Recycling chemicals on the anodizing line - cost savings and quality improvements

by
Kevin Munns, P.Eng.
Marketing Manager - Eco-Tec Inc.

1.0 Abstract

Aluminum is anodized with simple water-based chemicals that can be treated easily. However, many plants now use recycling equipment to extend chemical life and reduce waste treatment costs. Etching and anodizing solutions are the ones most frequently recycled but technologies are available for other finishing solutions as well. As most recycling approaches involve some degree of purification, anodizers often find that quality improvements go hand in hand with chemical savings. This paper will discuss the technologies available to anodizers and some recent developments that have helped to enhance the anodized surface finish.

2.0 Introduction

Anodizing processes use simple water-based chemicals that can be treated easily. While most municipalities require that the waters leaving the plant be adjusted to the correct pH (acidity/alkalinity) range, many now also specify removal of the suspended aluminum solids. After pH adjustment, the solids can be filtered out of the water and disposed of in a landfill as a non-hazardous waste. Some anodizers have been able to send this solid waste to companies that convert it into aluminum sulfate liquid or alum. Alum can be used by municipal waste treatment plants for phosphate removal.

Although anodizing wastes are simple to treat, many plants use recycling equipment to produce valuable byproducts. Two recycling techniques that are commonly used regenerate the etch and purify the anodizing acid. This is due, in part, to the large amount of solid waste (aluminum hydroxide sludge) that

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etching and anodizing generates (Table 1). Recycling reduces this waste, cuts chemical costs and, frequently, improves product quality.

Table 1 - Solid waste from an Etch/Anodize operation

Basis: 1000 ft^2 ($93m^2$) of anodized surface area

Aluminum dissolved in etching (1.5 mil etch per side)	20.3 lb (9.2 kg)
Aluminum dissolved in anodizing (0.7 mil anodic film)	2.1 lb (0.93 kg)
Waste sludge produced (15% w/w solids)	431 lb (196 kg)
Waste sludge produced when etch regeneration is used	64 lb (29 kg)
Waste reduction with etch regeneration	85%

Note: 1000 ft^2 of extrusions will typically weigh about 400 lb. Therefore, without regeneration, a pound of waste sludge is generated for every pound of extrusion. Also, calculations do not apply for hollow extrusions which generate more waste due to the etching of the inner surfaces.

3.0 The technology behind recycling systems

Many recycling technologies can be grouped as being:

- concentration based or,
- separations based

For example, coloring bath chemicals are rinsed from anodized parts with water. The dilute waste that results contains metal salts from the coloring solution. A recycling system here might work by concentrating the rinse water until the volume was small enough to allow it to be added back to the coloring tank. This would be a concentration based process.

In contrast, anodizing solution gradually becomes contaminated with dissolved aluminum as it is used. A system that removes the aluminum would be an example of a separations based technology.

3.1 Concentration based processes

The simplest recycling systems often use concentration based processes. A common pitfall with simple systems is the failure to consider contaminant buildup. Better designs include a purification unit with the concentrating equipment. This ensures that recycled chemicals will not degrade the process solution. Concentration based technologies include:

Evaporation

In order to maintain a water balance in the system (prevent overflowing), it is often necessary to concentrate the purified/recovered chemicals. The most common method used for this purpose is evaporation, which can employ either boiling or non-boiling techniques.

The best known application of the non-boiling technique is the "atmospheric evaporator" which employs the humidification principle. See Figure 1. Liquid is pumped through a heat exchanger into the tower where it drips down through the packing (plastic rings provide a high surface area). A draft of air is drawn up through the tower evaporating the water. Continued circulation of the liquid increases its concentration to the desired level. The design is very simple, inexpensive and ideally suited to smaller applications where the final concentration of the liquid is not too high. The only disadvantage of this simple design is that the energy requirements are 10-20% higher than with boiling evaporators since both air and liquid phases must be heated.

Natural and forced circulation boiling evaporator designs employed in the chemical process industries are also very effective, particularly for higher solution concentrations and capacities. They are somewhat more complex and considerably more expensive than the "atmospheric evaporator" discussed above. These units are often operated under *vacuum* to reduce the boiling point of the solution and improve heat transfer.

Evaporative recovery systems have been extensively applied in the metal plating industry for some time. Packaged evaporators, both boiling and non-boiling types, are available from a number of vendors.

Reverse Osmosis (RO)

Reverse osmosis uses high pressure to force pure water through a *semi-permeable* plastic film or *membrane*. Rejecting the dissolved salts, RO produces a concentrated metal salt reject stream (see Figure 2). The membranes are susceptible to fouling and degradation so proper pretreatment of solutions is critical to success. The major operating costs for RO are membrane replacement and energy.

While RO systems have been used to recover nickel from electroplating rinsewater with various degrees of success, they have not been used to a significant degree in the North American anodizing industry.

3.3 Separation based systems

Separations technology can be used in conjunction with a concentrating system (to recover a pure bath chemicals from a rinse, for example) or on its own (to purify a process bath).

Acid Sorption

Certain ion exchange resins (fine plastic beads that have chemically active sites attached to them) have the ability to absorb strong acids (sulfuric, hydrochloric and nitric acid) while rejecting metal salts of these acids. See Figure 3. Water is used to recover the acid from the resin. Recovered solutions contain most of the unused or *free* acid with up to

90% of the metals removed. The most unique feature of the sorption process is that no chemicals or significant amount of energy are required.

The acid sorption process has been packaged into a standard, skid-mounted piece of equipment called an acid purification unit (APU®). APUs have been used to purify acid based process baths and used in conjunction with other purification and concentrating equipment as part of more complex systems.

Diffusion Dialysis (DD)

Diffusion dialysis is similar to acid sorption except an anion exchange membrane is used instead of sorption resin. The ion exchange membrane is permeable to acids but impermeable to metal salts (see Fig. 4). Contaminated acid flows past one side of the membrane, while water flows past the other side. The acid passes through the membrane into the water stream, while the metal salt impurities stay behind. As with acid sorption, no chemicals are required in the separation and energy requirements for solution pumping are small.

A multitude of these membranes are alternately stacked with gaskets and held together in a unit that resembles a filter press. Pretreatment for removal of suspended solids is very important for this process since the space between the membranes is very small and dirt tends to stick to the membranes.

The diffusion dialysis process has not been utilized to a large extent in North America, although it has been used in Japan for some time.

Crystallization

Crystallization processes depend on variations in the solubility of metal salts. Temperature and composition can often be adjusted to cause an metal salt to crystallize from a saturated solution. The salts can be filtered, washed and, often sold. As crystallization systems tend to costly, the number of applications where they are viable is limited.

