APPLICATION NOTE

SHORT PATH DISTILLATION

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Short path distillation (molecular distillation) is thermal separation processes for thermally sensitive products. Short residence time and low evaporation temperature will cause minimal thermal stress to the distilled product and consequently a very gentle distillation.

With using vacuum solution in short path distillation, a substantial decrease of boiling temperature is obtained by reducing the operating pressure. It is a continuous separation process with very short residence time (tens of seconds) compare to hours on other conventional separation methods.

Edwards' vacuum system

This feature allows thermal separation of the products which would be damaged due to the long residence time and high temperature required in other continuous (circulation, film or distillation) or non-continuous (batch distillation) conventional distillation processes.

Unlike other distillation techniques, short path distillation is invariably applied for the separation of the high molecular weight organic components, where the other distillation methods lead to breakdown heat sensitive molecules at high temperatures, i.e. above 200°C.

The distillation rates can be achieved within the pressure and temperature range of 1 to $1x10^{-3}$ mbar and 150°C to 280°C respectively.

The short path distillation is specifically well suited for distillation, evaporation, concentration and stripping of heat sensitive products as follows:

PHARMACEUTICALS

APIs, natural and synthetic vitamins, stabilizers

FINE CHEMICALS & SPECIALITY

Stripping of monomers from silicone oils, resins, & polymers, stripping isocyanates from prepolymers, stripping solvents and oligomers form all kind of resins

FLAVOUR AND FRAGRANCES

Distillation of monoglycerides from di- and triglycerides, concentration of Omega-3 fatty acids

PETROCHEMICALS

Evaporation of oil and wax fractions from petroleum, fractionating of waxes into hard and super hard waxes, lube oil production

PLASTICS

Polyurethane pre-polymers, epoxy resins, acrylates, polyols, plasticizers

KEY FACT

Suitable for high boiling point or heat sensitive compounds to be separated

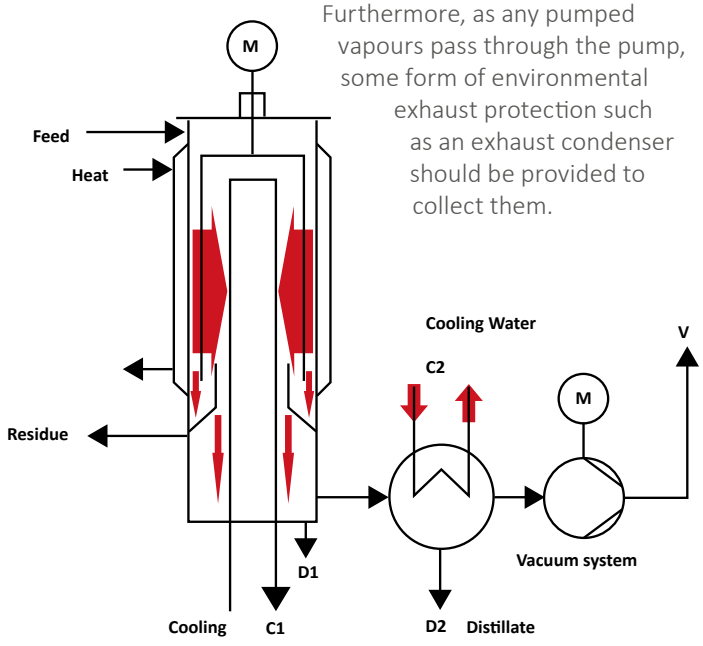
CHALLENGES

Vacuum is used to separate a liquid mixture via partial vaporisation of the components and the separate recovery of vapours and residues, where other distillation methods lead to breakdown of heat sensitive molecules.

Theoretically, through a conventional vacuum distillation process, only non-condensable gases require to be removed.

Improper operation and unstable temperatures of primary and/or secondary condensers together with excessive fouling of condensing surfaces will allow stripped or react vapours enter the pumps, giving rise to contamination issues, pump corrosion and to further extend pump failure.

Furthermore, as any pumped vapours pass through the pump, some form of environmental exhaust protection such as an exhaust condenser should be provided to collect them.



Short Path Distillation PFD (1 to 10^{-3} mbar)

SOLUTION

Edwards' application Know-how, CPI industry experience, the most up-to-date process modelling techniques, and bespoke system design expertise can be used to optimise the pumping system configuration to maximise pumping performance through the most reliable, cost-effective and environmentally friendly way.

To minimise the pumping failure mode, the backing pump can be effectively protected by using customised low temperature interstage condensers. For instance, liquid nitrogen cooled traps, can be used to protect the backing pump and eliminate serious contamination on smaller plants. Such traps can be useful to recover some valuable by-products such as fragrances.

On the event of the pump upstream protection mechanism failure, Edwards' Vacuum pumps do not suffer from contamination and excellent solid & liquid handling capacity makes it possible to pump the most contaminated and corrosive vapours to maximise process uptime and minimise maintenance cost.

The short path distillation using Edwards' vacuum solution makes a gentle separation process that is widely applied on deodorisation, decolourisation, and purification of high value, heat sensitive substances, that can be easily oxidised.

CXS Screw Pump

EXPLORE A WIDE RANGE OF VACUUM PUMP SOLUTIONS AND THEIR BENEFITS

EDS Screw Pump

EDP Claw Pump

nHT Diffusion Pump

EH Mechanical Booster Pump

BENEFITS

Edwards chemical dry pumps in combination with EH and vapour boosters provide the following benefits for short path distillation.

Flexible Range

Flexible range of pump and booster combinations can meet any process requirement for short path distillation

- Vapour booster for high throughputs at high operating pressures up to 1mbar
- EDS, EDP, and CDX backing pumps for speeds up to 1000m^3/hr
- EH boosters for reduced base pressures up to 10^{-3} mbar

Temperature Control

Temperature control ensures that process gas temperatures are optimised to maximise the distillation rate and eliminate condensation and corrosion

- The integrated temperature monitoring system on CXS pumps gives accurate control that can be configured to requirements
- EDS and EDP employ simple cooling configurations, robust for harsher conditions and poor-quality water supply

Improved Robustness

Proven vacuum pump mechanisms for improved liquid & solid handling capability. This allows the pump to handle excessive fouling of particulates and liquid slugs from the condenser surface such as oils, resins and polymers.

Automation Capabilities

- CXS is an intelligent product that monitors pump conditions to optimise and automate the distillation process
- EDP and EH can be systemised with a range of control and automation options

Environmental Protection

Edwards' vacuum pumps have this functionality to capture and eliminate exhaust harmful gases

- With modern exhaust management techniques
- Using exhaust condenser to remove condensable and harmful gases from the pump outlet flow

Flexibility

Edwards' vacuum pumps can be easily systemised with a wide range of accessories

- Compatible accessories include condensers, KOPs, filters, exhaust condensers, and solvent flush for continued operation even in the harshest environments
- Dual exhausts allow EH pumps to be configured for any installation
- CXS integrated purge gives added process handling and protection from condensed materials as standard, whilst the EDP offers the flexibility for bespoke system requirements

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Publication Number: 3602 559 9 01
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