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## Reduction of chromium in the vicinity of Industrial area, Srikakulam Dt. (A.P.)

A.V.L.N.S.H.Hariharan<sup>1</sup>, J.V.S.K.V.Kalyani<sup>1</sup> and T.Siva Rao<sup>2</sup>

<sup>1</sup> Department of Chemistry, GITAM Institute of Technology, Gitam University, Visakhapatnam – 530 045, INDIA.

<sup>2</sup> Department of Inorganic and Analytical Chemistry, Andhra University, Visakhapatnam – 530 0035, INDIA,

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**Abstract:** Analysis of heavy metals – (iron, copper, chromium, lead and zinc) in effluent samples collected in the vicinity of M/s. Samkerg pistons & Rings Ltd., Srikakulam Dt.) has been carried out for a period of two months during January & February (2014) in Srikakulam Dt.(A.P.). The concentration of these metals except chromium were found well within the limits as per the standards. The results obtained in the study were compared by carrying out the same procedure with synthetic samples. Attempts were made to reduce contamination due to chromium using analytical techniques.

**Keywords:** Chromium (VI) - Srikakulam industrial effluents- synthetic samples

### INTRODUCTION

The pollution due to toxic heavy metals is increasing with industrial progress<sup>1,2</sup>. Heavy metals [such as chromium (Cr), iron (Fe), cadmium (Cd), copper (Cu), lead (Pb) and zinc (Zn)] etc. are major pollutants in marine, ground industrial and even treated wastewaters<sup>3,4</sup>. In the developing countries like India food safety and quality are most important in maintaining human health. Effluents emanating from the mining industry and metal plating factories contain dissolved heavy metals<sup>5</sup>. Cr(VI) is more toxic than Cr(III). It is also responsible for chrome ulcer and kidney damage<sup>6,7</sup>. Sources of contamination of chromium in the environment are Chlor-alkali, electroplating, leather textiles,

pigments, metal finishing, mining and metallurgical industries. The ash from thermal plants of burning of coal as fuel in various industries contain significant amount of chromium which seeps through earth and affects the fertility of land. Other environmental pollution problems are involved in the disposal of industrial effluents on to land such as possibility of chromium (III) being oxidized to chromium (VI), thereby increasing the release of chromium (VI) into the environment. In view of this dissolution in acid followed by selective extraction of chromium from the industrial waste requires necessary attention to be paid.

In the light of these, it is proposed to take up studies on the determination of heavy metals in the vicinity of M/s. Samkerg pistons & Rings Ltd., Varisham Village, Ranasthalam Mandal, Srikakulam District. AP.

## MATERIALS AND METHOD

Analysis of heavy metals has been carried out during monsoon winter and summer seasons for the ground water samples collected from these locations belonging to Srikakulam Dt., Sampling apparatus are washed with dilute sulphuric acid (1:1) and then rinsed with tap water and finally washed with redistilled water. One litre samples are collected in plastic carboys with all necessary precautions. They are appropriately labelled stating the location and date.

All the chemicals and reagents used were of analytical grade. D.D water was used for the preparation of solutions. Heavy metal analysis was done using Atomic absorption spectrophotometer type- AAS – SVL Spectronics–205 Model. The pH of the samples was determined by a pH-meter and conductivity was measured by a conductivity meter (Systronics). The results obtained were compared with WHO (1984)<sup>8</sup> as well as Indian standards (1992)<sup>9</sup> for drinking water.

**Procedure for extraction of chromium:** An aliquot (250ml) of the filtered effluent sample is taken and boiled till its volume is reduced to about 1/5 of the initial volume (50ml). The interference due to iron (III) (present in samples) in the proposed method of separation of chromium, the procedure adopted by Beccari *et al.*<sup>11</sup> was used. Iron (III) is separated as iron (III) –cupferron complex by precipitation, filtration and quantitative washing for complete recovery of chromium (III). The filtrate is then quantitatively transferred to a 100 ml beaker. Then chromium content present in it is oxidized to chromium (VI) using Ce(IV) as an oxidizing agent<sup>10</sup> (0.2 N solution of ammonium hexa nitrate cerate). After oxidation the solution is transferred to a 100 ml volumetric flask and made up to the mark. 20 ml of this solution is taken in 150ml separating funnel and is extracted with 20 ml of 0.025 M Tribenzyl amine (TBA) in chloroform. The aqueous phase is then neutralized with 1: 2 sulphuric acid and the chromium (VI) content in the solution is estimated by AAS. The total chromium content in the sample is then computed. A synthetic solution with composition Cr = (0.1 – 0.25) mg/l, Fe (III) = 0.25 mg/L is subjected to the above described separation procedure and tested for recovery of chromium (**Table - 3**).

## RESULTS AND DISCUSSION

The results of the analysis of heavy metal concentrations (Cd, Cr, Cu, Fe, Pb, Ni and Zn) obtained in the current study (for nearly 2 months) indicate that chromium content was found above the permissible limits as per Indian standards. **Table 1**. Hence a detailed study has been carried out to know about the contamination due to chromium. The pH values obtained were within the prescribed limits (6.93-7.77) and the Total Suspended solids (TSS) were found to vary between 7.0 and 15.9 ppm **Table-2**. Further studies were undertaken to know the extent of contamination especially due to

chromium. Hence the effluent samples were analyzed by direct determination (AAS method) and were compared with those done using solvent extraction method **Table 3**.

