	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
20	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
21	111	97	111	123	152	131	183	176	149	131	149	197	103	92	113	126
22	79	71	156	162	321	286	201	217	352	313	236	201	66	59	149	154
23	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
24	0.8	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
25	21	19	14.6	16	21	16.8	14	19.3	24	21.6	14	15	27	25.2	10	13
26	nd	-	-	-	7	5	6	6.1	12	8.3	6.4	6.5	nd	-	-	-
27	nd	-	-	-	nd	-	-	-	nd	-	-	-	14	12.3	8	8.9
28	9	7.7	4.6	6.9	5.4	4.5	4	4.3	5.6	5.2	4.8	6	6	4.6	5	5.3
29	10	8	1.2	1.9	8	5.9	1.2	2.6	6	4.6	1	2.2	7	5.5	1.9	2.1
30	0.3	0.3	0.05	0.2	1.3	1.2	0.9	1	0.8	0.5	0.1	0.3	0.6	0.05	0.08	0.16
31	10	7	1	2.8	9.1	6.2	2	2.6	7	4.3	3.6	2.8	5	3.9	0.2	1.6
32	2	1.7	0.3	0.9	3	2	0.4	0.9	1	0.6	0.2	0.3	5.1	4	1	1.6
33	12	7.6	0.6	3.2	12	8	0.5	2.4	9	4.3	0.4	1.1	5	5	0.5	2.2
34	8	6	3	3.6	20	16	5.6	8.2	25	18	5.8	14.2	12	8.5	3.9	5.3
35	0.8	0.6	0.2	0.3	0.5	0.3	-	0.2	0.9	0.4	-	0.2	0.9	0.5	0.3	0.4
36	7	4.6	0.3	2.1	0.9	7.1	6.1	5.2	13	7	0.3	4.2	6	3.9	0.1	1.7
37	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
38	0.02	-	-	-	0.6	0.02	-	-	0.5	0.3	-	0.2	0.02	-	-	-
39	100	96	90	102	40	28	49	49	61	50	42	47	180	181	161	180
40	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-
41	nd	-	-	-	nd	-	-	-	nd	-	-	-	nd	-	-	-

values decreased largely in downstream. Ni was found in the range of 11.0.4 ppm, with a decreasing trend with season and year. Vanadium was identified from the residence of oil fired boilers and flue, liner, vanadium in water may be accounted for teaching from residence.

The discharge from battery industries related particularly with the recyclic activity, contributes the major fraction of the toxic materials to the water of river khan. The COD, values were high owing to in organic chemicals. DO & BOD values followed decreasing trend towards downstream.

The efficient acidic in nature having pH<4.4 Though the quantity of discharge is less but it's effects are considerably harmful to aquatic biota.

Among the major anions identified form the effluents were carbonated, sulphates, chlorides and phosphates.

The organic content was found to be high which are characteristics of the TDC values depicted as in the table (2T1 - 2T8). Apart from these, phenols were identified from the effluent of transformer and polymer processing wastes which are dumped in the vicinity of river Khan and related site.

Metal Plating/Refining

Because of diversified applications the waste effluent from electroplating contributed a variety of toxic and hazardous anions viz. carbonates, chlorides, sulphates and also the cations viz. copper, cadmium, zinc and nickel etc. The effluents directly taken from source differ in appearance owing to different processes.

Effluent was acidic in nature at source, which had slightly shifted to neutral after being discharged into the stream and at the downstream pH remained < 7.1.

Concentrations of total solids existed high in the effluent. The concentration at the source was highest in April and March. About 75% of total solids was present in dissolved state and remaining is in suspended form. Thus the dissolved solids increased total solids in suspended form. Thus the dissolved solids increased total solids in April.

The COD values increased with total solids while the BOD values does not reveal any significant observation.

Among cations chromium (o.5-30 mg/L) (0.3-13mg/L during Jan. 05-Nov. 05 and Nov. 05-Sept. 06 respectively and cadmium (at source) ranged (1.9-21mg/L) during Jan. 05 - Nov. 06 and (0.5 - 12 mg/L) during Nov. 05 - Sept. 06. In downstream the concentrations of chromium were also found very high and may be explained in terms of high sulphates and due to the low sedimentation property of chromium. In contrast to chromium, cadmium reduced completely in downstream. The

P- Parameter	SS-Sampling Site I to IV
1. Color	21 Bicarbonate
2. Temperature °C	22 Carbonate
3. pH	23 Phenol
4. Eh in MV	24 Phosphate
5. Specific Conductivity in MS	25 Total N
6. Dissolve Solids	26 Nitrate-N
7. Suspended solids	27 Nitrite-N
8. Total Solids	28 Organic-N
9 Alkalinity	29 Iron
10 Total Hardness	30 Copper
11 Acidity	31 Nickel
12 T.O.C.	32 Manganese
13 T.D.I.C.	33 Cadmium
14 D.O.	34 Zinc
15 C.O.D.	35 Lead
16 B.O.D.	36 Chromium
17 Chloride	37 Magnesium
18 Sulphate	38 Vanadium
19 Sulphite	39 Calcium
20 Sulphide	40 Tin
41 Arsenic	

Mean concentration (except colour, temperature & pH) expressed in Mg./L

G - Gray, T - Turbid, Bf - Buff, n.d. - Not Detected

presence of ions in the source needs special attention as it concerts more Cr(VI) to Cr (III) resulting in high dissolved concentration of Cr (III). Apart from these, nickel and zinc were also contributed from other pools constituting a mined effluent.

The metal refining processor also discharge highly toxic forms of metallic species such as vanadium, lead etc. High levels of lead were detected in the out coming effluents. The results of analysis is given in table from (2T9-2T16).

CONCLUSIONS

The effluents coming into water body (Pond) is characterized to be highly acidic in nature having pH<4.4. Though the quantity of discharge from industrial unit is less but it's effects are considerably harmful to aquatic biota. The waste effluents from electroplating contributed a variety of toxic and hazardous anions as discussed on the basis of available date of study.

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