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# A STUDY ON METALS RECOVERY FROM THE WASTE WATER EFFLUENTS IN ELECTROPLATING INDUSTRY

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## ABSTRACT

*Rapid industrializations and urbanizations were produces very huge amounts of waste water and effluents during various unit operations and the processes. It seems to huge burden to manage to supply the sufficient quantity of water and also very difficult to manage the waste water and its effluents, and it may lead to increasing of cost and maintenance of the ETP's. In this contest this present study attempt was done for reduction of total water consumption and to recovery of Nickel and Copper metals from the waste water effluents coming from electroplating industry were analyzed by Nickel Recovery Units and Copper Recovery Units, The metals, which are casted from aluminum wheel. The recovery units, which has a rinse bath – 1, rinse bath - 2, drag out bath, copper plating bath and cartridge filter, carbon filter , copper recovery. It was found that, after following of Nickel & Copper recovery systems, total water consumption is drastically reduced, sludge generation also reduced and also effluent generation in both the cases of nickel and copper were also reduced*

**Key Words:** Effluent Treatment Plant, Effluent, Nickel, Copper, Sludge, Metals Recovery

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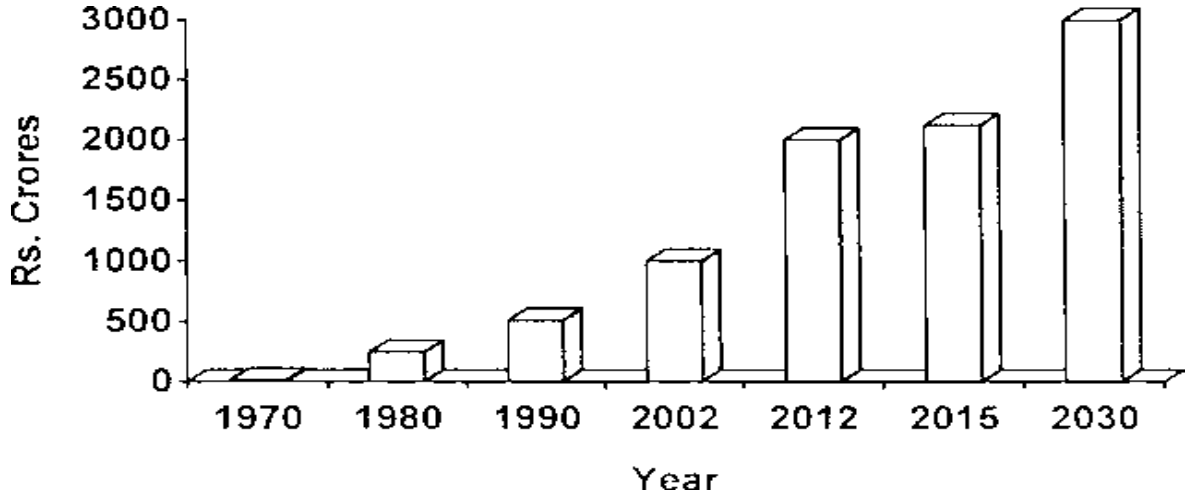
## 1. INTRODUCTION

Electroplating has a long history in India. Like many other industrial activities, it gained momentum after independence. Modern techniques in electroplating started in early sixties in India, but the first semi-automatic plant was set up in 1976 in Mumbai. Since then, the industry has grown steadily without facing any recession. Currently there are more than 600 automatic plants in the country (Comprehensive Industry Document on Electroplating Industry (COINDS)), 2007)

Although official figures are not available, estimates indicate that in 1970, electroplating industry was of Rs. 100 million. During the period 1970-85, the government policy on the restriction import in force led to high growth of this industry (International Metalworkers Federation, 2002).

The growth of the industries is shown in Graph 1.1. Though the curve of the growth rises steadily from 1980-2002 but a jump was observed in decade 2002-2012. It is estimated that electroplating industry may now worth Rs. 2000 crores (Rs. 20,000 million) in year 2012.

In Electroplating sludge contains a great number of valuable Chromium, Nickel and Copper. So far, plating sludge and metals in it have been regarded as solid wastes and been disposed by means of landfill site. However, the way to dispose plating sludge leads to serious disadvantages, as it has great effect on the surface of the earth as an environmentally hazardous material. On the other hand, the reuse of heavy metals might bring great potential profits and reduce the load on the Effluent Treatment Plant (ETP).




