

## 72 % Operating Cost Savings in the Sweeteners Industry with SUPRApak™ Technology

### Overview

Trap filtration in the sweeteners industry often requires the use of sheet filters downstream of primary clarification steps such as centrifuges, rotary vacuum drum filters, or pressure leaf filters. Polishing filtration for sweetener derivatives downstream of hydrogenation steps is often also satisfied by sheet filters. If selected and operated properly, filter sheets are capable of providing acceptable filtrate quality with good throughputs, due to their high porosity and resulting high dirt-holding capacity.

Classical sheet filtration, however, brings with it inherent disadvantages. The installation is an open system, with potential exposure of the filtered products to the surrounding environment. Drip losses typically common to sheet filters decrease product yield. In the case of sticky fluids, accumulation of residues on the outside of sheet filters poses a sanitation issue which, if not properly dealt with, constitutes a source of microbial growth.

Additionally impacting product yield, sheet filters traditionally are not fully drainable. While a portion of the product can potentially be pressurized out of the filter, depending on the size and the design, it is virtually impossible to recover all the entrained fluid.



SUPRApak modules represent the latest evolution in filter sheet technology



SUPRApak L module and SUPRApak housing

The labor required for changing out spent filter sheets, especially with sticky fluids, and the process downtime which results due to tear-down, cleaning, and reinstallation of new filter sheets impacts process efficiency and labor costs. Finally, servicing a sheet filter involves the maintenance of multiple seals and often, a hydraulic tightening ram.

### The Challenge

A sweeteners producer wanted to evaluate the benefits of choosing new solutions over existing sheet filter technology. In a continuous process run at 70 – 75 °C (158 – 167 °F), sheet filters were being used for polishing downstream of a hydrogenation step. The purpose of the sheet filters was to remove particles and achieve application-specific microbial bio-burden reduction in order to meet end customer specifications for the product.



## The Solution

Capitalizing on the benefits, but eliminating the inherent disadvantages of classical sheet filtration, Pall's SUPRAPak technology provided an excellent alternative to replace filter sheets efficiently and economically, with a closed system.

The unique performance of SUPRAPak modules is due to an entirely new flow configuration called "edge flow" (Figure 1). This edge flow principle maximizes the surface, depth and adsorptive mechanisms of filtration that normally occur in sheet media, resulting in the maximum use of filtration capacity. Modules can be stacked up to six high in one filter housing, providing a compact footprint in a closed system.

A SUPRAPak module is a cylindrical module, which consists of densely packed filter sheet material wrapped around a central permeable core. The sheet material is punched with an intricate pattern of feed and filtrate channels, separate from one another, which direct the flow of the fluid through the entire filter package. The driving force of differential pressure pushes the fluid from the feed channels (red arrows) through the sheet media parallel to the sheet surface (purple arrows), toward the filtrate channels. The filtrate channels (blue arrows) then carry the fluid toward the center core where it exits the module.

Differing from lenticular module design, SUPRAPak modules are intended for providing extremely high throughputs especially in continuous production processes.

During piloting, Pall's Scientific and Laboratory Services determined that four SUPRAPak modules were able to provide 4 – 6 times the life of the existing filter sheets of comparable filtration area, with equivalent filtrate quality. A total of 10,000 m<sup>3</sup> (>2.6 x 10<sup>6</sup> USgal) of product could be processed over 6 weeks before module change-out was necessary.