3.3 Other processes

Some technologies span both the concentration and separations categories:

Ion Exchange (IX)

Ion exchange resins can replace cations (positively charged ions such as aluminum, sodium and most metals) with hydrogen (H^+) or anions (such as sulfate and chloride) with hydroxyl (OH^-). In a water deionizer, an anion exchanger would follow a cation exchanger and the cumulative exchange would yield pure water (H_2O). Cation exchangers are regenerated with sulfuric (or hydrochloric acid) while sodium hydroxide is normally used to regenerate an anion exchanger.

While the most common use of ion exchange is water deionization, a more attractive application in the metal finishing industry is the recovery or purification of finishing solutions. A special form of ion exchange (reciprocating flow), readily identified by its short resin columns, is particularly well suited for chemical recovery applications.

Electrodialysis (ED)

In the ED process, electricity is used to drive ions across ion exchange membranes. A combination of cation and anion exchange membranes can be used to deionize a solution, and recover a concentrate (see Fig. 5). Solutions containing low levels of metals (such as rinsewaters) can be concentrated to allow metal salt recycle. The process is better suited than RO to applications where a high degree of concentration is required.

The major industrial applications of electrodialysis in the U.S. to date have been in the field of water purification.

4.0 Recycling anodizing solutions

Aluminum anodizing is normally done by immersing parts in sulfuric acid and applying current, however, there are a number of other important steps involved. Many of these processes present recycling opportunities.

4.1 The Cleaner:

Before any finishing can be done, grease, fingerprints and other soils must be removed. Alkaline and/or acid cleaners are used.

Cleaning chemicals are discarded periodically as dirt and oils accumulate and cleaning power is lost. Filtration systems have been developed for recycling cleaners based on a technology called ultrafiltration (similar to reverse osmosis), however, they tend to be costly and may well be better suited to large operations such as steel mills. Cleaners normally require neutralization prior to discharge and, where strong alkaline cleaning leads to aluminum dissolution, removal of suspended aluminum hydroxide solids.

4.2 The Etch

Extruded parts show die lines and minor surface imperfections which must be removed in the etch tank. A hot solution of sodium hydroxide (a common ingredient in many cleaners - including household products) removes a thin layer of aluminum and creates an appealing matte surface finish.

Etching is caused by a reaction between the aluminum and caustic soda that produces sodium aluminate and hydrogen gas as follows:

<u>etching reaction</u>

$2Al + 2NaOH \longrightarrow 2NaAlO_2 + 3H_2\,(gas)$

The etching process is responsible for 80-90% of the aluminum in the waste treatment system, however, etch solutions rarely need to be dumped. Traditionally, chemical stabilizers (complexing agents) are added to prevent the aluminum from crystallizing out in the etch tank. The additives thicken up the solution to the point where enough liquid is carried out on the parts to keep the aluminum level from building up in this "never dump" etch. Water is used to rinse the etching solution off the parts. The rinsewater carries dissolved aluminum and caustic to the plant's waste treatment system.

If stabilizers are not used and the sodium aluminate concentration is allowed to rise too high, it will hydrolyze according to equation (2) to produce alumina tri-hydrate ($Al_2O_3 \cdot 3H_2O$), liberating free caustic soda.

hydrolysis reaction

$$2\ NaAlO_2 + 4H_2O \dashrightarrow 2\ NaOH + Al_2O_3{\cdot}3H_2O \quad (2)$$

This reaction, known as the Bayer process , is used in the primary aluminum industry to make alumina. While this converts the aluminate back to sodium hydroxide, it also leads to an accumulation of a rock-hard aluminum hydroxide scale in the etch tank. By seeding the etch solution with alumina crystals in a separate crystallizer tank, it is possible to regenerate the etch solution without having scale buildup.

The basic operation of a regeneration system is illustrated in Figure 6. Etch solution is recirculated continuously between the etch tank and the crystallizer. Hydrated alumina crystals form in the slurry section of the crystallizer and settle out in the clarification section. Regenerated etch solution, with reduced aluminum and increased free caustic levels, flows back to the etch bath directly from the top of the crystallizer. Alumina crystals are withdrawn periodically from the bottom of the crystallizer and dewatered in a centrifuge or filter press.

Over the past ten years many large architectural anodizers have installed regeneration systems based on this process. Regeneration can reduce a plant's solid waste by over 80% while lowering caustic chemical (and neutralization) costs by over 70%. The alumina crystals which are removed can be put to a variety of uses as an alumina substitute. Although these systems are relatively expensive to install, larger plants can recover their costs within two or three years.

One drawback to a regenerated etch relates to its lower aluminum levels. As high aluminum levels promote a more matte finish, there were initially some concerns that a regenerated etch would not yield a finish suitable for the North American market. With several systems now in operation, a regenerated etch is widely regarded to produce a finish that is slightly less matte than a "never-dump" finish but satisfactory for most applications. Recently, however, a new high performance etching process has been introduced that is compatible with regeneration systems. This process, known in North America as Euro-Etch, allows an anodizer to achieve a premium heavy matte finish while reducing etch time, chemical costs and waste generation.

4.3 Other Etching processes

Die cleaning

Extrusion dies are changed frequently and normally must be cleaned before they can be reused. Dies are soaked in hot caustic soda to dissolve the aluminum plug that remains in the die after it is removed from the extrusion press. Although die cleaning is normally done in a small tank found in the repair shop, it is often responsible for several thousand gallons of waste each month.

Neutralization with sulfuric acid is one treatment alternative, however, spent die cleaner can create up to twice its own volume in waste sludge. There are other problems as well. The graphite compound that is used to lubricate the aluminum ingot in the extrusion press leaves a deposit in the die that ends up in the die cleaner. These fine graphite solids, together with alloy smut, settle slowly and tend to clog filter press cloths. As a result, die cleaner is often hauled offsite for disposal.

A crystallization system similar to that used for caustic etching solutions has been modified for use in die shops. A flocculation / clarification / filtration process is used up front to remove the suspended solids. The chemistry is also modified to a high speed formulation often used in the aerospace industry for chemical milling of aluminum sheets. A small amount of water is added during flocculation to dilute the die cleaner. The dilution actually causes the solution to saturate, promoting the crystallization reaction. The extra water is not normally a problem, however, as the high temperature of the die cleaner leads to an adequate amount of natural surface evaporation.

Hydrochloric acid etching

Dilute hydrochloric and nitric acid solutions, often modified with various organic and/or inorganic acids, are used to electrochemically etch aluminum sheet. These baths become contaminated with dissolved aluminum and must be dumped frequently and treated.

