St. Lawrence TECHNOLOGIES

ABSTRACT

The treatment of industrial wastewater generates sludges that may be toxic. These semi-solid wastes require a minimal water content for their treatment or safe disposal according to government standards. The development and demonstration of a mobile rotary press prototype was undertaken to verify its performance on various types of industrial sludge.

This process filters and mechanically compresses the sludges through rotary screens. The rotary press compares favourably to conventional technologies in its high sludge dewatering rate, suspended solids (SS) capture rate and production rate.

INDUSTRIAL WASTEWATER

MOBILE PROTOTYPE OF A ROTARY PRESS FOR DEWATERING INDUSTRIAL SLUDGES

MAIN FEATURES

- **Technology**
  - Rotary screens retain solids (cake).
  - Screens resist abrasion and corrosion.
  - Potential for integration into existing treatment systems.
  - Compact installation.
- **Environment**
  - Reduction of sludge volumes for disposal.
  - Reduction of leachate waters.
- **Cost**
  - Low capital costs relative to other dewatering processes.
  - Low operating costs in terms of energy consumption and sludge disposal.

ST. LAWRENCE ACTION PLAN

Environment Canada
Conservation and Protection
St. Lawrence Centre

Environnement Canada
Conservation et Protection
Centre Saint-Laurent

fournier

CRIQ
CENTRE DE RECHERCHE INDUSTRIELLE DU QUÉBEC

PROJECT OBJECTIVES

The main objectives of the project were the following:

- To evaluate the efficiency of the process: sludge dryness, SS capture rates and production rates.
- To develop new filtering elements (screens) that are resistant to abrasion and corrosion.
- To design and manufacture a mobile rotary press dewatering unit for industrial sludge and to carry out dewatering tests under actual conditions.
- To synthesize methods for sludge characterization.
- To evaluate the economics and the energy efficiency of the rotary press with existing systems.

PHASES

PHASE 1: DEVELOPMENT

- Characterization of industrial sludge from 10 plants.
- Design and construction of mobile unit.
- Development of new filtering elements.

PHASE 2: DEMONSTRATION

- Tests on process sludges (sodium chloride): PPG Canada Inc.
- Tests on residual sludges (mineral dust): Québec Iron and Titanium Inc.
- Tests on residual sludges (jarosites): Canada Electrolytic Zinc Ltd.

The project was carried out from January 1990 to December 1992.

BACKGROUND

Industrial sludge disposal constitutes a major expense because of the volumes generated and, at times, because of their toxicity.

For some industrial sectors, conventional dewatering processes are not efficient enough to obtain the dryness needed to lower costs and allow for better sludge management (treatment/elimination). The introduction of new processes like the rotary press onto the market is therefore an interesting solution for these industries.

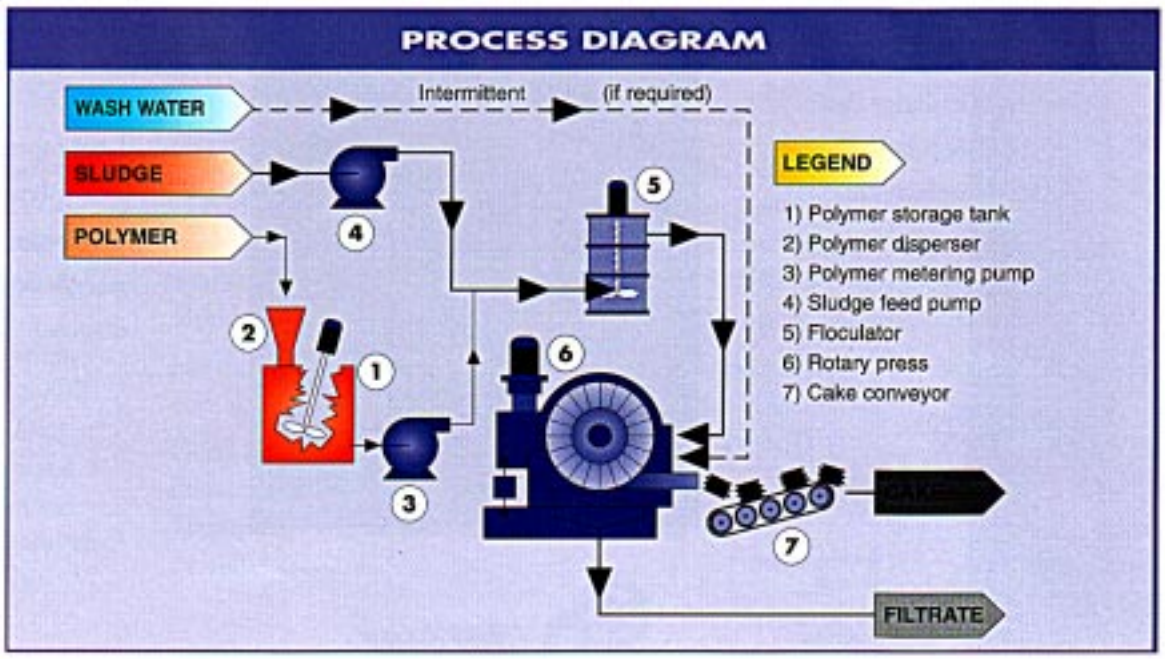
A demonstration of the rotary press under actual conditions was conducted to evaluate its economic and environmental performance.

