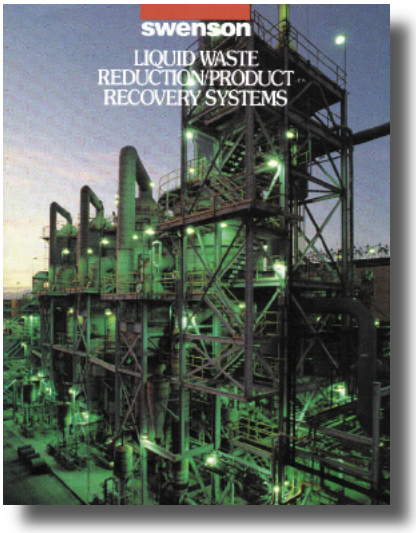
Whiting Equipment Canada Inc.

Swenson Liquid Waste Reduction/ Product Recovery System



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Provides the solid solution to liquid waste problems.

Swenson has been designing and building evaporators to handle waste streams for leading companies for a century. This tremendous backlog of experience, coupled with our commitment to staying at the forefront in research and development, has enabled Swenson to develop an ever-widening range of equipment and systems to process liquid waste and deliver usable or salable by-products in the bargain.

VOLUME REDUCTION significantly lowers processing costs.

- Reduce or eliminate transport costs for hauling waste
- Lower waste treatment costs
- Recover clean water or raw materials
- Recover salable or usable by-products
- Reduction in use of raw materials due to product recovery from waste stream
- Heat recovery from waste streams to reduce consumption of coal, gas, oil, or steam
- Minimize housekeeping and maintenance problems due to discharge of corrosive or dust-laden vapours
- Improved company public relations within the community
- Improved working conditions

SWENSON EQUIPMENT currently in use at our Research Center:

Forced-Circulation Evaporator | Falling Film Evaporator | Rising Film Evaporator

Draft Tube Baffle Crystallizer | Forced-Circulation Crystallizer | Bench Crystallizer

SWENSON designs systems to:

- Reduce solutions to manageable volumes or concentrations
- Purify waste streams by crystallization or evaporation
- Carry out neutralization reaction-digestion type operations
- Condense and collect process vapours
- Convert solutions, slurries or wet solids into dried products
- Achieve partial separations through crystallization
- Separate solids from slurries by filtration or centrifugation

Over the years, the experience we've gained from recovering chemicals from plant waste streams has shown us that there is no single answer to chemical pollution problems. The first step in correcting any pollution problem is to make a definitive study of chemicals in the waste stream.

The Swenson Test Center staff is prepared to review the contents waste streams, then after in-depth testing in the Swenson Laboratory system recommendations are made. The laboratory is fully equipped (see equipment list below) with everything necessary to turn a liquid feed into a dry solid.

Because of this testing capability and our extensive field experience, Swenson's activities in processing liquid waste have centered chiefly on solutions involving evaporation, crystallization, filtration, drying, centrifugation, and heat transfer.

Photos at test center below:
A SWENSON bench scale testing facility.
B SWENSON pilot plant control room. **C** SWENSON falling film pilot plant evaporator.
D SWENSON parallel flow pilot plant spray dryer. **E** SWENSON forced circulation and DTB crystallizers.

Fluid Bed Dryer and Cooler Rotary Dryer and Cooler Steam Tube Dryer Belt Filter

Suspension Dryer Commercial Size Parallel-Flow Spray Dryer Pusher Centrifuge

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TYPICAL SWENSON INSTALLATIONS – providing the solid solution to liquid waste problems.

SWENSON three stage forced circulation evaporator.

SWENSON fluid bed dryer system.

SWENSON quintuple effect natural circulation evaporator.

SWENSON skid mounted forced circulation crystallizer.

SWENSON DTB crystallizer with SWENSON rotary dryer.

The processes shown in this brochure barely scratch the surface of Swenson waste stream processing system capabilities. Working with you, we can tailor systems suited to your particular operation. We have the flexibility, and capability, to provide everything from processing equipment for installation by your own staff to a fully integrated turn-key system.

DTB CRYSTALLIZER

Quadruple effect forced circulation evaporator with mechanical vapor recompression effect.