**Graph 1.1** Increasing trend and predictions based on growth rate of electroplating Industry in India (Source: Comprehensive Industry Document on Electroplating Industry (COINDS)

## 2. OBJECTIVES OF THE STUDY

- Recovery of Nickel and Copper metals from the waste water effluents
- Reduction of Total water consumption and Effluent Treatment Plant (ETP) Sludge generation

## 3. METHODOLOGY

### 3.1. Nickel Recovery Unit:

Nickel electroplating imparts a thin layer of Nickel onto a Casted Aluminum wheel. The Nickel layer can be decorative, provide corrosion resistance, wear resistance, or be used to build-up worn or undersized parts for salvage purposes.

High selectivity for heavy metals permits separation of these ionic compounds from solutions containing high background levels of calcium, magnesium and sodium ions. Chelating resins exhibit greater selectivity for heavy metals in the sodium from than in the hydrogen form.

Ion exchange resin ensures the effective recovery of nickel in electroplating operations. The rinse water is pumped through cartridge filters and then through the carbon filters. All the suspended particles will be filtered in these filters. Then pumped to brightener resin bed to remove the brightener (organic foreign impurities). Then pumped nickel recovery resin, where the nickel is exchanged on the resin. The filtered water will be reused in the process for the bath makeup.

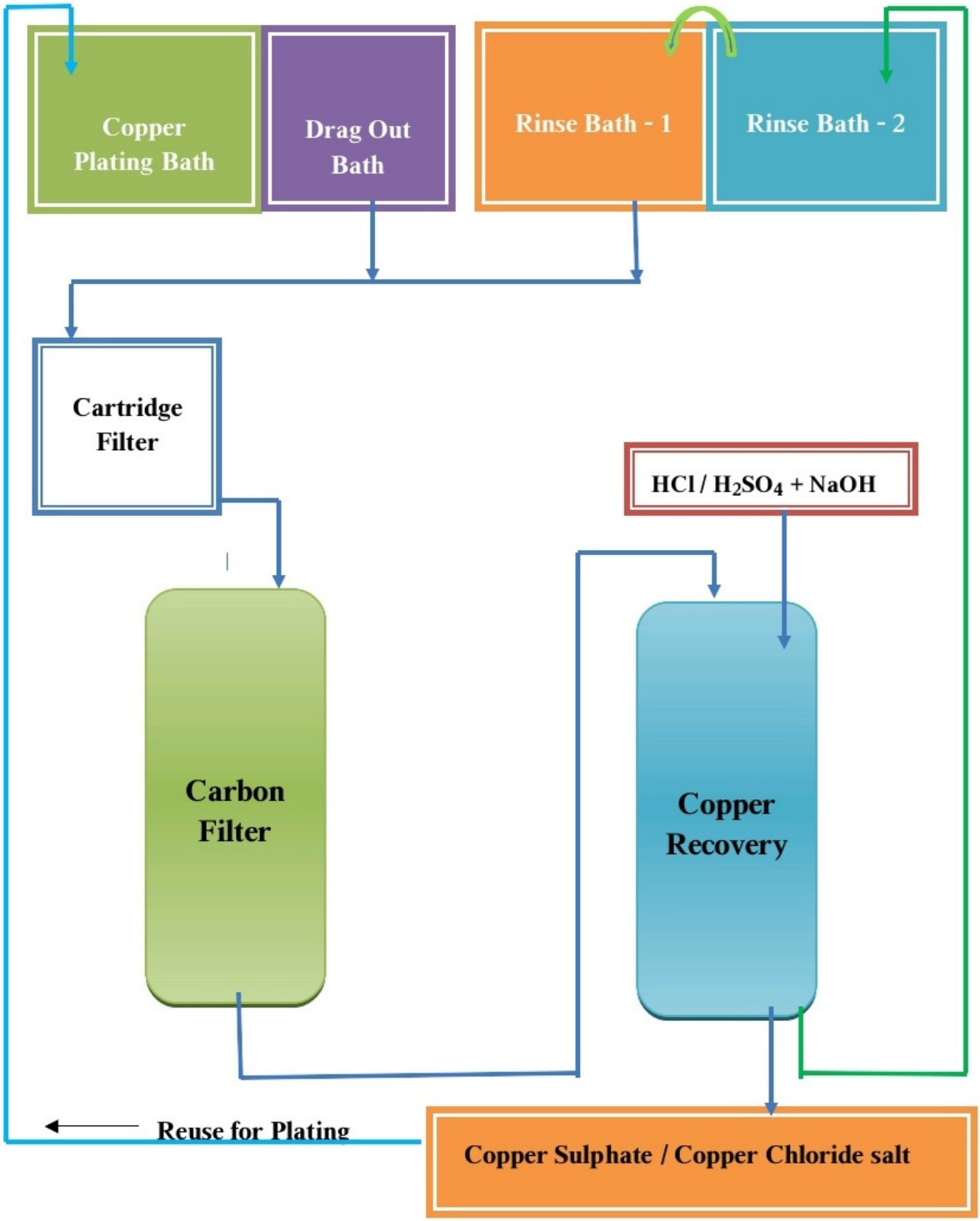
During regeneration that trapped ions or compound on the resin can be collected as concentrate of Nickel Sulphate/chloride compound. This concentrate nickel compound can be reused in plating baths as a pure source of Nickel Sulphate/chloride for plating of Nickel. In other words nickel will not pass to effluent treatment plant thus content of same heavy metal will go down by 98%.