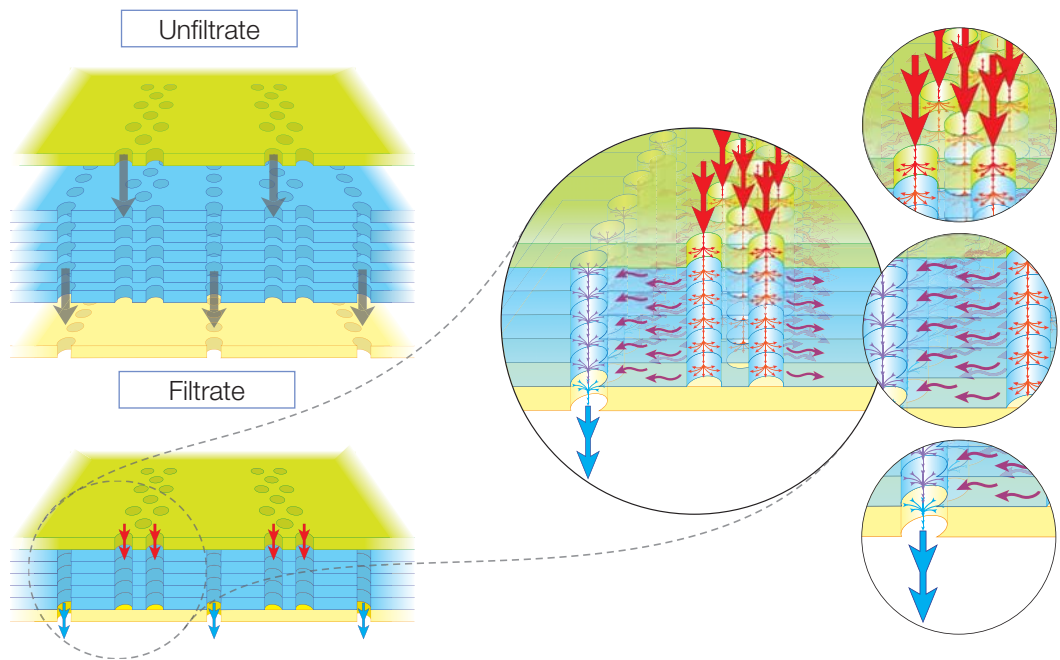
An operating cost comparison between an existing sheet filter and the SUPRAPak installation was undertaken to quantify OPEX reductions. Table 1 shows the cost savings achieved based on selected running cost factors, and highlights the importance of considering total cost of ownership. Other factors, which additionally impact OPEX are cleaning costs (including chemicals, water and energy), and shipping and disposal costs, all of which are positively impacted by the much higher product throughputs experienced with SUPRAPak filtration.

Table 1 - Operating Cost Analysis

Operating Cost Factors (OPEX)	OPEX Savings (%)*
Disposables	17
Product losses	94
Change-out/handling (Labor)	95
Yearly maintenance	73
Total	72

\*Based on 6 times longer life with SUPRAPak module filtration than with filter sheets

Figure 1 - Schematic representation of SUPRAPak module with edge flow technology





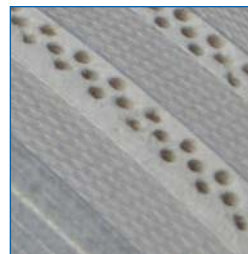
When variations in feed quality caused the SUPRApak modules to last only 4 times longer than sheets, a parallel analysis of the cost of ownership still showed at least 65 % in OPEX savings.

The operating cost analysis was augmented by capital investment savings of 50 % in this case, when choosing a SUPRApak installation over a classic sheet filter, with the additional benefit of a 70 % reduction in footprint using the SUPRApak assembly.

### The Benefits

Sweeteners producers can achieve cost-effective particle filtration and microbial bio-burden reduction with SUPRApak modules. This case illustrated the following benefits:

- Increased process security and product quality due to an enclosed, hygienic system
- Operating cost reduction by at least 65 – 72 % compared to filter sheet technology
- Compact filter design with 70 % reduced system footprint as compared to sheet filter assemblies
- 50 % less capital investment compared to a new sheet filter assembly
- Increased process uptimes due to high filter packing density, unique fluid flow path, and full use of the available filter area
- 95 % less product losses due to smaller hold-up volumes
- 65 % lower yearly filter material disposal weight (comparing wet weights)
- SUPRApak module installation requires a very low number of spare parts, no hydraulic parts, and almost no maintenance
- Reduced cleaning costs, including chemical, water, and energy use, due to lower frequency of filter change-outs



Perforated channels allow maximum usage of filter area



Densely packed sheet material is wrapped around a permeable core

### About Pall Corporation

Pall Corporation is the largest and most diverse filtration, separation, and purification company in the world. Pall serves the food and beverage industries with advanced membrane filtration technology and systems engineered for reliability and cost-effectiveness. Easy to install and simple to use, our systems satisfy a wide range of filtration requirements. Our Total Fluid Management<sup>SM</sup> (TFM) approach offers customers solutions to address the needs of an entire process, encompassing filtration products, services, systems and training.



The case study presented is based on a customer-specific application and reflects empirical results gathered under field conditions. Please consult Pall for your specific application.



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