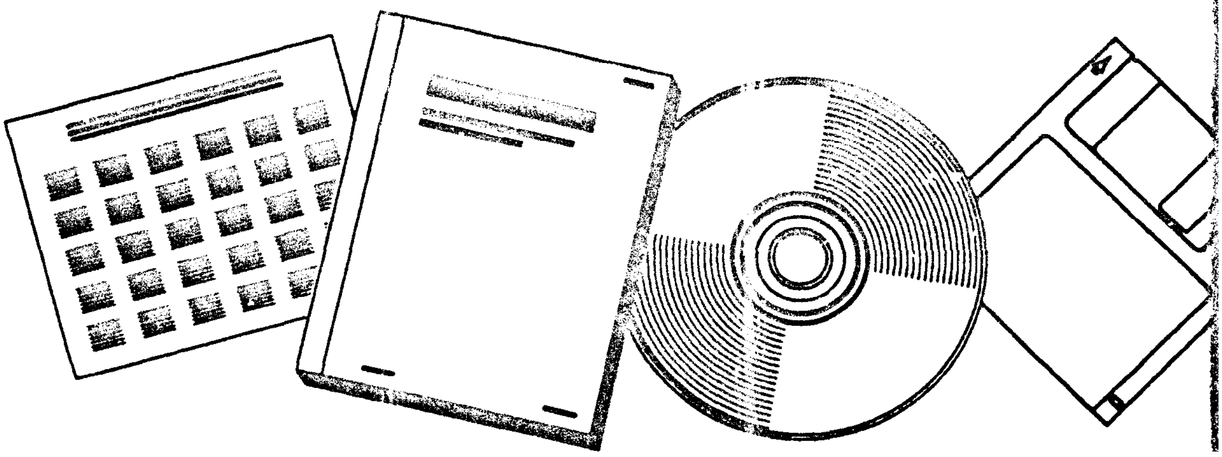
PB95-251583

AESF/EPA CONFERENCE ON ENVIRONMENTAL CONTROL FOR THE SURFACE FINISHING INDUSTRY (12TH). HELD IN KISSIMMEE, FLORIDA ON JANUARY 28-30, 1991

AMERICAN ELECTROPLATERS AND SURFACE FINISHERS SOCIETY
ORLANDO, FL

1991



U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

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Session V

WASTE MINIMIZATION
IN
DECORATIVE CHROMIUM PLATING BATHS

by

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Problem

Decorative chrome was traditionally done by using a hexavalent chromium plating bath to deposit chromium on top of nickel plated objects. Starting in the early 1980's, plating departments started looking at alternative technologies because of concerns about fumes from the plating bath and because of the problems involved in removing residual chromium from waste water. Trivalent chrome was a popular choice. However just switching to that did not solve all of the environmental problems. There still remained the expanse of meeting tota1 chromium limits for waste water and the increasing costs of disposal of spent or contaminated plating baths.

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Those problems were addressed at the Abbott Plating Company in Philadelphia. The following describing the systems which were installed and their findings.

The trivalent chrome plating solution at Abbott contains the following known ingredients.

sodium sulfate	20 oz/gal,	for conductivity
chromium sulfate	1.5 oz/gal	
boric acid		
saccharin		
organic wetting agent		

The plating bath normally operates at a pH of 3.5 - 3.9, a temperature of 110 to 126 degrees Farenheit .

One way to meet the city's new Pretreatment standards would be to install an ion exchange resin system which would selectively remove the trivalent chrome and other metallic pollutants. Such a system has four objectives:

1.) The resin must remove trivalent chrome and other metallic contaminants selectively versus sodium.

2.) In order to recover the cost of the ion exchange system , it must produce water of good enough quality to be recycled to the rinse tank and to not leave spots on the parts.

3) The third criteria is waste minimization or what do you do with the chrome, copper, nickel and zinc removed from the ion exchange resin . The system has to recycle the multivalent cations to the plating tank.

4.) The fourth objective is that the ion exchange system must have a way to bleed sodium sulfate from the rinse water. This criteria arises because we are adding back sodium sulfate to a system from the regeneration of the cation exchange resin, which the plating process does not consume .

System and Operating Procedure

The ion exchange resin system which meets these criteria consists of :

(1) a 5 micron reusable prefilter,

(2) a cation resin which can operate in the hydrogen form to remove all cations from the system and operate in the sodium form to remove multivalent cations in preference to monovalent cations to the ppm range (much as a water softener works),

(3) an anion resin which can be regenerated with caustic, and

(4) a quality assurance system which monitors the quality of the water being returned to the rinse tank: for conductivity and the quality of the water with regard to multivalent cations when the treated waster is discharged to the drain to control TDS.

Such a system was put in. Initially, the waste water flows from the first rinse tank to the second rinse tank:. While this is going on, the tank operator only has to monitor the total dissolved solids content of the water in the second tank. When the ion exchange system becomes loaded, sodium sulfate, without chrome, could pass through to the rinse tank and build up the salt content of the final rinse tank to the point where parts are not effectively rinsed. Therefore when the operator notices that the dissolved solids has increased or when a conductivity meter installed on the tank gives a warning, his procedure is to direct the discharge of treated waste water to the sewer and makeup with city water. The operating procedure is to operate in the discharge mode long enough to discharge at least the amount of sodium sulfate that he will be adding back to the plating tank when he regenerates the ion exchange column.

In regenerating the ion exchange resins, the following steps are carried out:

The cation resin is regenerated with dilute sulfuric acid, flowing into the column counter currently, to minimize leakage of trivalent chrome from column. The regenerant and rinse solutions are collected in one tank (chrome sulfate? sodium sulfate and sulfuric acid) and returned to the drag out tank: for concentration prior to their return to the plating tank.

The anion resin is regenerated with dilute caustic., The regenerant and rinses are co1lected in one tank for testing and then they are discharged to the city sewer.

When the ion exchange resins are regenerated, the filter in front of the resin is usually cleaned or replaced. (A used filter which can not be kept in service must be disposed of as a hazardous waste. The solids collected in this system are usually boric acid. To recapture the value, the filter can be reconditionned by dissolving the solids in a bucket of spent regeneration solution from the cation column, which is typically acidic to a pH of 2. At the next recycle time, this solution may be dumped back into the drag tank: and replaced with fresh spent regenerant. (Spent regenerant is used because the solution is part of the process and the return of sulfates should be minimized.