ENVIRONMENTAL TECHNOLOGY VERIFICATION STATEMENT

TECHNOLOGY TYPE:	**ION EXCHANGE RINSEWATER RECYCLING**
APPLICATION:	**TREATMENT OF METAL FINISHING RINSEWATERS FOR THE REMOVAL OF CATIONS AND ANIONS**
TECHNOLOGY NAME:	**HYDROMATIX 786E ION EXCHANGE SYSTEM**
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The Environmental Technology Verification (ETV) Program was created by the United States Environmental Protection Agency (U.S. EPA) to facilitate the deployment of innovative or improved environmental technologies through performance verification and information dissemination. The goal of the ETV Program is to further environmental protection by substantially accelerating the acceptance and use of innovative, improved, and more cost-effective technologies. The ETV Program is intended to assist and inform those individuals in need of credible data for the design, distribution, permitting, and purchase of environmental technologies.

The ETV Program works to document the performance of commercial ready environmental technologies through a partnership with recognized testing organizations. Together, with the full participation of the technology developer, the ETV Program partnerships develop plans, conduct tests, collect and analyze data, and report findings through performance verifications. Verifications are conducted according to an established workplan with protocols for quality assurance. Where existing data are used, the data must have been collected by independent sources using similar quality assurance protocols.

EPA's ETV Program, through the National Risk Management Research Laboratory (NRMRL), has partnered with the California Department of Toxic Substances Control (DTSC) under an ETV Pilot to verify pollution prevention, recycling, and waste treatment technologies. This verification statement provides a summary of performance results for the Hydromatix 786E Ion Exchange System.

TECHNOLOGY DESCRIPTION

Hydromatix Corporation (Santa Fe Springs, California) developed its 786E system to remove cations and anions from rinse wastewaters generated during metal finishing operations such as electroplating, cleaning, and anodizing. Regeneration of ion exchange resins consists of a series of acid and base rinses which result in restored resin functionality, while minimizing the volume of regenerant waste produced.

Hydromatix developed an ion exchange regeneration process for their Model 786E system which uses a programmable logic controller (PLC) system to coordinate acid and base rinse water reuse. This reduces the volume of regenerant chemicals wasted, and consequently the volume of regenerant wastewater produced. The Hydromatix system features packed bed, counter-current ion exchange columns with conductivity meters, PLC, and automatic valves to control the regeneration process. The cationic and anionic ion exchange columns are packed with Purolite PFC-100 H and Purolite PFA-300 OH resins (Purolite USA, Bala Cynwyd, Pennsylvania), respectively. By reusing portions of the regenerant rinses as make-up solutions for the next cycle, and by returning other rinses to the feed tank rather than to waste, the system is able to achieve a substantial reduction in the amount of chemicals used as well as in the amount of wastewater produced during each regeneration cycle.

Precipitation and clarification methods are traditionally used for conventional ion exchange regenerant waste treatment because they are able to process large volumes. These methods generally produce wastewaters which meet local Publicly Owned Treatment Works (POTW) or National Pollutant Discharge Elimination System (NPDES) requirements. The large volume of regenerant wastewater requiring precipitation and clarification treatment often precludes the use of evaporation as a disposal method, which could result in zero wastewater discharge from the facility.

EVALUATION DESCRIPTION

The central claim made by Hydromatix is that their technology reduces the volume of regenerant waste produced. The ratio of gallons of waste produced per cubic foot of resin regenerated, the specific volume, is smaller than in conventional ion exchange systems. This smaller specific volume allows more waste management options and assists metal plating facilities in achieving zero wastewater discharge. Thus, the primary objectives of the evaluation were to determine (1) the specific volume of regenerant waste produced, and (2) the cation and anion exchange capacities restored during regeneration. Secondary objectives include providing information for potential end-users and metal reclaimers, and observing the system during normal operating conditions in order to evaluate worker health and safety. Only the Hydromatix system was evaluated to achieve the primary and secondary

objectives of this study; no other competing ion exchange technologies were investigated. The manufacturer and users provided basic cost data. Users also provided information on system performance, reliability, and waste generation. The evaluation verified, through independent testing, the following performance parameters:

1. Regenerant waste volume produced
2. Cation and anion exchange capacities restored
3. Rinse wastewater volume treated
4. Masses of acid and base volume consumed
5. Masses of metal species in the regenerant waste

Five test runs lasting approximately one week each were conducted over a three month period at Aero-Electric Connectors, Incorporated (AEC) in Torrance, California. Details of the evaluation, including data summaries and discussion of results may be found in the report entitled U.S. EPA ETV Report, Hydromatix 786E Ion Exchange Rinsewater Recycling System.