TECHNOLOGY

With the rotary press process, sludges are fed into a rectangular channel on the periphery of a rotating disk whose lateral walls are composed of filtering elements (screens) which retain the solid fraction, yet allow the liquid to pass through (see diagram). The disk exerts a compressive force against the sludge and, together with a low feed rate and the mechanical pressure at the outlet, a sludge cake with a very low water content is produced. The internal pressures applied to the sludges can reach values up to 2000 kPa, depending on the type of material.

The rotary press operates continuously. A drive box maintains the disk rotation speed at between 0.2 and 2 rpm. The rotating disk is completely enclosed, thereby eliminating odour and health risks at the site. A pressurized flocculation system is integrated into the process to condition the raw sludges. The addition of polymers is required in most cases.

The rotary press was developed and patented by the Centre de Recherche Industrielle du Québec (CRIQ). Les Industries Fournier Inc. is overseeing the technological and commercial development of the rotary press at the international level.



RESULTS

Performance

- Use of the rotary press reduced the volume of sludge for disposal by 2 to 3 times.
- The rotary press filtrate has a very low concentration of suspended solids (95% capture rate in the cake), and may therefore be recirculated in plant operations.
- The capacity of the press varies as a function of the characteristics of the treated sludges. The results are very promising: daily production of 37 tonnes of dry matter is feasible using a four-channel 1200 mm rotary press with a dewatering area of five square metres.
- During the demonstration phase, a 70% dryness level was attained.

Design and operating criteria

The diameter of the rotary press and the spacing between the filtering elements are determined by the volume of sludges to be treated and their dewatering characteristics. The internal disk diameter ranges from 600 to 1200 mm and the channel width varies from 25 to 75 mm. The pore size of the filtering elements is dictated by the grain size of the sludge to be dewatered and should be between 0.1 and 0.4 mm to maintain SS capture rates between 90% to 98%.

Durability of filtering elements

A survey of 700 manufacturers of filtering elements identified nine (9) manufacturing techniques that correspond to the requirements of either the rotary press or the sludges to be treated. The screens manufactured by photo-engraving and by laser meet process requirements.

Resistance tests conducted on a semi-industrial scale showed that there was no benefit in using anything other than stainless steel 316 as a basic material. Screen-plating offered an important technical advantage. Ceramic plating proved to be the most efficient, whereas hard chrome plating offers good protection at a lower cost.

Mobile unit

A complete sludge treatment system – including storage, gravitational thickener, conditioning, dewatering and cake handling, as well as a laboratory – was set up inside a specially built 2.4 x 14.6 m trailer. A press prototype with a 1200 mm-diameter disk channel was installed, along with all the auxiliary equipment including pump, flocculator, control system and conveyer (see photo).

Costs of the process

A comparative study indicated that the capital costs required for the rotary press are lower than filter presses and similar to centrifugal and belt filter presses when the expected dryness yield is high. The capital cost of a rotary press varies from $10 000 to $30 000/tonne of dry matter collected daily. Operating costs of the rotary press are low because of its simplicity in operation, low energy costs and minimal mechanical maintenance. The frequency at which screens are replaced or replated is specific to each industrial application.

RESULTS
INDUSTRIAL SCALE DEWATERING TEST RESULTS

	Dryness - TS%		Production rate	Capture rate
	INPUT	OUTPUT	kg TS (dry) h.m²	SS%
PPG Canada inc.	28	47	127	95
Québec Iron & Titanium Inc.	22	70	236	94
Canada Electrolytic Zinc Ltd.	45	69	319	96

TS = Total solids
SS = Suspended solids
h.m² = per hour and per square metre of filtering surface

POTENTIAL AND LIMITATIONS

The rotary press generally dewaters sludges to rates similar to or higher than other dewatering processes. The rotary press is promising for use on highly abrasive or corrosive effluents. The press can be integrated into existing production processes, thereby offering great potential for the recovery and recycling of sludges.

The treatment of sludges with high concentrations of abrasive particles requires filtering elements coated with protective plating, and the use of special materials in both the filtering elements and the peripheral equipment. Finally, the addition of polymers, often required to successfully dewater diluted sludges, can sometimes be a problem for plants where the filtrate is recirculated in their industrial processes. In such cases, a settling unit can be combined with the rotary press in order to process only thickened sludge.

INFORMATION

This data sheet is based on the results of a project carried out by Les Industries Fournier Inc., in collaboration with the CRIQ, Québec Iron and Titanium Inc., PPG Canada Inc. and Canada Electrolytic Zinc Ltd. The project received financial support from the St. Lawrence Centre and the DRECT Program. The CRIQ and Environment Canada's Wastewater Technology Centre contributed to the scientific supervision of the project.

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St. Lawrence Technologies data sheets are intended for all companies, industries, organizations and individuals interested in new environmental technologies. They are produced by the Technology Development Branch of the St. Lawrence Centre, Environment Canada, as part of the St. Lawrence Action Plan. They serve to disseminate the results of technology development and demonstration projects conducted in the following four sectors: industrial wastewater; contaminated soil; hazardous wastes; contaminated sediment.

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Canada

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