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ENVIRONMENTAL MANAGEMENT SYSTEM IN ELECTROPLATING INDUSTRY – A CASE STUDY

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Abstract: India is recording a continuous growth in industrial development, leaving an impression that the country has potential to beat even most of the industrially developed countries of the world in a few years from now. This is true as well because the country has enormous resources – natural, mineral, technical and productive labor force. There is a direct impact of very nature of business on environment. In addition to complying with regulatory standards and norms, industries have to adopt clean technologies and bring about implementation in management practices. Environmental management is not, as the phrase could suggest the management of the environment as such, but rather the management of interaction by modern human societies with, and impact upon the environment.
Key words: Electroplating, Water, Waste Water, Waste minimization etc.

1. INTRODUCTION

Electroplating considered as a various techniques of metal finishing. It is a technique of deposition of a fine layer of one metal on another through electrolytic process to impart various properties and attributes, such as corrosion-protection, enhanced surface hardness, luster, color. They are also concerned with beauty or the appreciation of beauty to object. Electroplating process has applications in large scale manufacturing plants (e.g. automobile, cycle, engineering and numerous other industries), Job-work by small and tiny units. The main concern in Electroplating Industry is to control poisonous material discharged by it and also considered as a major polluting industry in India. In order to manage pollutants a variety of technique of treatment of waste are applied. These techniques for treatment as well as electroplating process require a large quantity of water, chemicals and equipments which again add the rate of process. Therefore, from economic point of view, there is a necessity to handle waste in a cost-effective manner. This holds with two procedures: waste minimization and recovery of chemicals from wastewater.

2. REVIEW OF LITERATURE

A water conservation and reuse study was done using a collaborative approach and project team. A study approach was developed and utilized to develop a site-wide water balance which was used to evaluate several alternatives to conserve and reused water. The recommendations were developed to decrease reliance on local public water supply by 80 percent and the key points include the great completion between the water needs of agriculture, industry, and the growing number of people in our world, and there are severe and ever-increasing freshwater shortages in many areas. The struggle for future water resources, while at the same time producing wastes and effluent which taint and damage the quality of this precious resource.

3. TYPICAL FLOWCHART OF ELECTROPLATING PROCESS

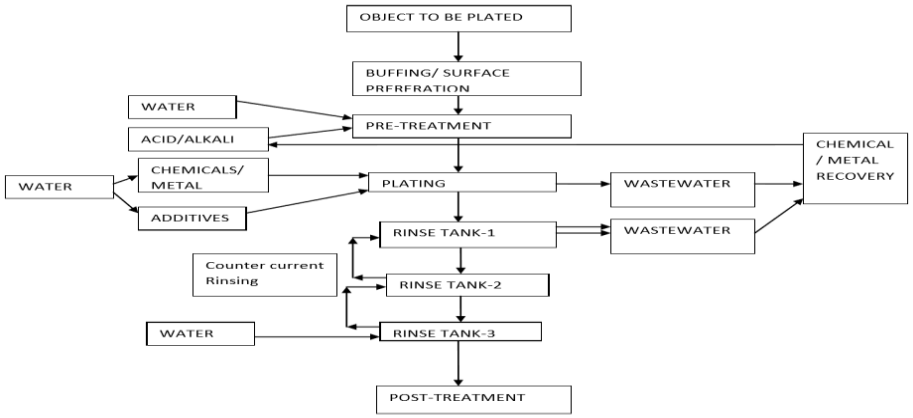

Figure 1: Typical Flowchart of electroplating process

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4. MATERIALS AND METHODOLOGY

To assess a system or facility, we have to primarily understand and practices carried out within. After understanding this, then deviations can be found out, this will help to suggest improvements for the existing practices. These improvements will further help in continual improvement of the environmental management systems of the facility.

The process and practices existing in the facility can be understood by field studies and inventories. These studies have to be carried out extensively and pre cautiously to get the exact and clear picture of the existing problem and finally arrive at a solution. These solutions and suggestions provided will improve and add in a better way to the existing environmental management system.

