

Technology Application Bulletin

Wastewater Treatment Systems

Introduction

Almost all industrial processes generate some form of wastewater. In a world of constantly changing environmental regulation, increasing water and sewer costs, and limited, costly fresh water supplies, dealing with wastewater presents complex, difficult choices to a wastewater generator. For instance, is it more cost effective to completely eliminate the discharge of a particular wastewater via treatment, recycle, or reuse; or simply treat the wastewater and release it to the environment? The answer to this question is unique to each situation. For this reason, ProChemTech investigates all available options and then custom designs a solution for each client. Custom designed and manufactured ProChemTech treatment systems and chemical products provide our clients with the most cost-effective answer to such questions.

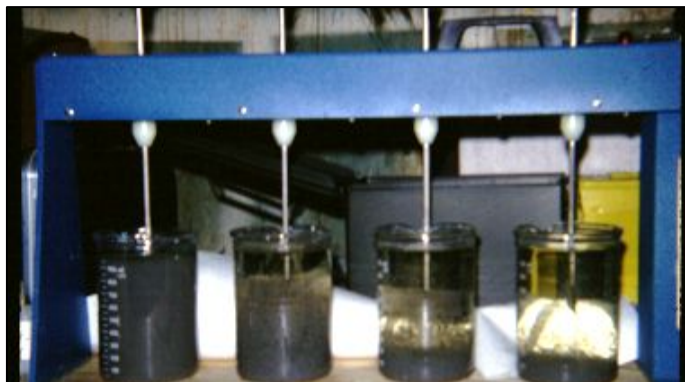
Company Mission

ProChemTech was founded in 1987 to provide industry with innovative quality chemical products, control equipment, system design, and the professional technical support needed to operate industrial and commercial water and wastewater systems in a cost effective and environmentally safe manner. The company is organized as a “single source” supplier, having capabilities in specialty chemical and equipment manufacture, system design, research, environmental services, analytical services, and engineering. This innovative and unique integration of chemistry, engineering, environmental expertise, and manufacturing technology by ProChemTech permits us to devise and provide complete, innovative, cost-effective solutions to any wastewater problem.

Wastewater Treatment Chemistry

Our experience has taught us that each wastewater is unique and that a specific treatment train should be designed for each to obtain optimum results. Finding the right chemistry to treat a given wastewater starts in our laboratory, where the level and chemical form of pollutants are determined. Using this analytical data, we select several chemistries for detailed bench-scale treatability testing to ascertain the best one for that wastewater. We have an

extensive selection of chemistries available to us due to our years of industrial wastewater treatment experience and in-house manufacturing capacity.



A graphic demonstration of the effectiveness of ProChemTech's polymers on suspended solids.

We custom design each wastewater treatment system using proven industrial grade components and our own design and manufacture equipment to specifically take full advantage of the chemistry developed in the bench studies. This method results in the most cost-effective, reliable treatment systems design possible.

Wastewater Recycle/Reuse

Recycle and reuse of industrial wastewater presents some unique chemical problems not normally considered during the design of wastewater treatment trains. For instance, many consulting engineers like to use ferric chloride as a primary precipitant followed by use of calcium hydroxide for pH neutralization. While this train will work on many different wastewaters, its use increases the amount of corrosive chloride and scale-forming calcium remaining in the treated wastewater. ProChemTech has invented a large number of unique treatment chemistries designed to prevent the addition of unwanted materials to treated wastewaters which facilitates recycle/reuse while effectively removing the targeted pollutants.

Pollutant Removal

Environmental restrictions are constantly changing, usually resulting in decreased discharge limits for wastewater pollutants. Meeting these decreased limits often requires application of non-traditional chemistry trains or research and development of entirely new chemistries. ProChemTech has met such challenges many times by developing innovative technology to reduce levels of such pollutants as arsenic, antimony, selenium, and lead to values impossible to obtain with traditional chemistries.

The following is a list of some of the industries where we have provided designs and systems to treat various wastewaters:

- ⇒ Gallium arsenide semi-conductor manufacturing
- ⇒ Glass container and light bulb manufacturing
- ⇒ Corrugate manufacture/printing
- ⇒ Electronic capacitor manufacturing
- ⇒ Ferrite magnetic material manufacturing
- ⇒ Electroplating – all metals and cyanide
- ⇒ Electroless plating – all metals
- ⇒ Phosphatizing, anodizing, and chromating systems
- ⇒ Semi-conductor packaging
- ⇒ Silicon carbide, carbon and graphite manufacturing
- ⇒ Vibratory finishing – all metals
- ⇒ Circuit board manufacturing
- ⇒ Organic dye wastewater
- ⇒ Industrial laundry wastewater
- ⇒ Cosmetic manufacturing
- ⇒ Railcar cleaning wastewater
- ⇒ Acid mine wastewaters
- ⇒ Gas well hydrofracture and production wastewaters



Demonstration of the water clarity achievable with ProChemTech chemistry and equipment

Wastewater Treatment Systems

Once an appropriate chemistry train has been devised, the success or failure of the treatment process is governed by the system where it is applied. ProChemTech has recognized this fact and addressed it by designing and manufacturing its own wastewater systems to complement the treatment chemistry. The integration of chemistry, systems, equipment design, and manufacture of the products required, results in an optimum design for the user.