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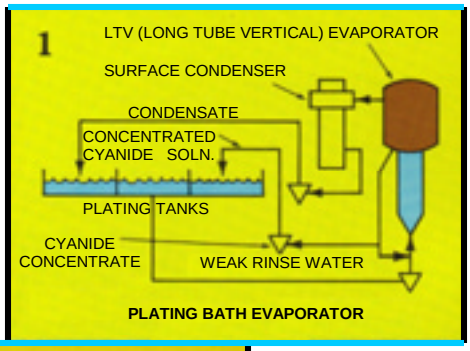
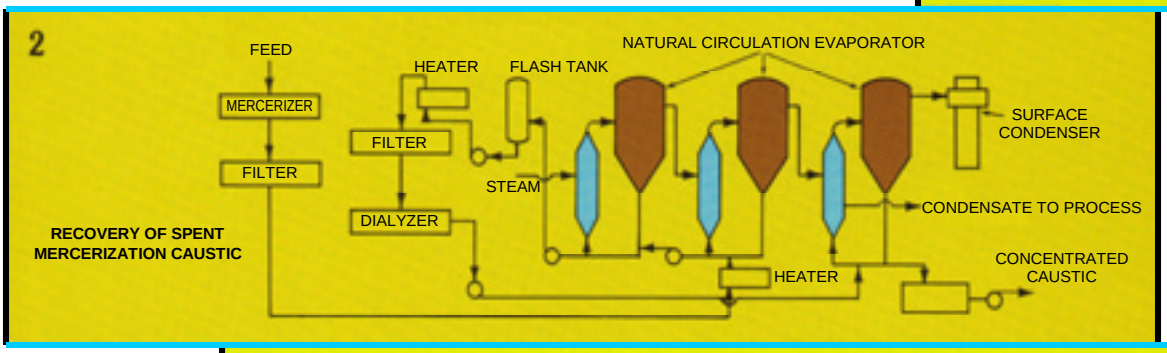
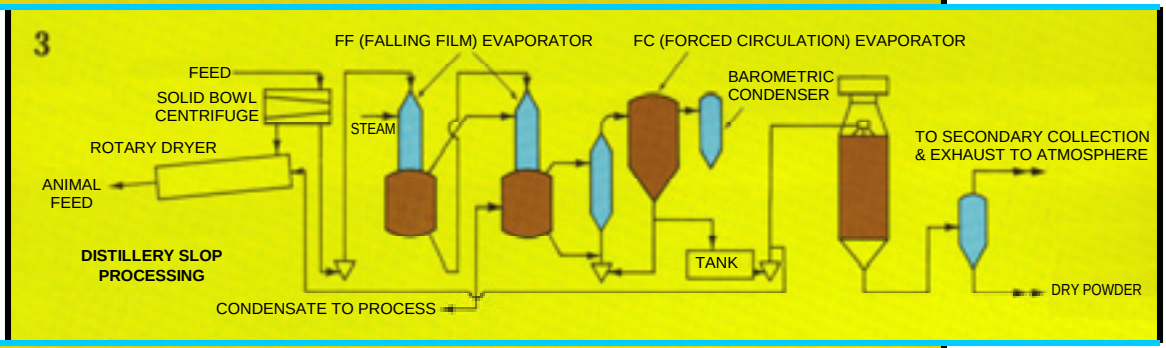
Typical Swenson Solutions to Liquid Waste Problems

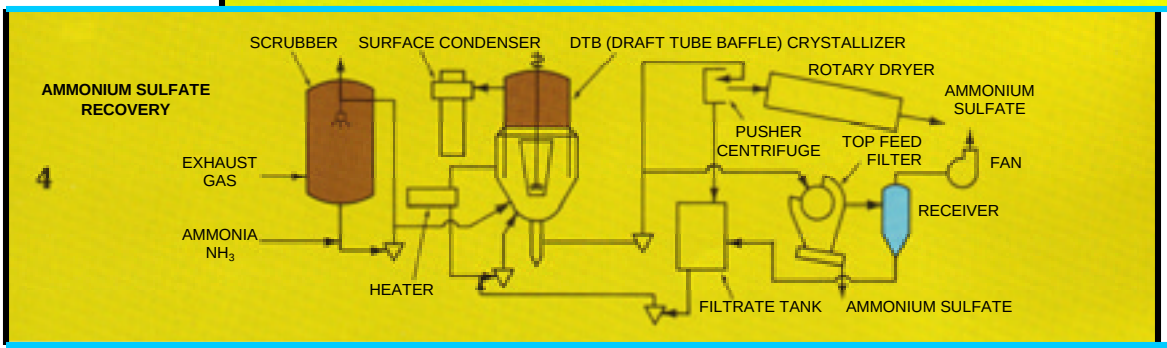
The simplified flow diagrams show some of Swenson' s waste treatment system capabilities.