VERIFICATION OF PERFORMANCE

Performance results of Hydromatix Corporation's 786E Ion Exchange Rinsewater Recycling System, are summarized as follows (all data calculated at the 90 percent confidence level):

- Regenerant waste specific volume: 17.1 ± 0.2 gallons of waste per cubic foot of resin (gal/ft^3). The cationic regenerant waste produced during four test runs averaged 302 gallons for 18 ft^3 of resin, yielding a specific volume of 16.8 ± 0.2 (gal/ft^3). The anionic regenerant waste produced during five test runs averaged 313 gallons for 18 ft^3 of resin, yielding a specific volume of 17.4 ± 0.1 gal/ft^3.

- Cation and anion exchange capacities restored: Cation and anion capacities restored were 94.5 ± 6.8 and 88.7 ± 1.7 percent over five test runs, respectively. Compared to new resin material, the remaining cationic resin capacity averaged 96.0 ± 2.1 percent, and the remaining anionic resin capacity averaged 79.9 ± 1.8 percent. For the cation resin, the resin utilization was found to be 46.6 ± 4.6 percent using three test runs, and the regenerant efficiency was 29.9 ± 28.8 percent using two test runs. For the anion resin, the resin utilization was found to be 57.2 ± 36.5 percent over two test runs, while the regenerant efficiency was 32.0 ± 3.7 percent using two test runs.

- Rinse wastewater volume treated: 75,565 ± 9,663 gallons average, measured over five test runs, containing typical cations and anions found in plating shop wastestreams.

- Masses of acid and base consumed: 144.3 pounds of HCl measured over two test runs, and 119.7 pounds of NaOH per regeneration cycle measured over five test runs. The regenerant solution volumes were 271 ± 11.6 gallons of acid, and 274.4 ± 6.5 gallons of base, each measured over five test runs. The volumes of concentrated acid and base in the regenerant solution volumes were 38.9 gallons of 37 percent HCl, and 18.7 gallons of 50 percent NaOH.

- The masses of metal species in the regenerant waste: The average masses and ranges of representative metal species were found to be: 113.8 ± 89.7 g with a range of 24.9 to 272.5 g for copper, 175.3 ± 70.5 g and 47.5 to 227.9 g for nickel, and 580.8 ± 411.5 g and 65.6 to 1,078.7 g for zinc. Metal species were determined using four test runs.

Original signed by E. Timothy Oppelt, 4/2/02

E. Timothy Oppelt, Director Date
National Risk Management Research Laboratory
Office of Research and Development
United States Environmental
Protection Agency

Original signed by Kim Wilhelm, 3/15/02

Kim Wilhelm, Acting Chief Date
Office of Pollution Prevention
and Technology Development
Department of Toxic Substances Control
California Environmental Protection Agency

AVAILABILITY OF VERIFICATION STATEMENT AND REPORT

Copies of the public Verification Statement are available from the following:

(NOTE: Appendices are not included in the Verification Report.
Appendices are available from DTSC upon request.)

United States Environmental Protection Agency/NSCEP
P.O. Box 42419
Cincinnati, Ohio 45242-2419
Web site: http://www.epa.gov/etv/library.htm *(electronic copy)*

Department of Toxic Substances Control
Office of Pollution Prevention and Technology Development
P.O. Box 806
Sacramento, California 95812-0806
Web site: http://www.dtsc.ca.gov/ScienceTechnology/etvpilot.html
or http://www.epa.gov/etv *(click on partners)*

NOTICE: U.S. EPA and California Environmental Protection Agency (Cal/EPA) make no expressed or implied warranties as to the performance of the technology described in this verification. Verifications are based on an evaluation of technology performance under specific, predetermined criteria using appropriate quality assurance procedures. The end-user is solely responsible for complying with any and all applicable federal, state, and local requirements

Photo 1. Aero-Electric Connector, Inc. facilities in Torrance, California, showing installation of Hydromatix 786E Ion Exchange treatment system and associated equipment.