Usually these baths are fairly dilute, making purification by cation exchange a practical choice. Cation exchange requires chemical regeneration, however, efficiency can be increased by using an APU to recover the used regenerant. In a new process, the units have been integrated together to improve efficiency and reduce cost. Several of these systems are now being used by manufacturers of lithographic plates to purify electrolytic etching (graining) baths. Typical results are summarized in Table 2. The aluminum chloride byproduct produced by these systems has been utilized by municipal sewage treatment plants for phosphate removal. This process has also been used with the hydrochloric acid based etchants used for aluminum capacitor foils.

Table 2: Recovery of lithoplate etchants - typical results

Stream	[Al]	[HCl]	[H_3BO_3]
	(g/L)	(g/L)	(g/L)
bath	4.7	7.0	10
byproduct	13.5	1.5	-

4.4 The Bright Dip

Concentrated phosphoric acid solutions, usually with additions of nitric acid, diammonium phosphate and copper, are used to chemically brighten aluminum parts. After brightening, the adhering solution must be rinsed off immediately with water. Due to the high acid concentrations (ie. 70-80% H_3PO_4) and viscosities of bright dip baths, carryout of bath solution on the parts is typically 3-4 times greater than from an anodizing tank. While aluminum contamination of the bath is rarely a problem, there is a substantial loss of bath chemicals.

Most plants collect the rinsewater as a 35% solution for resale as fertilizer. The seasonal and regional variations in demand for the rinsewater reduce the value to between 10-20% of the original chemical cost. The net cost for larger plants can easily reach several hundred thousand dollars per year.

The rinse can be reconcentrated to bath strength with a vacuum evaporator, however, a purification step must be employed to prevent aluminum buildup. A typical system layout is shown in Figure 7. The feed to the cation exchanger unit or DCU is drawn from the first of a series of counterflowing rinse tanks at a concentration of 10-15% acid strength. Typically 90% of the aluminum is removed by the DCU before the solution flows to the evaporator for concentration to bath strength. The cation exchanger is regenerated with sulfuric acid and the waste, containing sulfuric acid and aluminum, is processed with an APU. Purified sulfuric acid is returned to the DCU for use in the next regeneration cycle.

The aluminum sulfate waste or byproduct produced by the system can be neutralized in the plant waste treatment system or concentrated by evaporation and sold as liquid alum. Typical results are given in Table 3.

Table 3: Typical Results Phosphoric Acid Bright Dip Recovery

Bath	H_3PO_4 (g/L)	Al (g/L)
Bright dip bath	1340	20-40
First (feed) rinse	150-200	3-6
Third (final) rinse	<10	<0.5
Evaporator product	1365	<5

By using the combination cation exchange/APU system the cost of operation is reduced to the point where recovery becomes economical for any plant consuming more than three truckloads per month of 80% acid. Several installations have been installed over the last ten years and, in all cases, acid recovery efficiencies in excess of 85% have been reported.

A number of plants are now using a proprietary bright dip chemistry that employs a high sulfuric acid content. The process offers a number of quality enhancements when compared to ordinary bright dips, however, until recently, recovery has not been possible. The sulfuric acid affects evaporator design due to boiling point elevation and higher corrosivity. The effect of the proprietary additives on the system and additive replenishment have been two other concerns.

Currently an evaporator design has been developed that is compatible with the higher sulfuric level. Work is also underway to evaluate and resolve issues related to the additive.

4.5 The Desmut Tank

Alloying metals such as copper, magnesium and zinc are not usually removed in the etch tank and leave a dark film on the etched parts. This "smut" must be removed with an acid wash. The actual amount of metal dissolved in the acid is quite low so it unusual for a bath to be dumped because of metallic contamination. Water from preceding tanks that is carried in to the desmut bath on the parts occasionally leads to dilution of the acid. Technically, an APU or small evaporator could be used in these cases. The desmut tank generally does not represent a significant waste management concern.

4.5 The Anodizing Tank

Anodizing tanks represent excellent opportunities for purification as the dissolved aluminum levels must be kept quite low. In addition to eliminating a waste problem, continuous purification can enhance the uniformity of the anodized film, making coloring easier.

Sulfuric Acid Anodizing

The anodize (oxide) film itself is produced by passing electricity through the aluminum parts while they are immersed in a cool sulfuric acid solution. Aluminum dissolves during the anodizing process and this causes the conductivity of the solution to decrease. To maintain a desired anodizing rate the voltage must be increased. The extra power generates heat causing the temperature of the solution to increase. A chiller is used to keep the solutions cool, however by the time the aluminum level in the acid reaches 15-20 grams per liter (g/L), further voltage adjustments are not usually practical and the solution must be discarded.

Other contaminants may also cause problems. Iron, copper and lead are all considered undesirable. Excess levels of chloride, nitrate and phosphate also create problems.

Maintaining low aluminum levels by continuous decanting leads to excessive chemical and treatment expense so that this is an ideal recycling opportunity. In addition, constant aluminum levels lead to a more uniform anodic film. This, in turn, helps to ensure color uniformity in subsequent coloring operations.

An APU (acid purification unit) based upon the acid sorption process can be used to continuously remove metallic impurities as well as phosphate from the anodizing bath. The aluminum level can be maintained consistently in a range (6-12 g/L) considered optimal for anodizing. A large number of these units have been installed around the world since the process was introduced in 1976. A typical APU designed for anodizing service is shown in Fig. 8.

The diffusion dialysis process has been utilized in Japan for the same purpose, although its application in North America and Europe has not been nearly so widespread. It is also possible to remove aluminum by crystallization as ammonium alum by adding ammonium sulphate and cooling, but this process has not been employed to any significant extent.

Chromic Acid Anodizing

Anodizing for military and aerospace applications is often done with chromic acid solutions containing about 30 g/L CrO_3. As with all anodizing processes, aluminum is continually dissolved from the film by action of the acid. This decreases the *free* chromic acid content of the bath. Aluminum dissolution may be countered by additions of fresh chromic acid but, once the aluminum level exceeds 12 g/L, the voltage required to work the bath becomes excessive and the corrosion resistance of the coating may suffer. At this point the bath needs to be either discarded or regenerated.

Trivalent chromium is a contaminant that is created by reduction of the hexavalent chromate at the cathode. Trivalent chromium must be controlled as it retards the dissolution of aluminum, essentially inhibiting the formation of an anodic film.

Cation exchange has been used for many years to remove aluminum and trivalent chromium contamination from chrome anodizing solutions. While the concentration of chromic acid in these baths is low enough to prevent severe resin oxidation, manufacturers often recommend macroporous type resins for this application because of their superior oxidation resistance.

