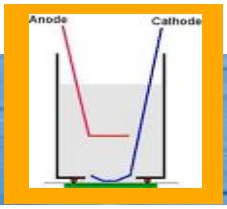
DURAFLOW

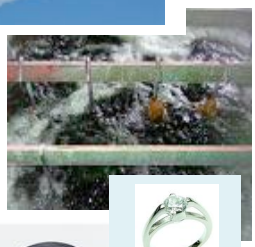
Total Performance: membranes, chemistry, service



Application Bulletin

Metal Finishing

Industry Challenges



Every manufactured product made of metal or having metal components will feature some type of metal finishing. Many industries use metal finishing in their manufacturing processes including aerospace, automotive, electronics, hardware, appliances, telecommunications and jewelry. Electrolytic plating, electroless plating, and chemical and electrochemical conversion are typically used in the surface finishing process. Other supporting processes can include degreasing, cleaning, pickling, etching, and polishing. The use of metallic compounds in electroplating and the application of organic solvents in all manner of metal finishing are the primary materials subject to extensive environmental regulations. In the U.S., the metal finishing industry is one of the largest users of many toxics chemicals.

The rinsing process and periodic disposal of spent chemicals are the primary source of wastewater generated in metal finishing operations. The major contaminants of concern can include Ag, Cd, CN, Cr, Cu, Ni, Pb, Sn, Zn and COD.

Like many other manufacturing industries, metal finishing shops have to confront the immediate challenges of various water supply issues. Among which is the severe shortage of water for production, quality and treatment of water from contaminated sources, and ever-increasing water cost. All these factors are the drivers steering the metal finishers to implement on-site wastewater recycle program to meet both the operational and economic requirements.

Duraflow Solution

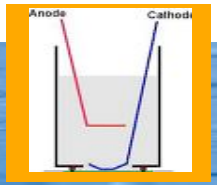
Flow Segregation ➔ ***Process Development*** ➔ ***Microfiltration Design*** ➔ ***Water Recycle Design***

Every metal finishing shop is unique. They use different chemicals and generate varying liquid waste with metals and other contaminants. A successful waste management plant must be custom designed to address all the process characteristics and management priorities. Duraflow employs a four-step approach to define a cost-effective solution to achieve complete removal of all regulated discharge parameters to meet the Federal, State and local standards, and generate a flow stream with NTU (<1.0) and SDI (<3.0) values in full compliance with the feed water criteria required for the Reverse Osmosis (RO) water recycle process.

(1) ***Flow Segregation*** - Evaluate the metal finishing production process to identify all sources of wastewater. Depending on the chemical constituents, flow rates and compatibility of each waste source, the waste streams are segregated into the following typical categories.

Rinses – Chrome Rinse, Cyanide Rinse, Metal Bearing Rinse and High COD Rinse

Concentrated Dumps – Chrome Dump, Cyanide Dump, Acid Dumps, Alkaline Dumps and Organic Dumps



Metal Finishing

2) ***Process Development*** – Based on the complexity of the segregation plan, a chemical treatment process is developed to address each of the contaminants via bench-scale or pilot-scale tests. The chemical treatment may take the form of precipitation, adsorption, chemical reduction/oxidation, pH adjustment and microbial control. The chemistries are evaluated for their compatibility and combined effect.

The chemical treatment will include one or more of the following processes:

- Chrome Reduction – Bisulfite reduction of chrome from hexavalent to trivalent
- Cyanide Destruction – Bleach oxidation of cyanide to carbon dioxide and nitrogen gas
- Fe/Ca/Sulfide Coagulation – Precipitation or agglomeration for membrane filtration enhancement
- Powdered Activated Carbon - Organic reduction, oxidant destruction and bio-film prevention
- pH Adjustment – pH operating zone optimization for the integrated chemistries

Duraflow MF Modules

(3) ***Microfiltration Design*** – After chemical reaction, the pre-treated wastewater is processed through the Duraflow microfiltration (MF) membrane filters designed for separation of the precipitates from water. The wastewater is pumped at a high velocity (12 – 15 feet per second) through the membrane modules connected in series with an inlet pressure of 45 – 50 psig. The turbulent flow, parallel to the membrane surface, produces a high-shear scrubbing action which minimizes deposition of solids on the membrane surface. During operation, clear filtrate permeates through the membrane, while the suspended solids retained in the re-circulation loop are periodically purged for further de-watering. Duraflow microfiltration membranes are manufactured in a tubular configuration capable of handling high solid concentration. The membranes, made of PVDF, are cast on the surface of porous polymeric tubes to produce a nominal pore size of 0.1 micron. The extraordinary chemical resistant property of PVDF allows the use of a wide range of chemicals - acids, bases and solvents for cleaning of the persistent fouling substances. An automatic back-pulse mechanism is an integral part of the operation design to provide physical surface cleaning by periodically reversing the filtrate flow direction.

(4) ***Water Recycle Design*** – Reverse Osmosis (RO) is a widely accepted membrane technology for metal finishing wastewater recycling. The pre-treated wastewater (microfiltrate) is typically pressured between 200 to 600 psig and processed through thin film composite or cellulose acetate RO membranes. Typical RO recovery ranges from 75% to 90%. The RO permeate is reused in selected production processes. RO membrane has low tolerance for a broad range of incompatible components in water. These substances are mainly removed by microfiltration prior to the RO operation. As the RO is protected from premature scaling and fouling, the membrane cleaning cycle is extended and membrane service life is prolonged significantly.