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SANITATION AND WATER FOR ALL

# Wastewater from electroplating industries of Karachi

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A FIELD INVESTIGATION has been carried out to quantify and characterise the effluent being discharged from the electroplating industries in Karachi. Seven factories were surveyed and their effluents analysed. It was estimated that the Ni-Cr plating industry was producing a liquid waste amounting to 0.1 to 0.4m3 per Kg of NiCr plated while in the Zn plating industry this value was 6 to 22m3 of wastewater per Kg of Zinc plated. The analysis of the effluent for the parameters such as pH, SS, TDS, COD, CN, and heavy metals (Cu. Co, I-Ig, Pb, Mn, Ni, Cr. Zn, Fe and Cd) showed that the effluent from all the factories except one did not conform to the National Environment Quality Standard (NEQS).

## Introduction

There has been a steady growth of independent, cottage and small to medium-scale electroplating industries in Pakistan particularly in the large cities like Karachi, Hyderabad, Lahore and Peshawar. In comparison with other industries, the electroplating industry uses much less water, hence the volume of the wastewater produced by this industry is also comparatively much smaller. Nevertheless, the wastewater is highly toxic in nature because of the presence of metals such as copper, zinc, nickel, chromium, cadmium, various acids and cyanide compounds. The methods of removal of these toxic constituents from wastewater are generally well established. In Pakistan however, the concept of treating electroplating wastewater is not tally developed. This is due to lack of awareness among the owners, legislation, shortage of resources and available space in the small size factories.

There is no data available about the characteristics and the amount of liquid, solid and gaseous wastes being generated Tom these units. Such information is important and required in order to design the waste management systems effectively. In order to initiate collecting these data a field investigation was carried out to quantify and characterise the liquid wastes being generated from the electroplating factories located in Karachi. This report summarises the results of this stuffy.

## Methodology

During this study 17 electroplating units were visited and contacted for the held survey and the collection of the effluent samples. Out of which only two large electroplating units namely Pakistan Air Force electroplating workshop and Sigma industry and five cottage units allowed the team to proceed with the investigation. Collection of only one effluent sample per site was permitted. The other industries were hesitant and did not permit the team to survey their facilities.

- During the study the following data were collected from the individual factories.
- Source of water supply.
- Consumption of water per day.
- Working hours of the shifts of staff.
- Liquid waste flow rate (m3/day).
- Amount of metal (anode metal) consumption (Kg/day).

The wastewater flow rate was determined al the location just before it is disposed to municipal sewer-. A large size sample (for 2-4 furs) of the effluent stream was collected from the point from where it was being directly fed into the sewer line/manhole. The sample, after mixing in a bucket, was placed in three plastic bottles for analysis. The pH of the sample was determined on the spot. In one of the sample bottles, the pH was increased to 12 by adding caustic solution. This sample bottle was used to determine total cyanide concentration as per requirement of Standard Method.

Parameters such as pH, alkalinity, suspended solids (SS), electric conductivity, total dissolved solids (TDS) and chemical oxygen demand (COD) were determined in the Environmental laboratory of NED Engineering University. Total cyanides determination was done in a commercial laboratory. Heavy metals such as Cu. Co, Hg, Pb, Mn, Ni, Ca, Zn, Fe and Cd were analysed on Atomic Absorption Spectrophotometer by Geological Survey of Pakistan (Habib, 1996). All the analytical methods used in the analysis were item standard methods (APHA, 1989).

The details of the study is published elsewhere (Altaf, 1997).

## Results and discussion

Table I presents the summary of the results on liquid waste quantification from the seven electroplating units of Karachi. The volume of effluent being discharged from Ni-Cr plating units ranged from 0.1 to 0.4m3 of wastewater per Kg of Ni-Cr plated. In the zinc plating units the amount of waste being discharged was found to be in the range from 6 to 22m3 of wastewater per Kg of zinc plated. Thus the results showed that the amount of waste water generated by the zinc plating units was significantly higher when compared to Nickel-Chrome plating units. It is to note that the amount of metal consumption in Nickel-Chrome plating

**Table 1. Waste quantification from electroplating industries**

**Table 2. Concentration of metals in different industries**

**Table 3. Analysis of effluent from electroplating industries**

This is due to the fact that a large amount of water was being used in the rinsing operation practiced in the zinc plating units.

The results from the samples analysis are presented in Tables 2 and 3 and are compared with National Environmental Quality Standards (NEQS) framed by the Government of Pakistan for the wastewater effluent from the industries (Gazette, 1993).

Parameters like pH, SS, TDS, and COD in the effluent of these seven electroplating units were found to be in the range of 3.70 to 7.93, 20 to 564mg/1, 328 to 2933mg/1 and 45 to 500mg/1 respectively. Except for Pakistan Air Force electroplating workshop, Shahid Galvanising Works and Naseem Galvanising Works, the remaining electroplating units did not meet the NEQS with respect to the above parameters.

The concentration of CN in the effluent of these electroplating units ranged from 0.1 to 58.7ppm. Only the effluent of Pakistan Air Force electroplating workshop was found to be within the permissible limits of NEQS. The PAF workshop has a treatment facility to detoxify the effluent for cyanide before discharging into the municipal sewer. The concentration of heavy metals such as Cu. Co, I Ig, Pb, Mn, Ni, Cl, Zn, Fe and Cd in the effluent of these electroplating units were found to be in the range from <0.01 to 5.17ppm, <0.02ppm, 16 to 25ppb, 0.02 to 0.74ppm, 0.05 to 37.8ppm, 0.()2 to 693ppm, <0.01 to 38ppm, 4 to 1130ppm and <0.02 respectively. These concentrations of heavy metals are well beyond the limits of the values provided in NEQS. From these results, it is therefore concluded that the effluent from all the electroplating industries surveyed except PAF did not meet NEQS limits. The PAF electroplating workshop has a treatment unit, due to which the effluent meets NEQS requirement failing only in Hg and Fe content.

## Conclusions

Results of the limited data obtained during the study show that the environmental conditions alarming in the small scale electroplating units located in the residential areas or in multi storeyed buildings. Posing health hazards not only for the labour force but also to the community living nearby. It is recommended that serious efforts Is should be made to move these units Tom residential areas to non residential areas where all the wastewater generated From these units can be treated in a combined treatment plant. It is suggested that NEQS for industrial effluent should be implemented and these should be monitored periodically. Efforts are needed to develop low cost the small methods to treat the effluents being generated Tom local cottage, to large scale electroplating units.

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