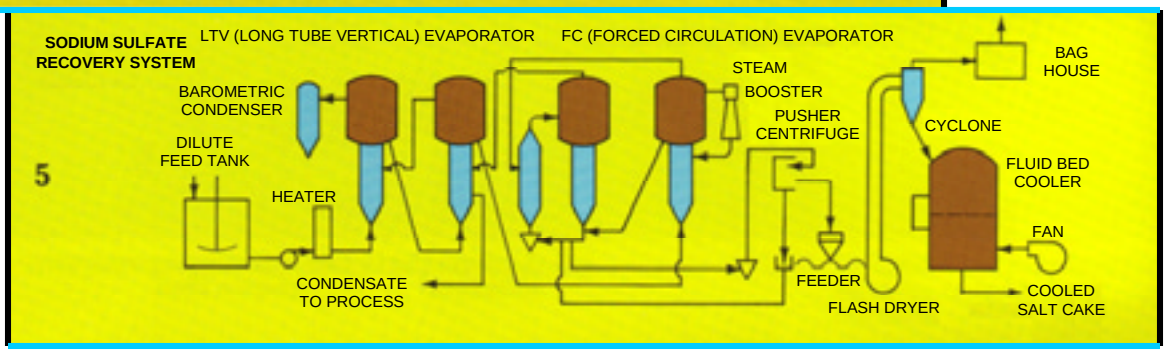
The range of our engineering versatility is illustrated by the plating bath (1) and sodium sulfate recovery (5) systems shown. The first a standard, straightforward arrangement, the other a much more complex system involving product recovery. However, both systems are designed to greatly reduce liquor volume for more convenient handling and treatment.











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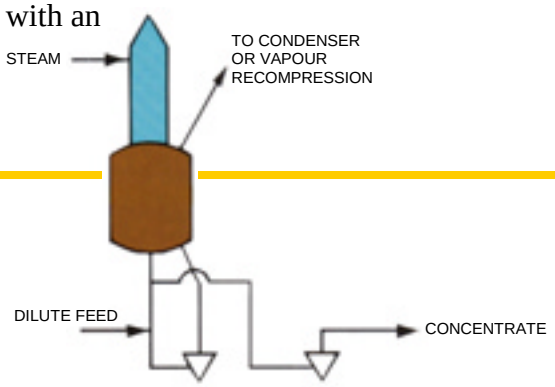
A Guide to Developing Your System

In designing a system for a particular application, many factors are taken into consideration. The goal of the system, whether it be simple volume reduction, separation, crystallization, purification, or product recovery determines the system design. Following are three basic types of systems all starting with an evaporation process.



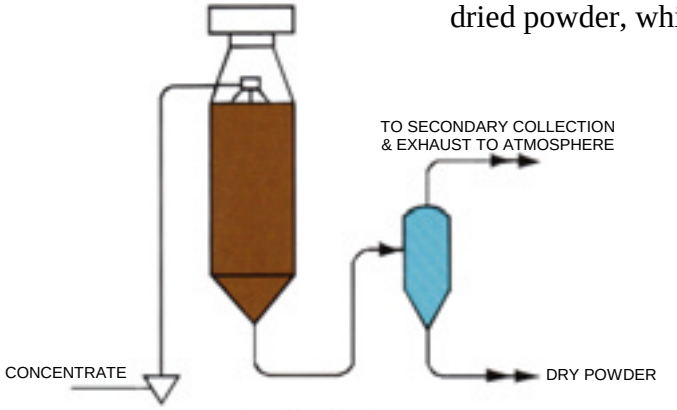
EVAPORATION

For applications requiring evaporation process only

This is a simple, straightforward process designed to reduce solutions to manageable volumes or concentrations. Concentrated liquor is either circulated back to the process or sent to disposal.

