Spinning Cone Column

A spinning cone aroma recovery and flavour management system that can process clear liquids, viscous products or slurries.

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The Flavourtech Spinning Cone Column (SCC) is a thin film, spinning cone, vacuum distillation column, commonly used for steam stripping applications. Due to the unique internal design of the SCC, high mass transfer efficiency is combined with the ability to process clear liquids, viscous products or slurries containing a high level of suspended solids.

For some time Flavourtech (developer of the SCC) has been the world leader in the provision of aroma recovery and flavour management systems to food and beverage processing industries.

Typical applications of the SCC include:

- **Aroma recovery from extract** during soluble coffee production.
- **Flavour extraction from slurries** of coffee beans or tea leaves.
- **Aroma recovery** during production of fruit and vegetable purees, juices and concentrates.
- **Dealcoholisation**, alcohol management and flavour management in wine, beer and sake.
- **Production of citrus oils** and terpene fractionation.
- **Deodourisation** of cream and flavour management of dairy products.
- **Essential oil extraction** from botanicals, herbs and spices.

Part of an installation of eight SCC 10,000s

History

Although there were published references to spinning cone columns as early as the 1930s, the modern - day SCC is based on a revolutionary design conceived in the laboratories of the CSIRO (an Australian government research organization) and subsequently developed, patented and commercialised by Flavourtech during the 1980s.

The first commercial unit was installed in 1988 and since then acceptance of this novel technology has spread throughout food and beverage processing industries. Spinning Cone Columns are now installed in more than 20 countries for a variety of aroma recovery and flavour management applications.

Advantages of the Spinning Cone Column

Control Flavour Profiles:

The SCC system has several operating parameters that may be used to control the type and relative proportion of groups of volatile compounds in the flavour extracted from the feed material. The SCC allows aroma profiles to be tailored for new product development or to comply with the nuances of regional taste differences.

Process Slurries or Viscous Purees:

The internal design of the SCC makes it particularly suitable for the processing of materials that cannot be handled by traditional aroma recovery systems. Examples include viscous liquids or slurries containing suspended solids. Products with viscosities up to 10,000 cP or suspended solids up to 50% have been processed.

Short Residence Time and Low Temperatures:

The residence time of the material passing through the SCC is typically less than 20 seconds. This, combined with low operating temperatures (typically between 30 – 120°C), avoids thermal degradation of either the flavour recovered or the material processed.

Negligible Pressure Drop:

The fins located on the underside of the spinning cones act as a centrifugal fan, effectively assisting in the transport of the vapour phase up the column. This action minimises the pressure drop across the SCC allowing isobaric, and hence isothermal, operation.

High Mass Transfer Efficiency:

When compared to other columns of the same equipment group, the SCC is approximately 4 to 5 times more efficient.

Flexible:

The SCC can operate at a range of feed capacities with no loss of performance.

Easy to Clean:

The SCC is a hygienic system with all product-contact parts manufactured from high-grade stainless steel. Each SCC system has a CIP (Cleaned-In-Place) function which may be controlled manually or, as an option, automatically.

Comparison of Distillation Columns

Characteristic	*Plate Column*	*Packed Column*	*Spinning Cone Column*
Mass transfer efficiency	Low	Medium	High
Solids handling ability	Negligible	Low	High
Liquid holdup	High	Medium	Low
Residence time	High	Medium	Low
Handle high viscosity	Negligible	Negligible	Excellent
Pressure drop	High	Medium to low	Negligible
Cleanability	Poor	Poor	Excellent

SCC Models and Specifications

The SCC is built in two standard column sizes. The larger model is the SCC 10,000 which is approximately one metre in diameter and five metres high. The smaller model is the SCC 1,000, one tenth the capacity of the SCC 10,000, and one-third of a metre in diameter and two metres high.

A SCC is generally delivered as a pre-assembled, factory tested system with all components (SCC, heat exchangers, condensers, pumps, etc.) mounted on a stainless steel base frame. All electrical wiring, product and services piping is completed prior to delivery. Only product and service connections need to be completed on site, reducing installation time and cost.