### 3.2. Copper Recovery Unit:

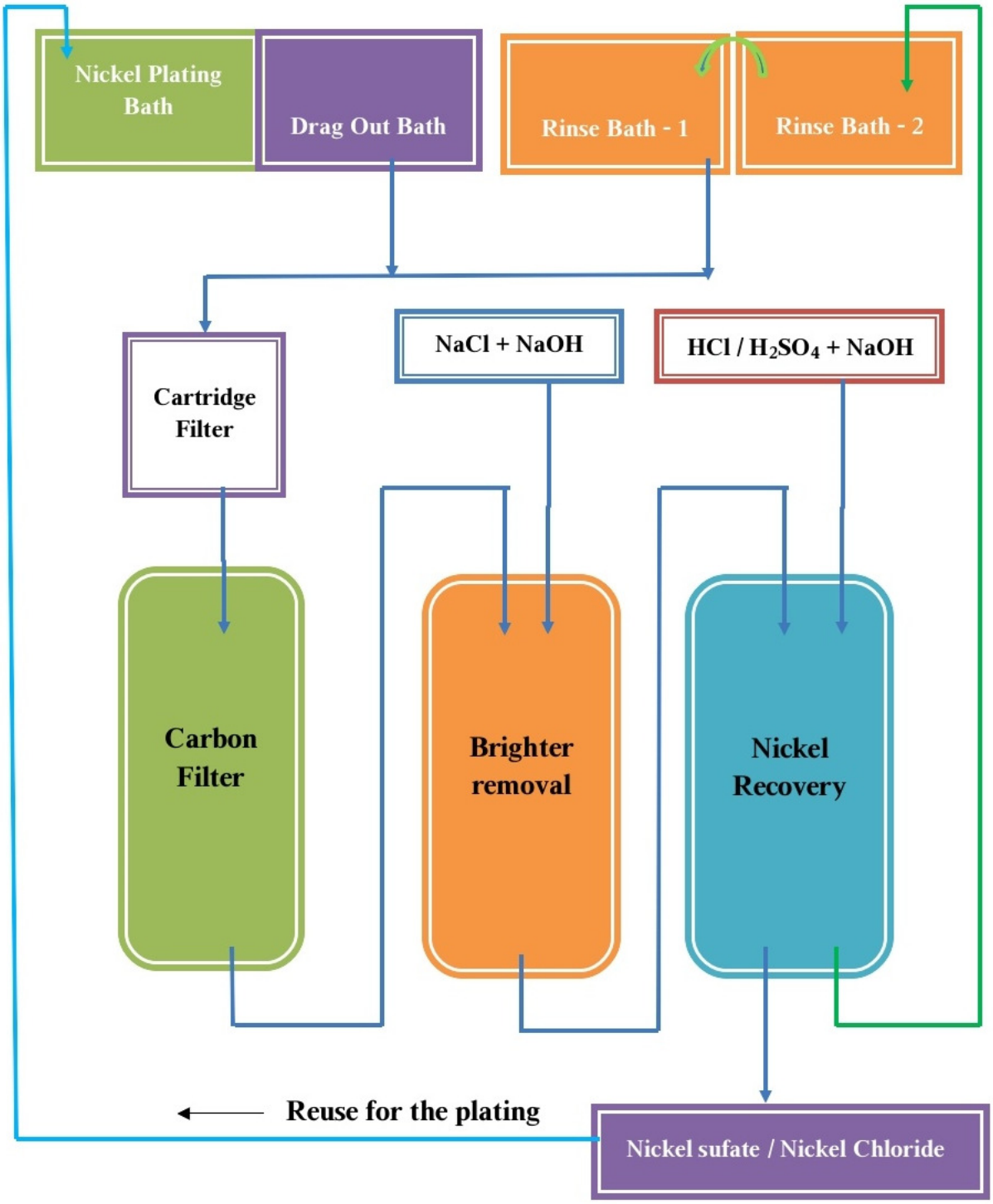
Acid Copper Strike for copper deposition to level the non-uniform nickel strike layer. The copper deposit is to provide uniform layers of soft buff able surface for mechanical finishing, if desired, and to minimize the surface roughness from the nickel strike deposit.