Anodic oxidation of the trivalent chromium is also possible. This method has been used by chromium platers for some time. A separate electrolysis tank fitted with a high ratio (eg. 30:1) of lead anodes to iron or stainless steel cathodes will oxidize the trivalent chromium back to the hexavalent state. This process can be enhanced through use of a ceramic diaphragm that separates the anolyte (ie. the solution around the anode) from the catholyte, thereby suppressing further oxidation of chromium in the anodizing electrolyte.

The simple electrolysis process described above will not remove aluminum or other metals to any significant degree. In order to do this it is necessary to employ a cation exchange membrane in place of the ceramic pot. This will allow migration of aluminum cations from the anodizing solution, which form the anolyte, to the catholyte.

Dragout of chromic acid from the anodizing bath into rinses can pose a severe disposal problem. Ion exchange and evaporative recovery processes, originally developed for recovery of chromium plating rinse water, can be similarly applied in anodizing.

Like their plating counterparts, chrome anodizing baths are extremely sensitive to chloride and sulfate contamination. Chloride levels of 0.2 g/L (as NaCl) and sulfate levels of 0.5 g/L (as Na_2SO_4) are considered maximums. For this reason rinsing of sulfuric acid regenerants from the ion exchange resin bed is critical. Remaining sulfate impurities can be removed by precipitation with barium carbonate or barium hydroxide. Chloride impurities can be precipitated with silver oxide or anodically oxidized to chlorine.

Phosphoric Acid Anodizing

Since phosphoric is a much weaker acid than sulfuric acid, it is possible to remove aluminum from phosphoric acid anodizing baths containing about 30% H_3PO_4, by cation exchange. An APU can then be used to recover the excess sulfuric acid used to regenerate the decationizer. An evaporator may be necessary to remove water added to the bath when the phosphoric acid is rinsed from the ion exchanger.

Phosphoric acid anodizing solutions are extremely sensitive to sulfate contamination. A very small amount of sulfate contamination sometimes occurs, sometimes as a result of inadequate rinsing of the cation exchange resin after regeneration. The excess sulfate can be removed by precipitation with barium carbonate.

4.6 The Coloring Tank

Three types of coloring methods are commonly used with anodized materials:

Integral Coloring

This method uses a weak sulfuric acid anodizing solution containing an organic acid to simultaneously form and color the anodic film in bronze and black shades. These baths are more sensitive to dissolved aluminum than conventional (clear) anodizing baths and must be carefully monitored. Cation exchange has been used with integral color baths for many years to remove dissolved aluminum. When used in conjunction with an APU for regenerant recovery, the operating costs of the purification equipment are quite modest.

Electrolytically Deposited (Two-Step) Coloring

Two-step coloring is done after anodizing in a separate tank. Electrolytes are based on nickel, copper, cobalt or tin salts, and frequently contain a weak organic acid. With its low electrical usage, the two-step coloring process has become a popular alternative to integral color anodizing in recent years.

After coloring, the aluminum must be well rinsed before sealing. The coloring solution carried out of the bath on the surface of the parts (dragout) causes an create appreciable loss of metal salts.

Several ion exchange systems have been installed in cobalt based coloring operations with excellent success. Similar ion exchange technology has also been used for many years to recover copper and nickel sulfate from electroplating rinsewater. With tin based processes, the stannous tin tends to oxidize in the rinsewater to the insoluble stannic form and precipitating from the solution and limiting the amount of tin that can be recovered.

Metal recovery from coloring rinsewaters may also be a good application for electrodialysis and reverse osmosis.

Inorganic Dyeing

Various dyes have been developed for architectural applications and are also applied after the anodizing step. Increasingly, dyes are being used after two-step coloring (over-dye) to produce a wide variety of colors.

Coloring systems based on dyes frequently use a simple recovery method of returning rinsewater back to the dye tank to make up for evaporation and dragout losses.

4.7 Chromate Processes

Chromate is used in several aluminum finishing processes, including conversion coating and chrome anodizing. To avoid pollution hazards there has been a recent trend away from chrome based processes, even though these baths are often better understood. Ion exchange has been used for many years to recover/purify chromic acid from plating operations and has recently been applied to chrome anodizing with good results.

Conversion coatings are difficult to recover. Many formulations are proprietary and, while it may be technically possible to recover chromate from the rinsewaters, it can be impractical to re-formulate the bath. In addition, the amount of chromium involved is usually small and may not warrant the care required to successfully recycle.

4.8 Sealing

This important process closes the tops of the holes in the oxide layer. Sealing ensures that the surface finish will be colorfast and resistant to staining and corrosion. Seals can be based on either hot water or chemicals. Most chemical seals are very dilute solutions that contain a small amounts of dissolved nickel. The low chemical loss from seal tanks does not represent a significant waste treatment problem or warrant recovery.

5.0 Conclusion

With the increased focus on the 3R (reduce, recycle, reuse) approach in all facets of business, anodizers can look to a host of opportunities in their plants that will:

- reduce process chemical costs,
- reduce waste treatment chemical and labor costs, and
- in many cases, enhance product quality.

Recycling is an environmentally pro-active step that demonstrates a responsible corporate image to your customers, employees and to the local authorities. It makes you feel good and it's not bad for the bottom line, either.

