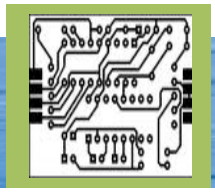
DURAFLOW

Total Performance: membranes, chemistry, service

Application Bulletin



Printed Circuits

Industry Challenges

The printed circuit board (PCB) industry is critical to manufacture of computing equipment, communication devices, automotive parts, home entertainment components and many other electronic devices essential to modern industrial development, business operations and everyday life basic needs. Production of PCB involves drilling, scrubbing, chemical cleaning, electroless deposition, photo imaging, pattern plating (copper, solder or tin), resist stripping, and etching as the major steps. The manufacturing process requires high purity water for its process baths and rinse waters while it produces a high strength chelated wastewater that contains heavy metals, such as copper, lead, tin and nickel. The chelating agents (e.g. EDTA and Quadrol) bond strongly to heavy metal ions to form highly stable compounds in solution, which prevent the formation of insoluble metal compounds from removal in a wastewater treatment system. This high strength chelated wastewater presents a significant challenge to meet discharge permits.

In addition to be in full compliance with the effluent discharge standards, like many other industries, PCB 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 PCB shops 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 printed circuit board (PCB) shop is unique. They use different chemicals and generate varying wastewater 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 and local standards, and generate a flow stream with NTU (<1.0) and SDI (<3.0) values meeting the feed water criteria required for the Reverse Osmosis (RO) water recycle process.

(1) ***Flow Segregation*** - Evaluate the PCB 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 – Metal Bearing Rinses (Low COD) and Non-Metal Bearing Rinses (High COD)

Concentrated Dumps – Acid Dumps, Alkaline Dumps, Organic Dumps

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(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, pH adjustment and microbial control. The chemistries are evaluated for their compatibility and combined effect. The treatment process is typically carried out in a two-stage chemical reaction.

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

- Dithiocarbamate (DTC) - Heavy metal precipitation and biological growth control
- Powdered Activated Carbon - Organic reduction, oxidant destruction and bio-film prevention
- Fe/Al Coagulation – Precipitation and agglomeration for membrane filtration enhancement
- pH Adjustment – pH operating zone optimization for the integrated chemistries

(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.

Duraflow MF Modules

(4) ***Water Recycle Design*** – Reverse Osmosis (RO) is a widely accepted membrane technology for PCB 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.