Inclined Plate Clarifiers



ProChemTech's highly effective adjustable V-notch weir.

One of the workhorses of the ProChemTech line of treatment equipment is the inclined plate clarifier (IPC). This device provides effective removal of suspended solids from high flows of wastewater using minimal floor space. Slanted plates are set at an angle to the flow to dramatically increase the surface settling area as compared to a typical settling tank or clarifier.

ProChemTech manufactures a complete line of IPC to operate at flow rates ranging from 5 gpm to 250 gpm. Higher flow rates are easily obtained by parallel installation of multiple IPC units. ProChemTech inclined plate clarifiers have several features not found in competitive units. These include fully adjustable V-notch weirs constructed of stainless steel and fiberglass, easily removable plate packs constructed of polished fiberglass, zero head loss entry into the plate pack, integral "square" dimension mix and post clarifier tanks, and sludge collection hoppers with no moving parts. These features result in an inclined plate clarifier that, we believe, is simply the best unit manufactured in the world today. The performance of ProChemTech inclined plate units is best demonstrated by the clarity of the effluent, most units operate with an effluent turbidity less than 1 ntu, with many units at levels less than 0.5 ntu.



500 gpm IPC installation, acid mine drainage to makeup for a trout raising facility

Sequential Batch Systems

Where the wastewater flow is low, an IPC based system is often too costly for consideration. ProChemTech has devised programmable logic controlled (PLC) sequential batch systems (SBS) which provide a cost effective means to treat small amounts of wastewater; 100 to 10,000 gpd. The SBS is an extremely versatile single-tank treatment system that can be used for application of complex treatment schemes. The use of the PLC provides for accurate and consistent chemical additions. In a single tank, a set volume can be subjected to all typical chemical and physical processes such as neutralization, flocculant addition, coagulant addition, settling, decanting of clear water, and removal of sludge.



Sequential Batch Unit

Membrane Technology

In many situations, stringent requirements must be met before wastewater can be safely recycled, reused, or discharged to the environment. In these cases, where premium water quality is a requirement, membrane technology is often the method of choice. This advanced technology is useful for the removal of suspended solids, breaking of emulsions, and/or decreasing of dissolved solids. Membrane technology, which includes the specific processes of reverse osmosis, nanofiltration, ultrafiltration, and microfiltration, essentially is a cross flow filtration process using membrane elements which have "pores"

of specific, predetermined size. Water under pressure is supplied through as permeate, while the suspended and dissolved solids are removed in a reject of concentrate stream. Membrane technology is now a practical solution for many industrial treatment problems.



A ProChemTech manufactured microfiltration system awaiting shipment at our scenic Pennsylvania assembly facility.

Ion Exchange Units

Use of specific ion exchange resins for removal of targeted ions, such as copper, nickel, tin, and lead has proven to be very effective for treatment of specific wastewaters for reuse/recycle and discharge.



PCT manufactured ion exchange unit control panel.

In some cases, such as precious or costly metals, they can be recovered using ion exchange, reducing, or eliminating, the cost for operation of the wastewater treatment process. Water that is treated by ion exchanges resin is often of very high quality and can be recycled to the generating process or reused elsewhere in the facility

ProChemTech custom designs and builds PLC controlled ion exchange units using various resins and configurations specific for the wastewater to be treated. The use of industrial (Allen-Bradley) PLC controls with standard ladder logic makes these units extremely versatile, in comparison to the competitive proprietary design and controls on the market.

Media Filter Units

Many times the major problem is simply various suspended solids in the wastewater preventing legal discharge or reuse of the water within the facility. ProChemTech has developed a complete line of single and multi tank pressure filters using multimedia for removal of many different suspended solids. Multimedia, generally consisting of anthracite, sand, and garnet; is much more effective than the typical sand media filter in that solids loading is much higher, reducing backwash water use, and much smaller size suspended solids can be removed. Units can be teamed with polymer flocculation for cost effective removal of suspended solids down to less than 0.5 microns in size.



Dual tank multimedia filter, PLC controlled, total flow rating of 1000 gpm

ProChemTech can provide both electromechanical and PLC controlled units in flow ratings from 8 gpm to 2,000+ gpm. Smaller units can be supplied skid mounted, while bigger units are field assembled.

Cooling Towers

Costs for water and sewage disposal will continue to increase for at least the next ten years due to environmental regulations and almost complete use of the available fresh water capacity in many areas. Attempting to cut costs, many industries have begun to search for ways to recycle and reuse their cooling water. Systems that accomplish this goal normally rely on a cooling tower to reject heat and cool the recirculated water down to usable temperatures.