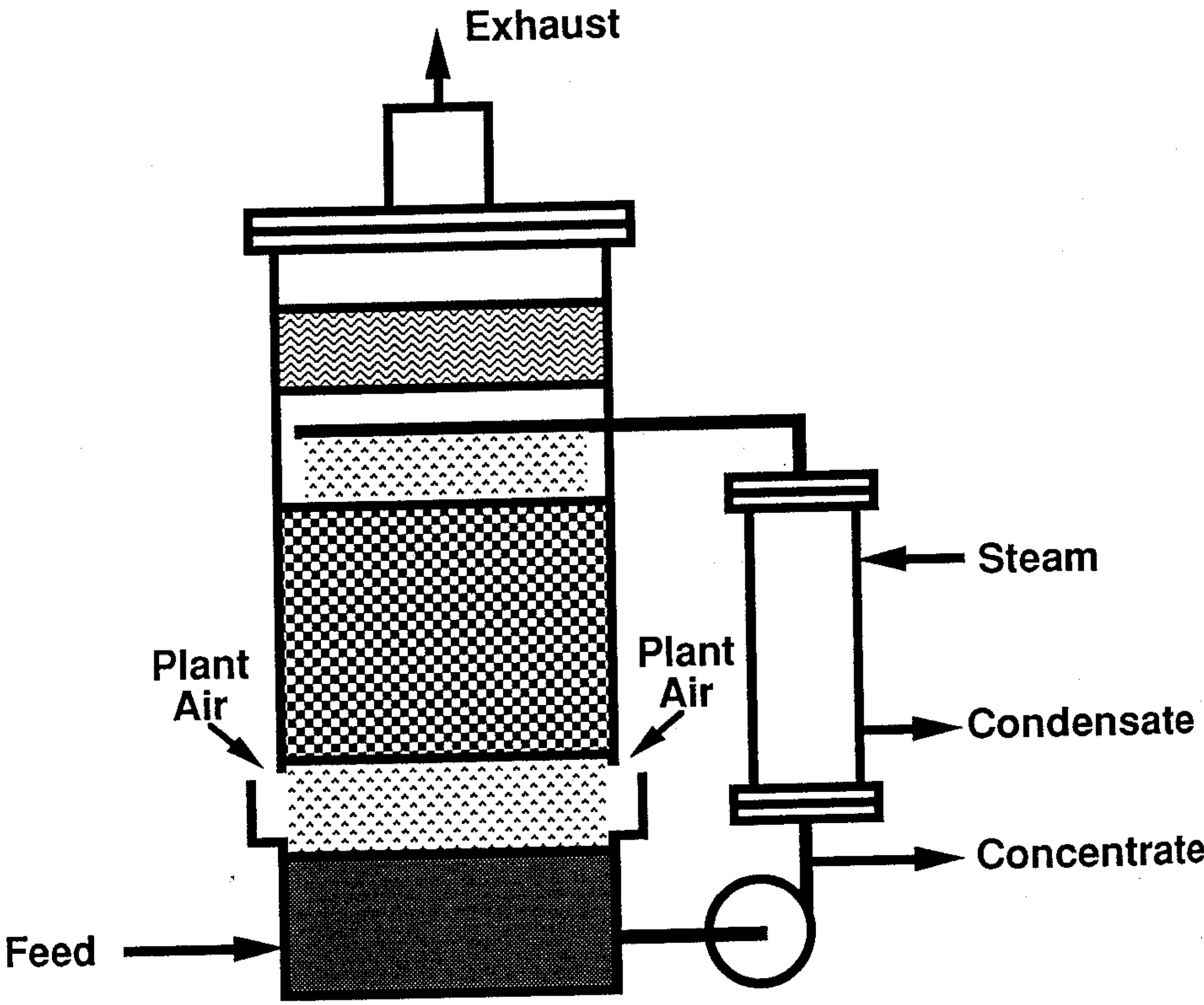


Fig. 1 - Atmospheric Evaporator

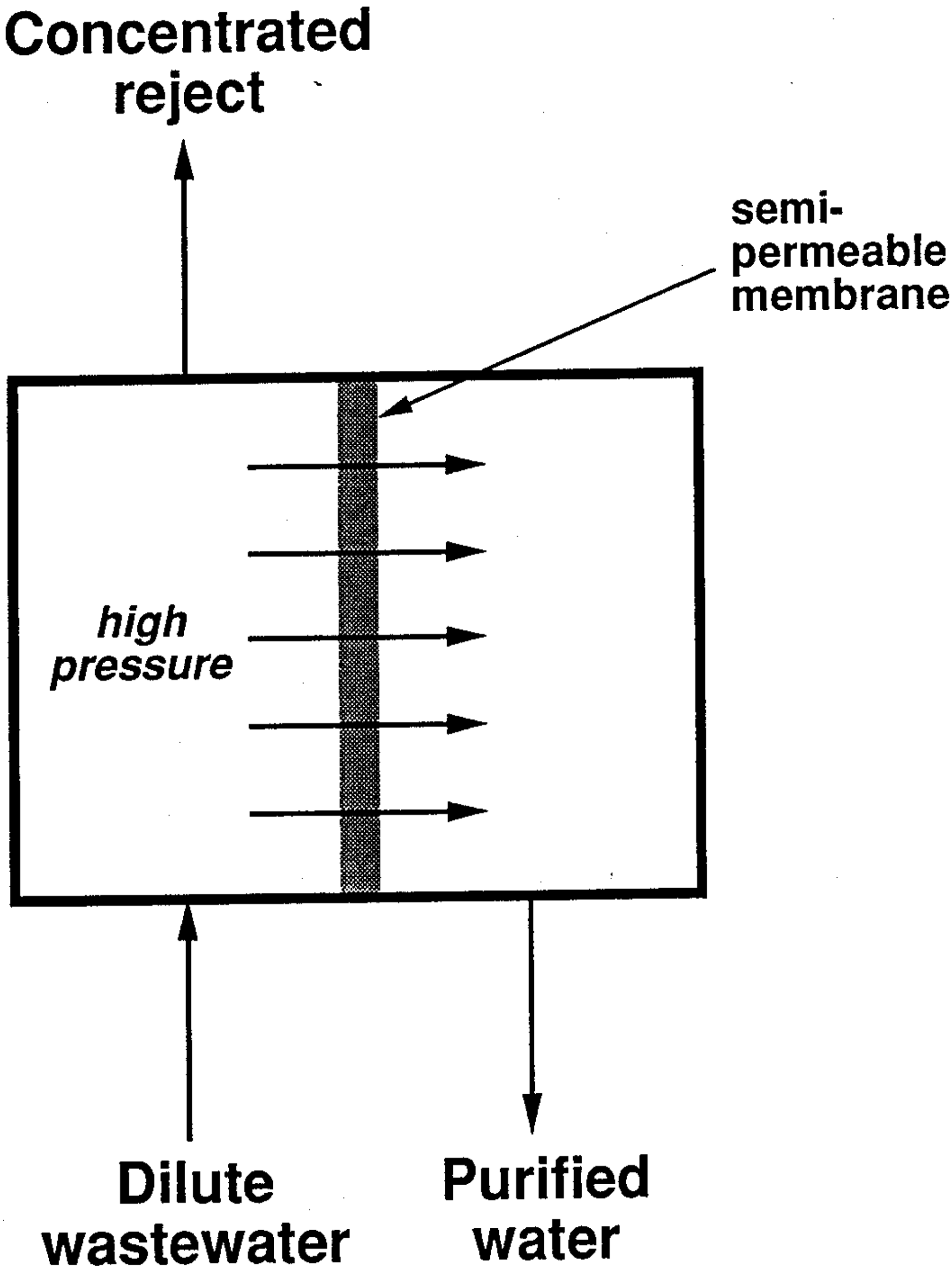


Fig. 2 - Reverse Osmosis

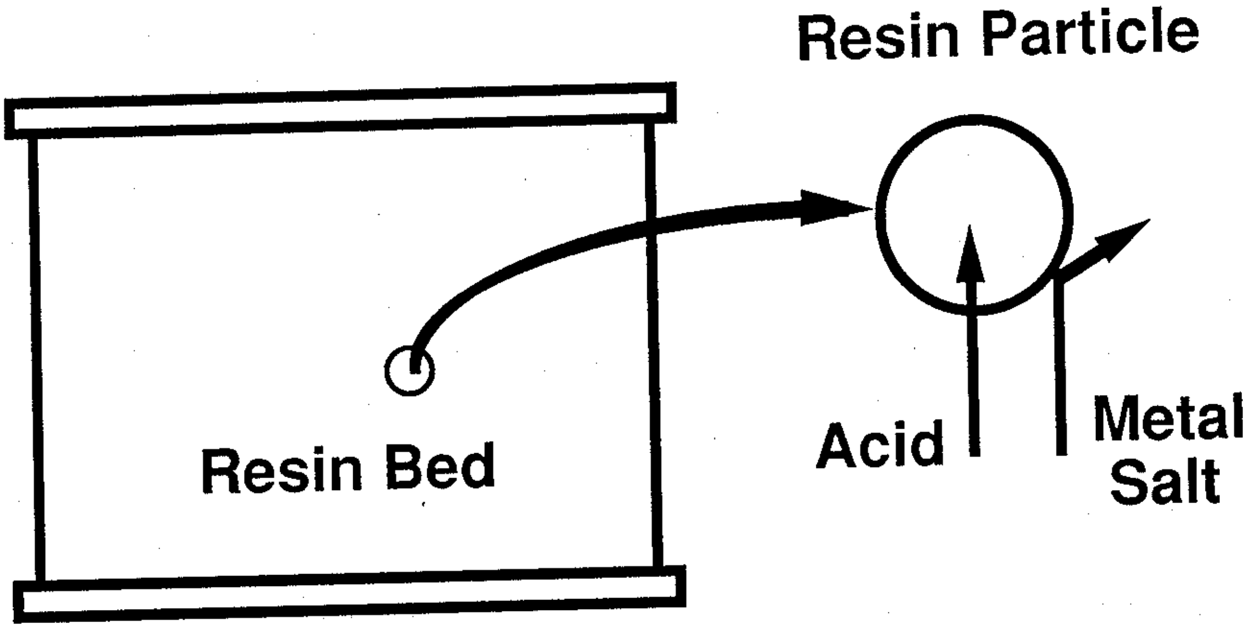


Fig. 3 - Acid Sorption Process

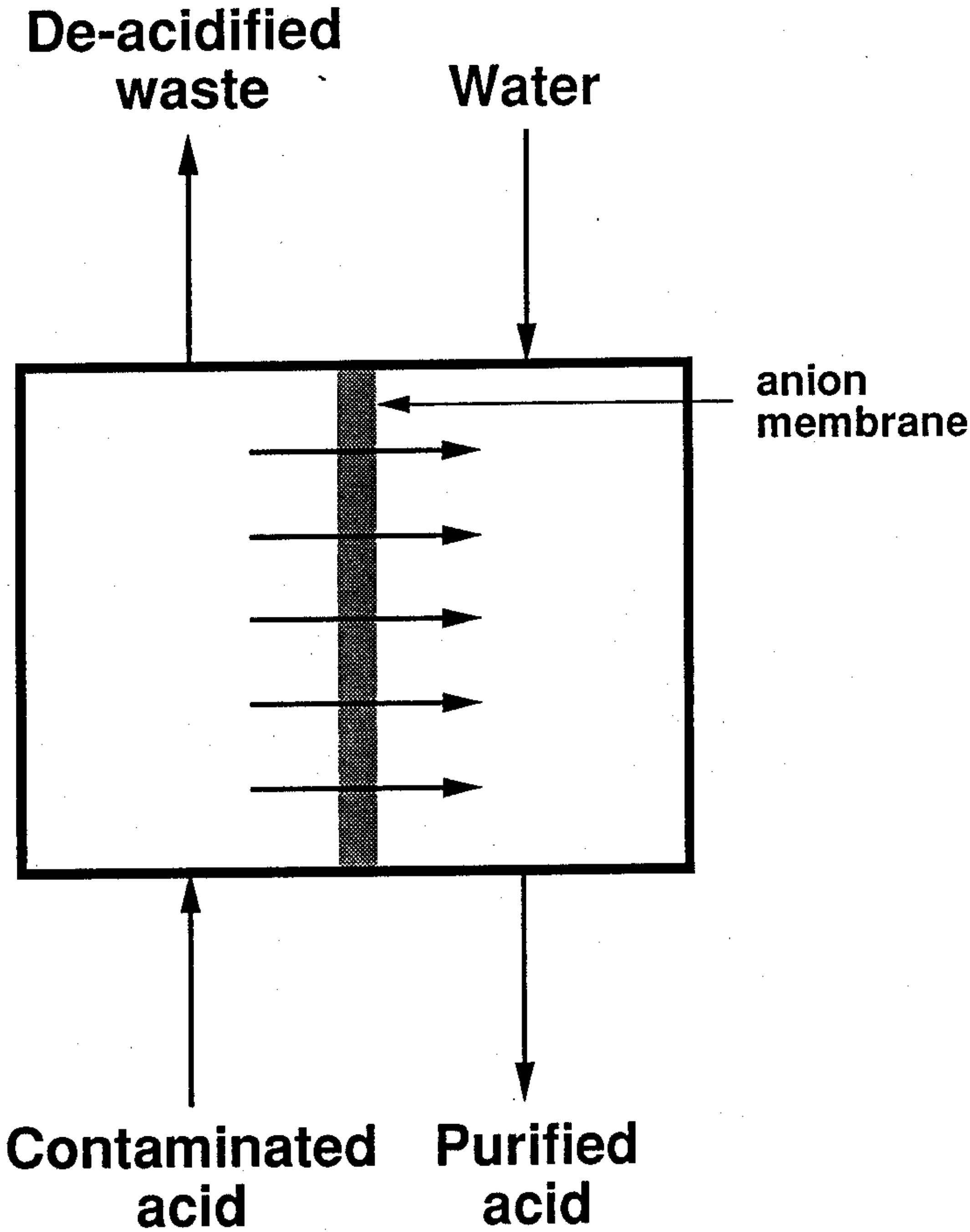


Fig. 4 - Diffusion Dialysis

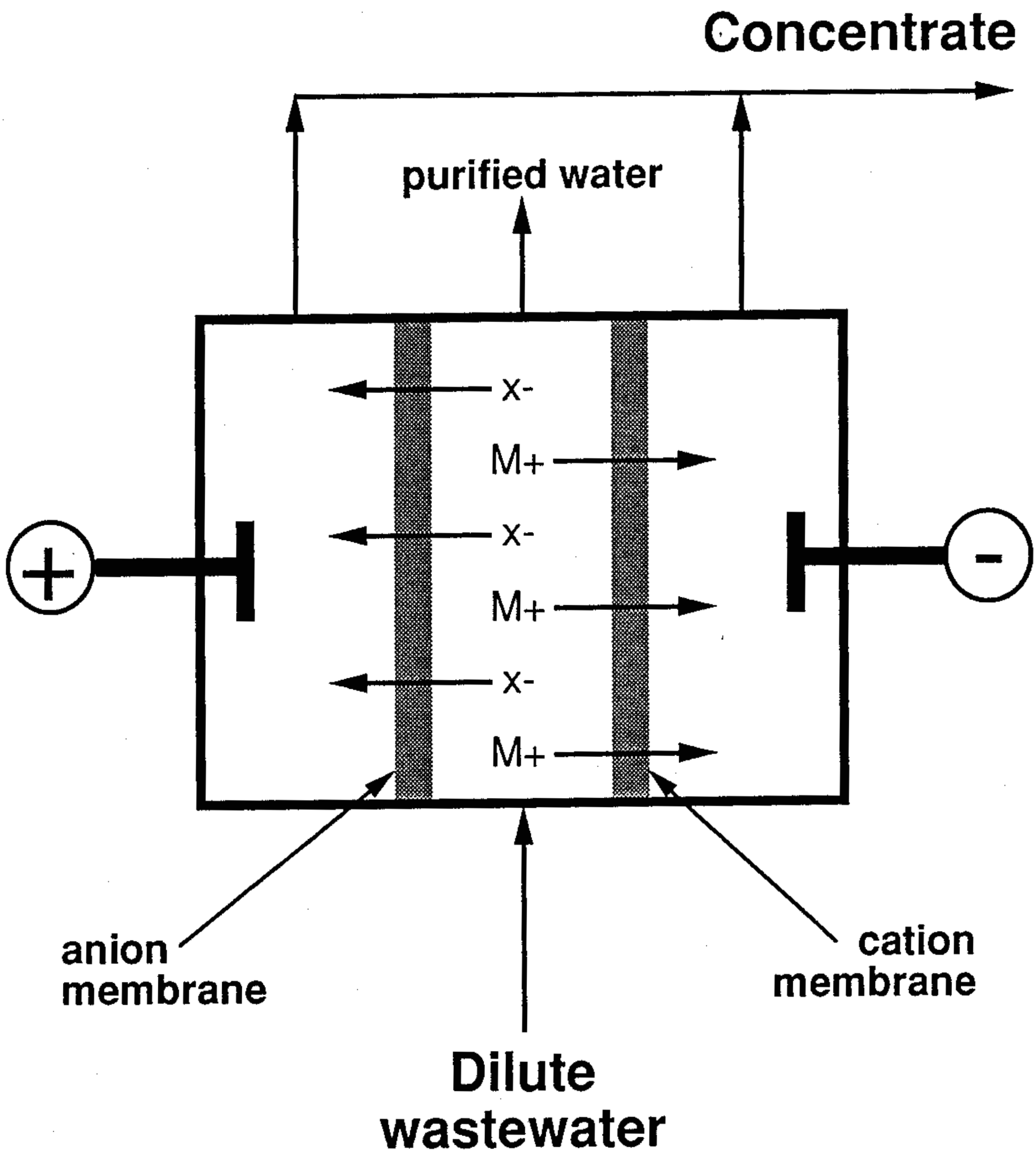


Fig. 5 - Electrodialysis

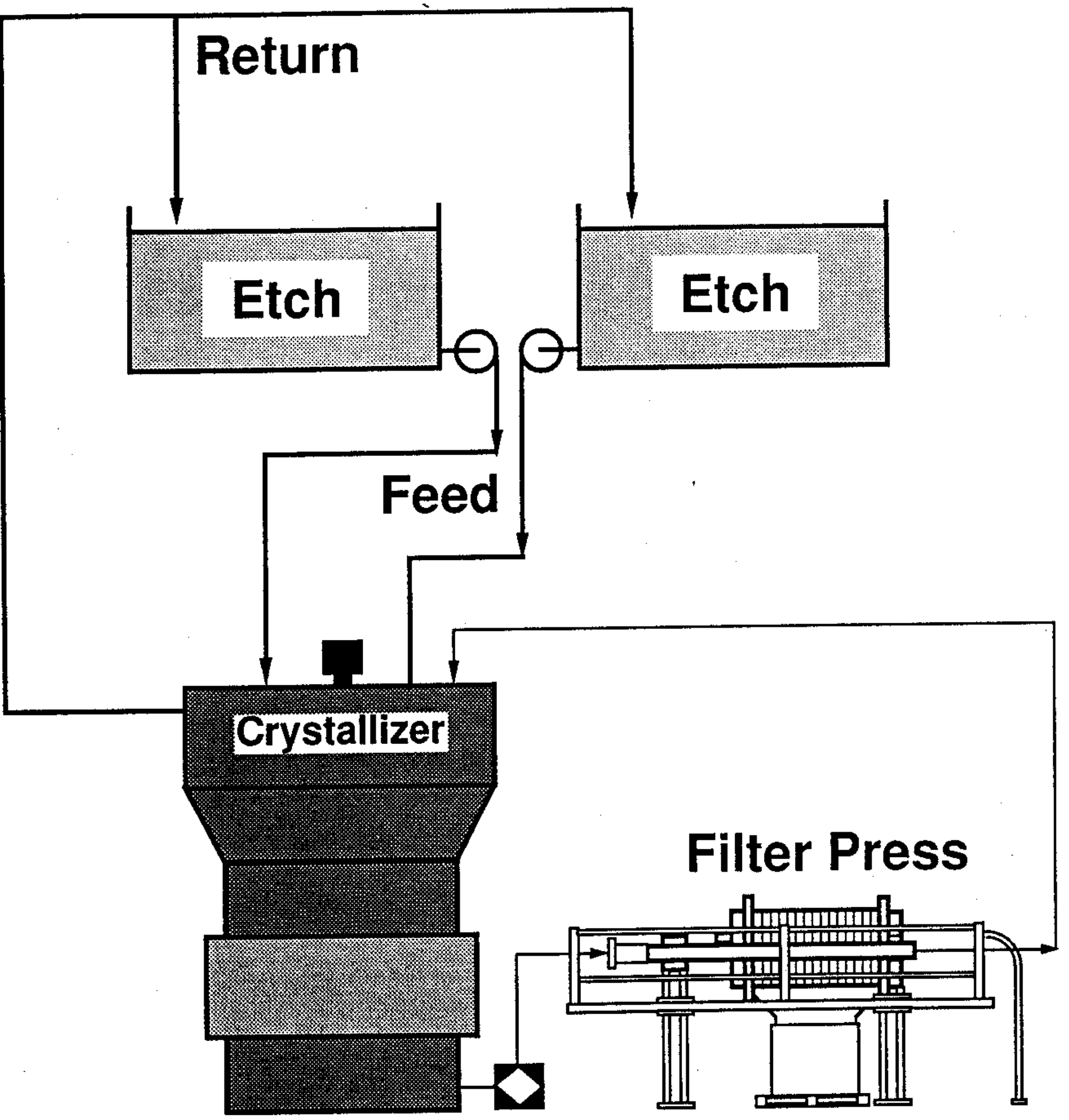
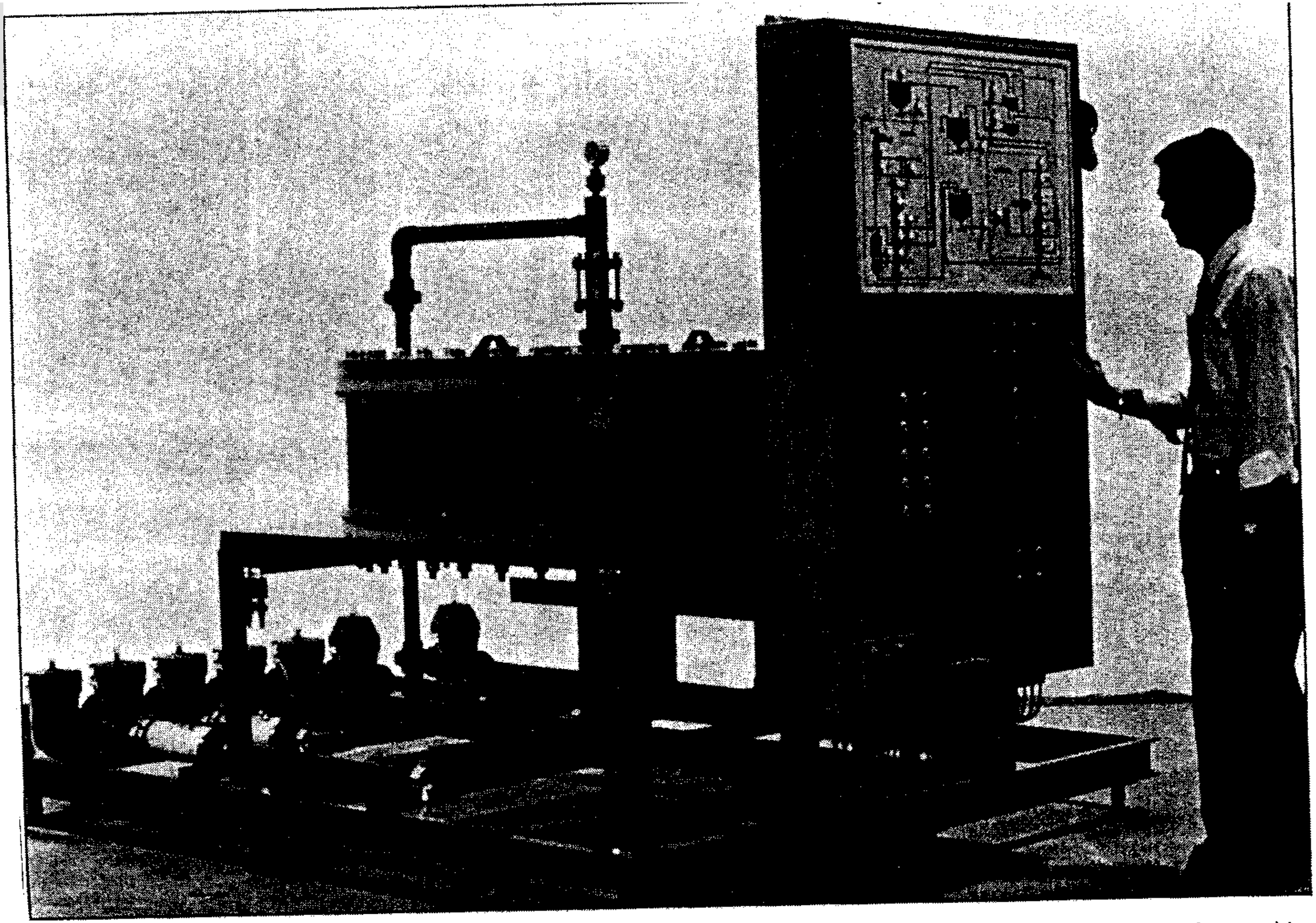


Fig. 6 - Caustic Etch Regeneration System

FIGURE : Acid Purification



The fully automated Acid Purification Unit uses a unique sorption process to separate dissolved metallic salts from acid.