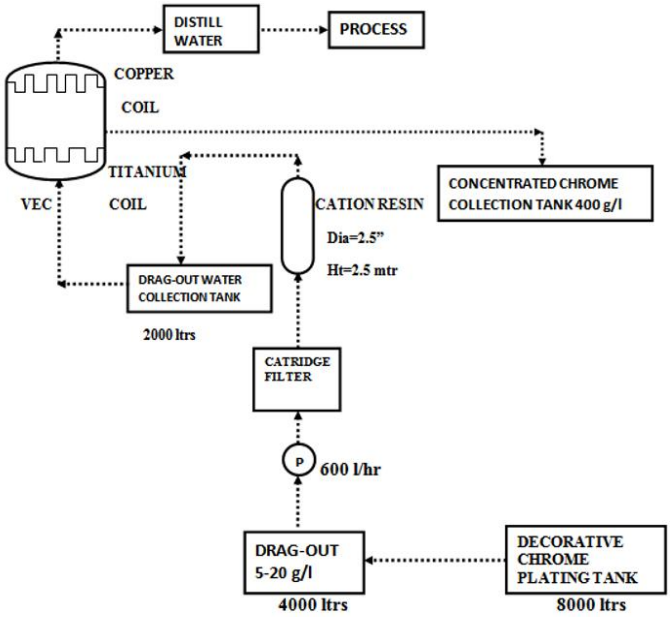

Figure2: Recovery process of Chromium in Chrome Recovery Unit

The sample which has to be coated with chromium is dipped in the decorative chrome plating tank of capacity 8000 liters and temperature of about 65-700 C. Next the coated sample is moved to the drag-out chamber of capacity 4000 liters, where the excess chromium is adhered to sample is removed. When the concentration in the drag-out chamber increases to about 20 g/l the pump of capacity 600 l/hr is switched on manually to pump the chromium from drag-out chamber to the cartridge filter where suspended particles are removed. Further it is passes to Cat ion resin chamber where the anions presented are removed. Then the solution is passed to the Drag-out water collection tank whose capacity is 2000 liters. From the drag-out water collection tank the solution is sent to the Vacuum Evaporation Chamber which consists titanium coil and copper coil. The solution is fed from the bottom where the titanium coil evaporates water from the solution and collects chromium near itself which is later taken to concentrated chrome collection tank with concentration of about 400g/l. The water evaporated is condensed near copper plate placed above in VEC and taken to the distill water tank which reused again in the process. Hence the process saves both water and chromium.

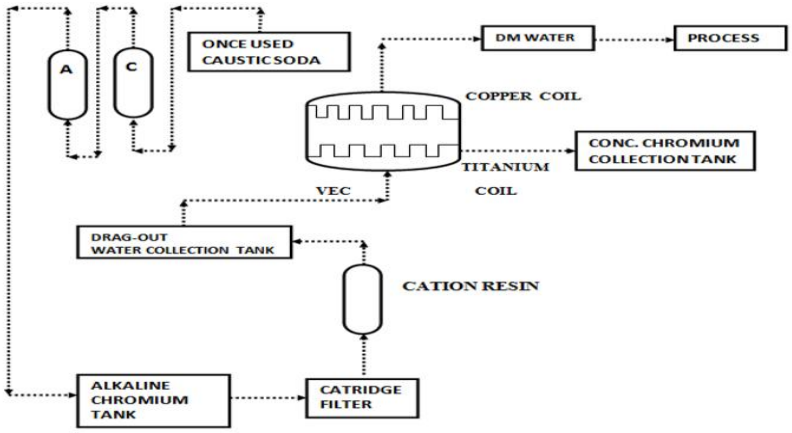

Figure 3: Recovery of Chromium by the standby Chromium recovery unit

After the regeneration process, the once used caustic soda is used rather than the fresh caustic soda. The once used caustic soda solution is passed through the cation and anion resin, the concentration of alkaline chromium is about the 26g/l in the alkaline chromium tank. The solution from the alkaline chromium tank is passed to the cartridge filter to remove the suspended particle, so that it helps to proper working of cation resin. In alkaline chromium we need only chromium, so this solution passed through the resin bed. In the Drag-out water collection tank, is used to collect then fed to the bottom of the vacuum evaporation chamber. When the volume reaches about the 170lites the titanium coil starts get heat and the solution get started to evaporate and is then collected at copper coil. The condensed water in the copper coil water is collected in distil water collection chamber and which is used in the process. The concentrated chromium tank is used to collect the chromium concentration which is further used in the chromium plating process or the concentrated chromium solution produced during regeneration is added to the chromium plating bath when needed.

4.1 Water Usage Management

The quantity of water utilized by the industry was analyzed, to identify and address the needs of the industry. Water usage points were studied, listed and categorized. From the analysis, it was that water could have been managed more efficiently and steps could be taken for better management.