Long term successful operation of such cooling systems depends upon both proper initial design and equipment selection, and use of the correct water treatment chemistry to control corrosion, deposition, scale, and microbiological growth. In many cases, companies have contracted system design to one firm, purchased a cooling tower from another company, obtained pumps and systems controls from a distributor, and then contracted with yet a fourth company to provide the chemical controls and water treatment chemistry. ProChemTech takes pride in its ability to provide all these services to its customers.

We have also developed, and patented, the technology to operate cooling towers with minimal, or no blowdown, with completely non-hazardous means for biological fouling control. No blowdown and no toxic chemical biocides, really “GREEN” technology.

Systems Integration

ProChemTech has been involved in industrial wastewater treatment for discharge, reuse, and/or recycle since 1987, with individual employees having experience levels varying from ten to forty years. It has been our collective observation that the success or failure of any wastewater treatment project is highly dependent upon the integration of the treatment chemistry and the process equipment used. By totally integrating both the treatment chemistry and equipment within one company, ProChemTech offers a superior service for resolution of industrial wastewater problems.

ProChemTech International, Inc.
“Innovation in Water Management”
Apache Junction, AZ, and Brockway, PA
814-265-0959 **www.prochemtech.com**

Representative Projects

Industry	Company	Pollutants
Ferrites	Spang & Company	iron, manganese, suspended solids
Electroless plating	Custom Industrial Processing	cadmium, chromium, zinc, phosphate, pH
NTC and PTC components	Keystone Carbon Company	cobalt, nickel, manganese
Cemented carbides	Newcomer Products	cobalt, pH - cobalt recovered as salable commodity
Electronic capacitors	MuRata Electronics	nickel, tin, pH
Industrial laundry	RUS	3 separate plants - oil/grease, heavy metals, suspended solids, pH
Rail tank car cleaning	RESCAR	oil/grease, pH, suspended solids, various organics - treated water reused as boiler makeup
Rail tank car cleaning	GE Capital	3 separate plants - oil/grease, pH, suspended solids, various organics - treated water reused as boiler makeup
Vibratory finishing	Keystone Carbon Company	oil/grease, copper, nickel, suspended solids
Carbon, graphite	St. Marys Carbon	suspended solids - zero discharge recycle system
Carbon, graphite	Carbonne of America	suspended solids - zero discharge recycle system
Carbon, graphite, silicon carbide	Morgan Advanced Materials	2 plants - suspended solids - zero discharge recycle system
Glass light bulbs	GTE Sylvania	2 - plants - heavy metal pigments - zero discharge recycle system
Semi-conductor	Litton Electron Devices	lead, arsenic, pH
Semi-conductor	L 3	2 - plants, various heavy metals from electroplating includes cyanide - zero discharge with reuse as CT makeup
Glass picture tube	Corning, Inc.	lead
Glass picture tube	Sony	antimony and lead, second system for oil/grease, suspended solids - recycle
Acid mine drainage	Toby Creek Watershed Association and PADEP	iron, manganese, aluminum, pH

Art glass	Steuben Glass	lead
Vibratory finishing	Keystone Pressed Metals	oil/grease, copper, nickel, suspended solids - recycle system
Electronic capacitor	AVX	barium
Semi-conductor	Motorola	arsenic and gallium - gallium recovery
Electroplating	Jamestown Electroplating	copper, chromium, nickel, zinc - zero discharge total reuse
Soft drinks	Coca Cola	sugar recovery
Electronic capacitor	MuRata Electronics	barium
Acid mine drainage	Toby Creek Watershed Association and PADEP	iron, manganese, pH - water reuse for fish culture station
CVD/DVD	Ageis	nickel, pH
Plating sludge recovery	World Resources	boron, nickel
Flexographic printing	4 M	heavy metal pigments, water recycle
Cemented carbides	Cerazit	barium
Electroplating wastewater	Atotech	copper, nickel
Die casting	PHB	oil/grease, suspended solids, pH - reuse as CT makeup
Pickle manufacture	Vaslic	iron, manganese
Soup manufacture	Campbell	2 - plants - iron, suspended solids
Electroplating	BFG Electroplating	2 - plants - copper, nickel, zinc, phosphate, pH
Glass container	Anchor Glass Container	2 - plants - soluble oil/grease, suspended solids
Electrostatic materials	Noble Biomaterials	silver, MBAS
Electronic capacitor	Olean Advanced Materials	barium
Stainless steel manufacture	Universal Stainless and Alloy Products	oil/grease, suspended solids, biological - recycle system
Mixed wastewaters	Castle Environmental	oil/grease, various metals, suspended solids
Glass bulbs	Osram Sylvania	oil/grease
Electroplating wastewater	Acutus Gladwin	copper, nickel, pH
Silicon wafer	Lucent	suspended solids, pH
Laser glass	Schott Glass	zinc, suspended solids

In addition to our own design-build projects, we have, as a chemical and systems technology firm, “debugged”, or designed new treatment chemistry, for a substantial number of wastewater treatment systems supplied by all other suppliers.