Acid is continuously purified for improved process quality and consistency, at a lower cost.
Commonly used for purifying anodizing, pickling and electroplating acids.

American Electroplaters and Surface Finishers Society

August 4, 1992

Mr. Victor Young
Waste Reduction Resource Center
3825 Barrett Drive, Suite 300
Raleigh, NC 27609

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Telephone (407) 281-6441 / Telex 510-601-6246 / FAX (407) 281-6446

July 25, 1992

Mr. J. Howard Schumaker, Jr.
Executive Director
American Electroplaters and Surface Finishers Society
12644 Research Parkway
Orlando, FL 32826-3298

Mr. J. Howard Schumaker Jr.

As a representative for the Waste Reduction Resource Center and an AESF member, I attended the SURF/FIN '92 technical conference in Atlanta on June 22-25. The conference was excellent and the proceedings are a major source of up-to-date information.

I've attached a copy of the WRRC operations. As you can see, we supply technical assistance and copies of technical articles on a no charge basis. The WRRC is the Clearinghouse and Tech Assist group for Region IV EPA.

Two copies(two volumes each) of the International Technical Conference Proceedings June 22-25, 1992 were purchased to become sources of information for Technology Transfer. One copy is in the EPA Region IV library in Atlanta. The other copy is being used as a reference document at the WRRC in Raleigh, NC. Reference Documents are used by many state offices, Universities, and industry. The WRRC also sends copies of articles on request by the general public.

I request that the WRRC and Region IV EPA Library be allowed to make copies of the papers in The Proceedings of the AESF Annual Technical Conference SURF/FIN 92. This will save us (taxpayer supported) the expense of contacting each author/presenter for copies of their presentations.

respectfully

Vic Young
Staff Engineer
Waste Reduction Resource Center