**Table 1:** Physico – Chemical Parameters of plating effluent Samples

Date	Temperature (°C)	pH	Cr	Cd	Cu	Fe	Pb	Ni	Zn
04-01-2014	27.02	7.60	30.5	0.005	0.0611	0.08	0.0065	0.008	0.256
19-01-2014	27.10	7.26	28.6	0.0071	ND	0.06	0.0022	0.002	0.175
23-01-2014	27.03	7.38	27.8	0.009	ND	0.29	0.0018	ND	0.281
29-01-2014	27.46	7.50	30.0	0.002	0.009	0.15	0.0048	0.007	0.025
03-02-2014	27.65	7.05	28.5	ND	0.006	0.53	0.002	0.021	0.138
07-02-2014	27.60	6.98	28.2	0.0032	0.004	0.06	0.029	0.009	0.33
12-02-2014	28.02	6.82	26.8	0.002	0.029	0.22	0.0022	0.018	0.032
15-02-2014	27.93	7.36	28.9	0.009	0.003	0.33	0.046	0.025	0.042

**ND = Not Detectable**

**Table 2:** Analysis of plating effluents for chromium

S.No.	Date	Temperature( °C )	pH	TSS	Amount of Cr found(ppm)
1	06-01-2014	27.52	7.46	11.2	30.5
2	12-01-2014	27.10	7.42	12.5	30.1
3	18-01-2014	27.35	7.34	15.9	28.8
4	20-01-2014	27.64	7.28	11.3	29.6
5	21-01-2014	27.15	7.20	10.5	27.2
6	24-01-2014	27.98	7.68	8.6	30.0
7	26-01-2014	27.76	7.85	12.5	26.5
8	28-01-2014	27.27	7.48	9.6	28.2
9	30-01-2014	27.52	6.93	8.3	27.8
10	01-02-2014	27.65	7.24	7.4	28.9
11	04-02-2014	28.02	7.64	7.0	28.2
12	05-02-2014	27.85	7.59	10.8	28.0
13	07-02-2014	27.95	7.63	8.5	29.2
14	09-02-2014	27.75	7.65	8.2	27.5
15	11-02-2014	27.92	7.77	7.9	26.1
16	13-02-2014	28.06	7.70	10.2	27.9
17	14-02-2014	27.88	7.63	11.4	27.5
18	17-02-2014	28.02	7.70	10.5	28.2

**Table 3:** Analysis of plating effluents (Extraction method)

Sample	Chromium (VI) added (ppm)	* Chromium found after recovery extraction (ppm)	% recovery
Synthetic sample 1	10	9.8	98.00
2	20	19.4	98.67
3	25	24.2	96.00
4	30	29.6	98.40
Effluent samples			
14-09-2013	---	---	30.2 (ppm)
03-10-2013	---	---	27.9
07-10-2013	---	---	28.6

**Reduction of chromium:** The results obtained on total chromium content (expressed as hexavalent chromium) was found to vary between 26.8 and 30.5 ppm **Table 2**. Hence the probable reduction of chromium has been tried attempts were also made to treat the effluent in order to reduce Cr(VI) to Cr(III) using (standard) ferrous sulphate solution. Different volumes of the stock solution were (0.020N) used to repeat the experiment until the optimum condition to obtain minimum chromium content. It was found that 97.0ml of ferrous sulphate is needed for reducing the chromium content from 30.5 ppm to 0.047ppm **Table 4**. During the process of treatment ferrous iron is converted into ferric hydroxide which forms brown coloration to water.

**Table 4:** Reduction of chromium in samples from industrial wastes

Sample	Iron (II) added (ml)	Chromium reduced (ppm)	TSS (ppm)
1	0	30.4	2.4
2	10	25.3	3.8
3	20	20.8	4.6
4	40	15.4	7.8
6	60	10.2	8.2
7	80	7.1	9.0
8	82	6.3	12.4
9	84	3.3	13.5
10	86	1.7	16.3
11	88	0.29	19.1
12	89	0.16	21.7
13	90	0.096	20.9
14	93	0.085	22.0
15	95	0.062	23.6
16	97	0.047	23.4

## CONCLUSION

The results of the present study (using different methods) have indicated that chromium concentration is at higher level (30.5 ppm). The extent of pollution due to electro plating effluents was decreased by adopting possible method of treatment for chromium and its reduction has been developed. It is found that chromium concentration was reduced below the permissible limits .ie., reduction of chromium (VI) to chromium (III) can be done effectively up to 0.047 ppm which is within permissible limits. Variation of TSS with Fe (II) showed inverse order (Table-4).

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**\*Corresponding author: A.V.L.N.S.H.Hariharan;** Department of Chemistry, GITAM Institute of Technology, GITAM UNIVERSITY, Visakhapatnam – 53