4.2 Wastewater Management

For many years, effluents discharges have been accepted as an important source for maintaining minimum stream flows. The investment in treatment technologies required to meet restrictive discharge limits has lead an increasing number of industries and communities to consider other uses for their treated wastewater effluents as a means to recover at least part of this investment.

Further, as sources of water supplies have become limited, there has been greater use and acceptance of re-claimed wastewater effluents.

Wastewater generated in electroplating industry comes from Effluent Treatment Plant.

Table 1: Lab Analysis for Influent and Effluent Characteristics

Sample Code	pH	EC	TDS	Chloride	Alkalinity	Total Hardness	Calcium	Magnesium	Nitrate
Influent	7.15	0.902	1200	451.12	220	595	198	98.95	89.12
Effluent	6.82	3.47	805.6	250.12	140	400	100.12	89.12	78.16

Except pH and EC (ms) all are in mg/l

4.3 Observations

Treated water parameters are well within the KSPCB prescribed standards.

Regular monitoring of parameters was maintained; efficiency of treatment units was monitored and recorded.

Sludge drying bed was not fully dry with lot of moisture content present in it resulting in the water loss.

Wash water recovery from the acid is adopted which helps in cost benefit mechanism.

4.5 Methods for Continual Improvement

Following suggestions were given for efficient waste water management.

Flow meter should be serviced at regular intervals to avoid breakdown and raw effluent must be collected and analyzed at regular intervals.

In the effluent treatment plant addition of filter press should be considered for the better sludge drying and quantity of the sludge can be reduced and also reduce the water loss.

Corroded and rusty equipments or conduit pipes should be serviced or replaced whenever applicable.

Proper operation and maintenance of the equipments and treatment units should be carried out periodically.

ETP operators must be trained for trouble shooting to avoid breakdowns.

The management should be willing to adopt new technology in wastewater treatment

5. RESULTS AND DISCUSSIONS

Drag-out refers to the solution remaining on products, racks, and barrels as the products and these suspension systems are from different processes like baths and water rinsing operations since used rinse water is usually a major waste stream from electroplating facilities. The chromium was pumped manually from the drag-out tank and analyses were conducted to measure the concentration of the chromium and pH using titration and pH meter respectively. The values obtained are tabulated below