Manufacturing Standards

Each SCC system is designed and built to the highest engineering standards using such codes as SEP (Safe Engineering Practice) and GMP (Good Manufacturing Practice). The column has a pressure vessel classification and certification where necessary (such as the CE mark for units delivered to the European Union).

The systems feature an all stainless steel construction, a high standard of surface finish, and an effective CIP system making the equipment ideal for hygenic applications.

Options

The SCC is a flexible system offering numerous options that allow customisation to meet the requirements of each individual application or customer

Different materials of construction and surface finishes are available as required.

The can be built to various electrical specifications, including those suitable for hazardous area operation. Different levels of automation are offered.

Other options available include multi-stage condensation, internal stripping steam generation, production of stripping steam from DI water, integrated product pasteurisation, and integrated slurry preparation systems.

Capacity

The SCC is capable of processing a wide range of feed rates without compromising performance. The maximum nominal capacity for the SCC when processing a water-like product is:

- 1,000 L/hr for the SCC1,000
- 10,000 L/hr for the SCC 10,000

Many factors can influence the actual maximum throughput of a SCC system, including:

- Product viscosity
- Suspended solids content
- SCC operating temperature
- Required strip rate

If the required duty is greater than that which can be handled by one column, two or three columns may be installed in parallel. In such cases auxiliary systems (feed, discharge, condensing and vacuum systems) are common to all columns (see photo of SCC 10,000-2).

Contact

For further details regarding specific applications or uses of the Spinning Cone Column, please visit our website at www.flavourtech.com.au Alternatively, you may contact Flavourtech as per the details overleaf.

SCC 10,000

SCC 10,000-2

The Operating Principle of the SCC

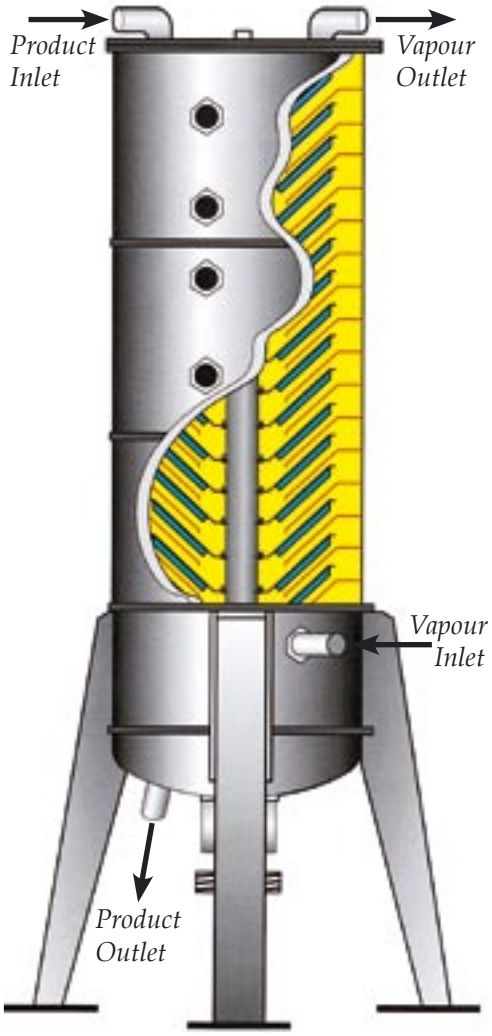
The SCC is a uniquely efficient counter-current liquid-gas contacting device, i.e. a distillation or stripping column, belonging to the same family of mass transfer devices as packed, plate and bubble-cap columns. The SCC is unique in its use of gentle mechanical forces to enhance interphase contact. This allows the rapid, efficient and cost-effective separation of volatile compounds such as aroma and flavours from a thin-film liquid system. The SCC can process thick, viscous slurries containing high levels of suspended solids just as readily as it can clear liquids without damaging the recovered flavour or the treated product.

