INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY

Volume: 2: Issue-1: Jan-Mar -2011 IJABPT *ISSN 0976-4550*

TREATMENT OF ELECTROPLATING EFFLUENTS FOR REDUCTION OF CHROMIUM

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ABSTRACT: Chromium (VI) is moderate to severe toxic which is responsible to produce deleterious effects in human beings and animals. The sources of contamination of chromium in natural waters and in the environment are from electroplating, tanning industries and waste solution from oxidative dyeing and leaching from sanitary land – fills. Hence the determination of chromium is of great interest to analytical and environmental chemists. The present study deals with the determination of physico-chemical parameters of electroplating effluents collected from a local industry. Probable reduction of hexa valent chromium was also attempted using standard iron (II) sulphate solution.

Key words: Chromium content - Reduction -- Treatment – Industrial effluents.

INTRODUCTION

The presence of toxic heavy metals such as chromium, mercury, cadmium etc. in aqueous metals in aqueous streams ,arising from the discharge of untreated metal containing effluents into water bodies is one of the most environmental issues. The heavy metals in particular hexavalent chromium is very much harmful. It was reported earlier that a high concentration of chromium(12mg/Lt) has been found in ground water(.Beena,2002). Exposure to Cr(VI) causes cancer in digestive tract and lungs(Mancuse,1951). And may cause nausea, vomiting, diarrhea and hemorrhage (Valkovic,1975) It is also responsible for chrome ulcer and kidney damage. The main sources of chromium in the environment are tannery, paint ,chlor-alkali and aluminum metal manufacturing industries etc. Hence it is very much essential to remove Cr(VI) from industrial waters .The discharge of Cr(VI) as per regulatory standards is below 2mg/Lt (Tiwari,.et al. 1989). The main aim of the present investigation is to carryout determination of chromium and its possible reduction from electroplating effluents.

MATERIALS AND METHODS

Electroplating effluents(New Bina electroplaters, Bowdara Road, Visakhapatnam) were collected for a period of 20 days in clean polythene bottles. The samples were analyzed for pH using Systronics digital pH meter type .. Total Suspended Solids (TSS) was determined by taking 250ml of the effluent in a volumetric flask and allowed to filter through a Gooch crucible containing asbestos mat.. The suspended solids retained in the crucible were washed with DD water to remove chloride. The crucible was dried, cooled in a desiccator and weighed. The increase in weight of the crucible was taken equivalent to TSS.

More sensitive spectrophotometer or atomic absorption spectrometry (AAS) are used to determine chromium in waste waters. In industrial waters it most convenient to determine chromium in the form of chromate in presence of other metals as their cations (Padarauskas, 1993).

PROCEDURE

An aliquot (250ml) of the filtered effluent sample is taken and boiled till its volume is reduced to about $1/5^{th}$ of the initial volume (50ml). The filtrate is then quantitatively transferred in to a 500ml beaker.

The chromium (III) present (if any) in it is oxidized to chromium (VI) using Ce(IV) as an oxidizing agent (0.2N solution of ammonium hexa nitrato cerate) (Blundy,1958). After oxidation the solution is transferred to a 250ml volumetric flask and made up to the mark. 10ml of this solution is taken and the separation of chromium (VI) is then carried out by extraction with 10ml of 0.025M TPAsO in benzene followed by stripping with1.0M NaOH and estimated the chromium content as Cr(VI) –DPC complex at 540nm using UV-visible spectrophotometer type UV-260 as per the procedure described earlier(Hariharan,2008).

RESULTS AND DISCUSSION

The results obtained in the present study are given in Table.1.

Table-1.Physico- chemical characteristics of electroplating effluents

S.No.	Date	Temperature	pH	TSS	Amount of Cr found(ppm)
1	20-11-2010	28.05	7.06	22.3	62.66
2	21-11-2010	26.90	7.48	21.9	64.40
3	22-11-2010	28.03	7.54	22.8	62.72
4	23-11-2010	27.84	7.23	22.6	65.36
5	24-11-2010	28.32	7.40	22.5	60.18
6	25-11-2010	27.23	7.61	23.3	65.43
7	26-11-2010	27.82	7.20	22.0	64.85
8	27-11-2010	27.4	7.44	22.8	60.82
9	28-11-2010	26.8	6.93	17.5	62.45
10	29-11-2010	27.2	7.27	22.6	65.26
11	30-11-2010	28.03	7.24	22.2	62.72
12	01-12-2010	27.8	7.54	22.5	63.55
13	02-12-2010	26.9	7.26	21.4	65.28
14	03-12-2010	27.5	7.65	21.9	64.70
15	04-12-2010	28.2	7.21	21.3	61.75
16	05-12-2010	27.8	7.74	21.9	62.82
17	06-12-2010	27.5	7.36	22.0	64.72
18	07-12-2010	27.9	7.04	19.7	65.05
19	08-12-2010	27.3	7.36	21.2	64.12
20	09-12-2010	27.8	7.54	20.7	60.78

The pH value of present study were with in the prescribed limit(6.93-7.74).. The higher the Electrical conductivity , the less water is available to plants, even though the soil may appear wet. Water with electrical conductivity less than 0.7 m mhos/cm is considered to be safe. However, in the present study, the conductivity values of water are in the range of 0.276-0.621 m mhos/cm .
The TSS and Cr(VI) were found to vary between 20.7 and 23.3 ppm and 60.78 to 65.43 ppm respectively.(Table-1). Attempts were also made to treat the effluent in order to reduce Cr(VI) to Cr(III) using(standard) ferrous sulphate solution During the process of effluent treatment ferrous iron is converted into ferric hydroxide which forms brown coloration to water. Different volumes of the stock solution were (0.018N) used to repeat the experiment until the optimum condition to obtain minimum chromium content. It was found that 90.0ml of ferrous sulphate is needed for reducing the chromium content from 65.38 ppm to.0.07ppm.

Conclusions

It can be concluded that chromium(VI) content in samples was found to be 65.43 ppm (Maximum). Reduction of chromium(VI) to chromium(III) can be done effectively up to 0.042 ppm. which is within permissible limits. Variation of TSS with Fe(II) shows inverse order(Table-2).

Acknowledgements

Thanks are also due to Principal, GIT and Management of GITAM University for providing necessary facilities.

Table – 2 Reduction of Chromium in Samples and industrial wastes

Sample	Iron (III) added (ml)	Chromium reduced (ppm)	TSS (ppm)
1	0	38.0	2.2
2	10	26.5	3.5
3	20	23.2	4.6
4	30	19.8	6.8
5	40	15.6	7.3
6	60	11.2	8.8
7	80	6.9	9.6
8	82	3.2	11.9
9	84	2.8	13.7
10	86	0.6	16.6
11	88	0.18	19.5
12	89	0.06	21.7
13	90	0.042	23.3

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