Ion exchange resin ensures the effective recovery of copper in electroplating operations. The rinse water is pumped through cartridge filters and then through the carbon filters. All the suspended particles will be filtered in these filters. Then pumped to copper recovery resin, where the copper is exchanged on the resin. The filtered water will be reused in the process for the bath makeup.

During regeneration, that trapped copper ions or compound on the resin can be collected as concentrate of Copper Sulphate / Chloride compound. This concentrate Copper sulphate /Chloride compound can be reused in plating baths as a pure source of Copper Sulphate /Chloride for plating of Copper. In other words copper will not pass to effluent treatment plant thus content of same heavy metal will go down by 98%. And methods used for recovery from the waste water effluents shown in Flow Chart 1 and Flow Chart 2




**Flow Chart 1** Copper recovery equipment process flow chart




**Flow Chart 2** Nickel recovery equipment process flow chart

## 4. RESUTS AND DISCUSSION

Results of Total water consumption and ETP Sludge generation and Effluent generation from Copper plating before not followed the Copper Recovery Unit an average of 6 months duration is shown in Table 4.1. And after installation of the various units results were shown in Table 4.2.

**Table 4.1.** Total water consumption, ETP Sludge generation and Effluent generation from Copper & Nickel plating, BEFORE installation of the Recovery Units

| S. No | Month | Effluent generation from Nickel plating (KL) | Effluent generation from Copper plating (KL) | Total water consumption (KL) | ETP Sludge generation (Kg) |
|---|---|---|---|---|---|
| 1 | March 2018 | 360 | 185 | 570 | 742 |
| 2 | April 2018 | 372 | 183 | 566 | 733 |
| 3 | May 2018 | 360 | 182 | 557 | 732 |
| 4 | June 2018 | 378 | 182 | 569 | 730 |
| 5 | July 2018 | 358 | 180 | 562 | 724 |
| 6 | August 2018 | 375 | 183 | 575 | 748 |

**Table 4.2.** Total water consumption, ETP Sludge generation and Effluent generation from Copper & Nickel plating, AFTER installation of the Recovery Units

| S. No | Month | Effluent generation from Nickel plating (KL) | Effluent generation from Copper plating (KL) | Total water consumption (KL) | ETP Sludge generation (Kg) |
|---|---|---|---|---|---|
| 1 | September 2018 | 30 | 25 | 60 | 475 |
| 2 | October 2018 | 24 | 20 | 52 | 450 |
| 3 | November 2018 | 23 | 19 | 49 | 442 |
| 4 | December 2018 | 21 | 18 | 46 | 438 |
| 5 | January 2019 | 21 | 18 | 45 | 435 |

## 5. CONCLUSIONS

The present study is aimed at analyzing for recovery from the waste water effluents of Nickel and Copper by collecting samples from the duration of 5 months i.e. from September, October, November, December, and January.

It was found that the Effluent generation from Nickel plating before not followed the Nickel Recovery Unit an average of 6 months duration is 367.16 KL, Effluent generation from Copper plating before not followed the Copper Recovery Unit an average of 6 months duration is 182.5 KL, Total water consumption is 566.5 KL and Environmental Treatment Plant (ETP) Sludge generation is 734.8 Kg's. After installation of Nickel and Copper recovery systems, The Results of Effluent generation from Nickel plating is 23.8 KL, Effluent generation from Copper plating is 20 KL, Total water consumption is 50.4 KL and Environmental Treatment Plant (ETP) Sludge generation is 448 Kg's. It was found that, after following of Nickel & Copper recovery systems, total water consumption is drastically reduced, sludge generation also reduced and also effluent generation in both the cases of nickel and copper were also reduced. So that, material recovery increased and sludge waste management also will become possible by the reduction of the volume

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