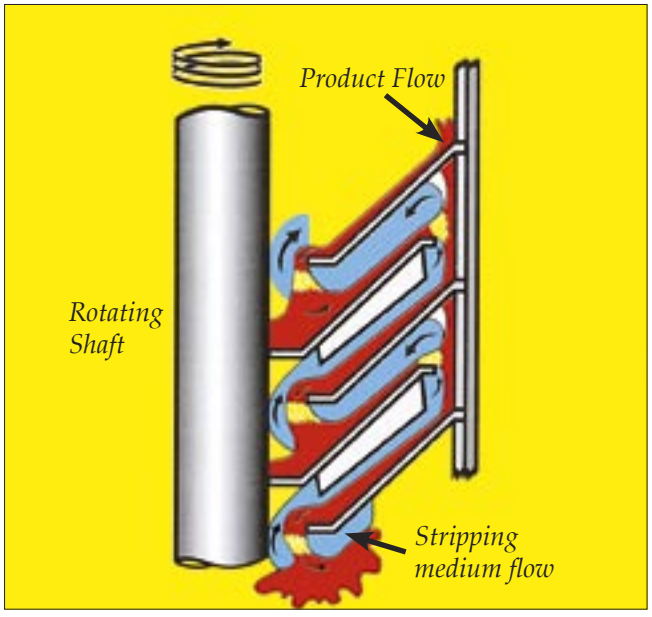
Internally, the SCC contains two series of inverted cones. Attached to the inside wall of the column is a series of fixed cones. Attached to the rotating shaft is another series of cones, parallel to the fixed cones in such a way that they alternate vertically: one fixed, one rotating.

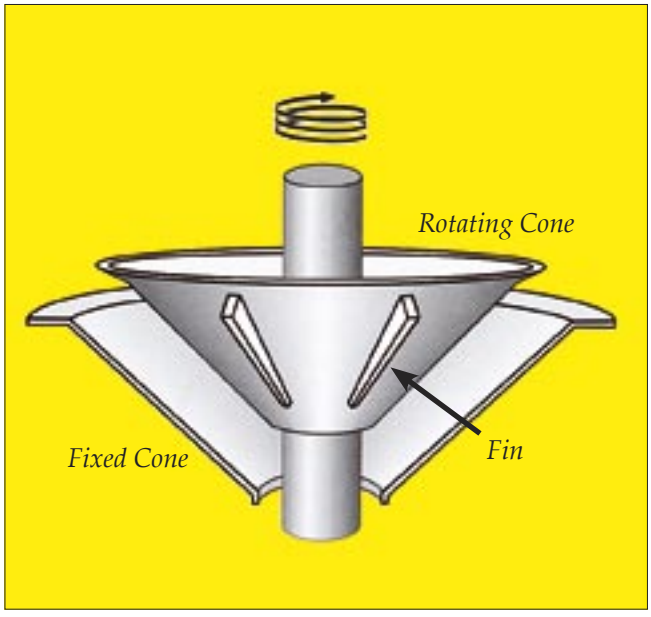
Product is fed into the top of the column (the red stream). Pulled by gravity, it flows down the upper surface of the first fixed cone and drops onto the first rotating cone which spins the liquid (or slurry) into a thin, turbulent film which is forced upward, out and off the rim of the spinning cone, dropping onto the next stationary cone below. In this fashion, the product works its way from cone to cone to the bottom of the column.

The stripping medium, usually steam, is fed into the bottom of the column and flows upward (the blue stream), passing across the surface of the thin film of liquid, collecting volatile compounds as it rises. Fins on the underside of the rotating cones induce a high degree of turbulence into the rising vapour stream. This, with the turbulent, thin film of liquid and the long vapour and liquid path lengths, leads to the highly efficient transfer of volatiles from the liquid to the vapour stream.

The vapour flows out of the top of the column and passes through a condensing system, which captures the volatiles in a concentrated liquid form. The remaining stripped liquid or slurry is pumped out of the bottom of the column.







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