Table 2: Concentration of Chromium in Drag-out tank

Drag-Out sol.Chromium conc./l	pH
16	4
24	6
22	4

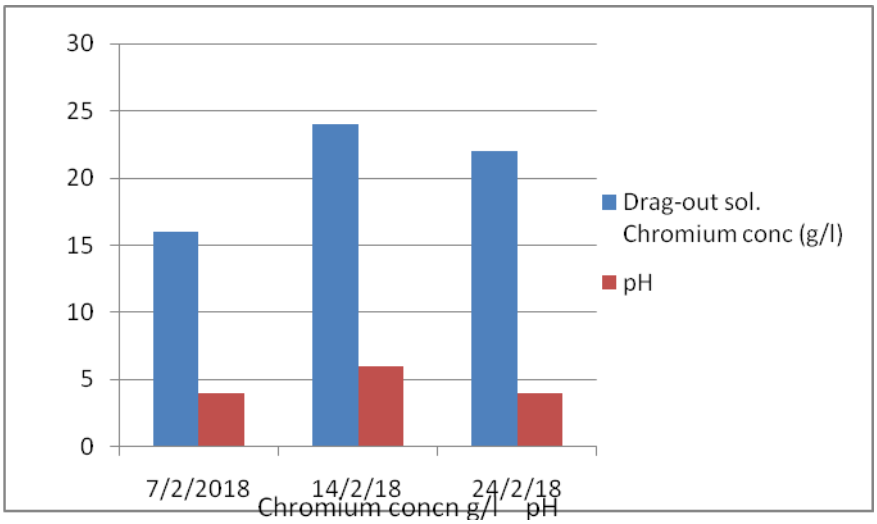

Figure 3: Graph showing Concentration of chromium in Drag-out tank

Table 3: Chromium concentration in Rinse-2 tank

Concentrated Chromium Collection tank Chromium conc. gl
315
355
390
320

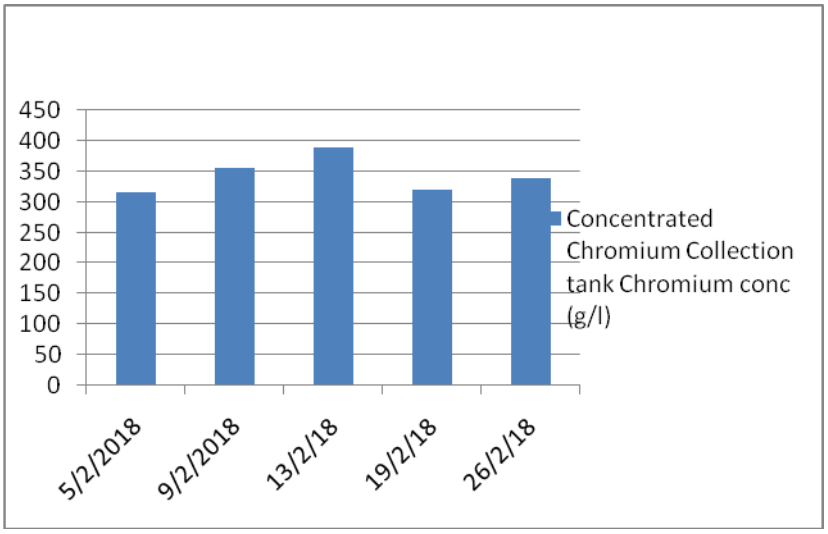

Figure 4: Graph showing Conc. of chromium in Chromium collection tank

Table 4: Chromium concentration in alkaline chromium tank

Once used Caustic soda tank Chromium conc. g/l	Alkaline Chromium tank Chromium conc. g/l
12	25
10	24
14	26
15	27

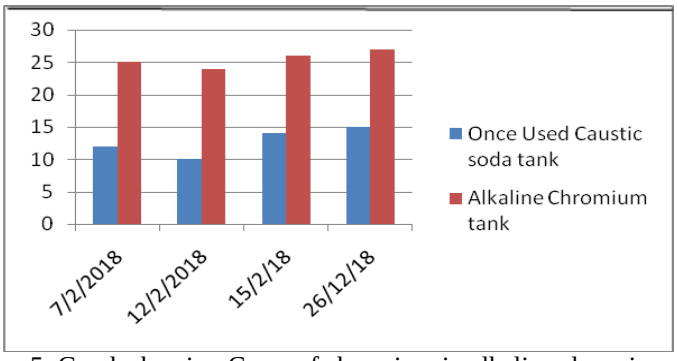

Figure 5: Graph showing Conc. of chromium in alkaline chromium tank

Organizations of all kinds are increasingly concerned with achieving and demonstrating environmental performance by controlling the impacts of their activities, products and services on the environment, consistent with their environmental, health and safety policies and objectives. These should meet legal and policy requirements. To be effective, they need to be conducted within a structural management system that is integrated within the organization.

Organizations take up environmental "reviews" or "audits" to assess their environmental performance. Most effective "review" and "audits" are conducted within a structured management system that is integrated within the organization. However, these "reviews" and "audits" are not sufficient to provide assurance that its performance meets legal and policy requirements for achieving economic goals. International Organization for Standardization (ISO) is one such body which provides Standards like ISO 14001 which is international standard for EMS.

This work carried out on Environmental Management System for electroplating industry included a detailed visit of the facility, understanding of the process, identifying the areas for continual improvement, and improving the Environmental Management System in the facility.

Based on the initial assessment made using a checklist it is identified that the facility uses a lot of raw materials, water and electricity to carry out the various process of manufacturing. As a result of this lot of waste are also generated at the same time during the time of manufacturing. Hence Environmental management system is one of the areas that have to be concentrated for aiming at continuous improvement.

6. CONCLUSIONS

By creating the water balance to the industry Site water balance helps to know the current and future water demands.

Helps to develop water conservation and reuse alternatives that are cost effective and also meet effluent permit limit

Reduce reliance on water source.

Helps to identify potential water conservation and reuse methods.

Identify potential reuse alternative for waste water effluent.

Suggestions for Methods of continual improvement for better water management are provided.

Lab results have shown that the tested parameters are well within the limits of K.S.P.C.B. standards and hence the efficiency of treatment plant is good.

Suggestions for Methods of continual improvement for better waste water management are provided.

Hence EMS is a overall tool which helps in continual improvement by taking into account almost all the aspects of business development accompanied and accomplished by sustainable environmental issues like pollution control, waste minimization, etc.

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