For concentrated liquor that does not lend itself to crystallization but requiring further processing

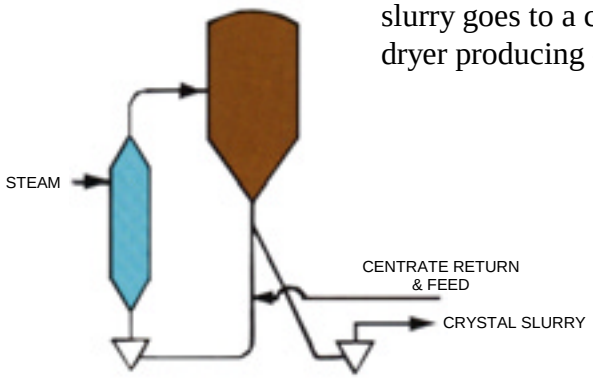
In this application a spray dryer is used to convert concentrate into a dried powder, which can be used or sent to disposal.



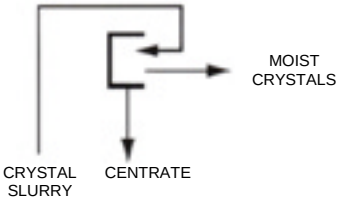
SPRAY DRYING

For concentrated liquor lending itself to crystallization

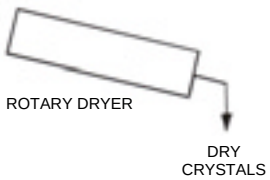
The crystallizer produces a crystal slurry. If further processing is required, the slurry goes to a centrifuge, which produces moist crystals that are fed to a dryer producing dry crystals.



CRYSTALLIZATION



CENTRIFUGATION



DRYING

SWENSON® EQUIPMENT FOR THE PROCESS INDUSTRIES

CONDENSERS
- Direct Contact Type
- Digester Blow
- Surface Type

COOLERS
- Flash
- Fluidized Bed
- Rotary
- Spray

CRYSTALLIZERS
- Batch
- Direct Contact Refrigeration
- Draft Tube
- Draft Tube Baffle
- Forced-Circulation
- Surface Cooled
- Reaction
- Decomposition
- Recompression
- Teflon Tube
- Multi-Stage Horizontal
- Spray Evaporators

DRYERS: FLUIDIZED
- Closed Cycle
- Direct Fired
- Indirect Heated

DRYERS: ROTARY
- Countercurrent
- Direct Fired
- Indirect Heated
- Parallel Flow
- Steam Tube

DRYERS: SPRAY
- Closed Cycle
- Countercurrent
- Mixed Flow
- Parallel Flow
- Research
- Reverse Flow

DRYERS: FLASH
- Direct Fired
- Indirect Heated

LABORATORY FACILITIES
- Bench Scale Tests
- Crystallization
- Evaporation
- Flash Dryers
- Fluidized Bed Crystallizers
- Fluidized Bed Dryers - Coolers
- Rotary Dryers - Coolers
- Spray Dryers
- Steam Tube Dryers

EVAPORATORS
- Calandria
- Forced-Circulation
- LIV Falling-Film
- LIV Rising-Film
- Natural Circulation
- Recompression

FILTERS
- Top Feed

HEAT EXCHANGERS
- Direct Contact
- Shell and Tube

PROCESSING AND PROJECT ENGINEERING
- Ammonium Sulfate
- Crystallization & Drying
- Caustic Soda Systems
- Citric Acid Systems
- Fluorine Recovery
- Salt Crystallization & Drying
- Sodium Sulfate Recovery & Drying
- Sodium Chlorate System
- Wet Process Phosphoric Acid
- Potash Crystallization & Drying
- Soda Ash Calcining, Crystallization & Drying
- Others

Rotary Dryer

Spray Dryer

Crystallizer

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