

Reduction of Nickel in Plating Operation Effluent With Nanofiltration

By Phil Katselnik & Samy Y. Morcos, CEF

Nanofiltration can be used successfully for recycling rinsewater and recovering plating chemicals. Operation and maintenance of the technology is simple, and the prorated cost per week for the membrane is no more than the cost of a filter cartridge.

Sanitary-Dash, North Grosvenordale, CT, is a manufacturer of solid brass plumbing accessories in polished chromium finish. The maximum allowable discharge limit for nickel effluent in the locality is 1.0 mg/L. Tests showed that the nickel content in the plant effluent was dangerously close to 0.8–0.9 mg/L, at the rate of 20 gal/min (12,000 gal/day—10 hr).

The plating machine* at Sanitary-Dash contains cleaning solution, 2,400 gal of nickel solution and 700 gal of chromium plating solution, along with all necessary rinse tanks. The system has three 200-gal rinse tanks after the nickel bath (see Fig. 1). Rinsewater from tanks 1 and 2 are returned to the nickel plating tank to makeup for evaporation losses. Tank 3 is a 5 gal/min, 3,000 gal/day,

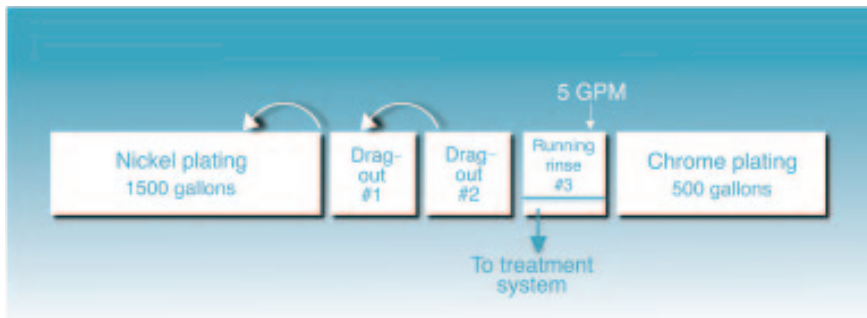


Fig. 1—There are three rinse tanks after the nickel tank.

running rinse. It is also one of three running rinses, 5 gal/min each, in the machine—one after each of the cleaning, nickel and chromium tanks.

Testing Nanofiltration

The management at Sanitary-Dash hired a company** that specializes in nanofiltration to improve the quality of the discharge effluent. The company installed a demonstration unit equipped with two 2.5 x 25 in. nanofiltration membranes with a surface area of 15 ft² each. Water flow was disconnected from tank 3, and over-flow was directed to an auxiliary tank.

The demonstration unit was installed (Fig. 2) to feed the concentrate from the auxiliary tank back to the same tank, and the permeate discharge from tank 3 to the auxiliary tank, thereby completing the loop. The 0.5 gal/min permeate volume was enough to maintain the quality of water in the rinse tank. Over a two-week period, it was necessary to operate the system several times overnight, and about 30 gal of concentrate (more than 15,000 mg/L total dissolved solids [TDS]) were removed to enhance rinse quality. A 1–1.5 gal/min system was recommended to meet the needs of the shop.

A second phase of the study was undertaken to confirm the size of the system, which included the addition of a second demonstration unit, identical to the first, installed in the same fashion. On the first day that both units operated, nickel level dropped from 986 mg/L at 9:00 a.m. to 39 mg/L at 3:00 p.m.

Based on the results, the management decided to purchase, on approval, a unit that produces 1–1.5 gal/min of permeate under similar conditions. The company installed a unit consisting of one 4 x 40 in. nanofiltration membrane with a surface area of 90 ft², high-pressure pump, prefilters and backwash manifold.

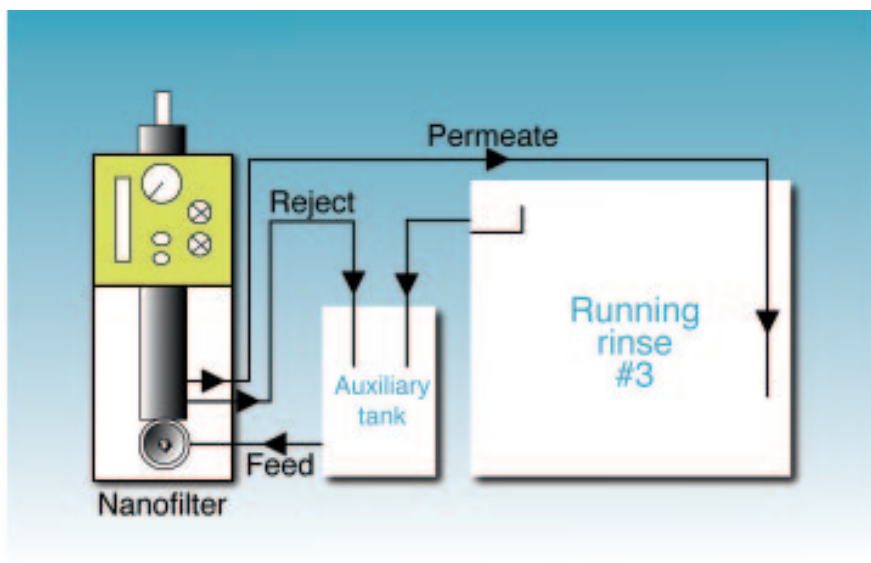


Fig. 2—The demonstration unit was installed to feed from an auxiliary tank.

* Udyllite Junior Enthone-OMI, Inc., New Haven, CT

** MichDan Environmental Technologies, North Providence, RI

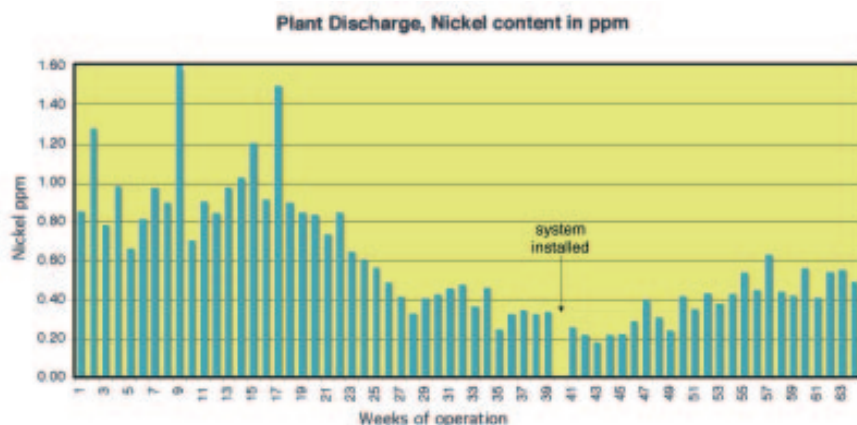


Fig. 3—Level of nickel reduction in effluent after unit was installed.

TABLE

	Before	After
High	1.60	0.62
Low	0.24	0.17
Average	0.72	0.38
Median	0.73	0.41
Weeks over 0.8	18	0

Effluent Improves

For the first six months, the nickel level in the plant effluent dropped to 0.2–0.4 mg/L (see Fig. 3), and water consumption was reduced by 2,800 gal/day (about 25 percent of total water consumption).

Weekly maintenance takes about one hr, and consists of a backwash, replacement of both cartridge filters and removal of concentrated solution from the auxiliary tank. Final volume of rejected concentrate removed from the system is about 10 gal/week (TDS 15,000–20,000 ppm). Although this solution could be returned to the nickel plating tank after removing trace amounts of chromium and impurities, the plant management decided to send it out to reclaim the nickel.

The results of discharge water analysis for nickel were tabulated for nine months before, and six months after installing the new system. The nickel contamination level was more than 0.8 ppm in 18 of 39 weeks before, but none after. [P&SF](#)

About the Authors

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