KWS EVAPORATORS PVT LTD

MANUFACTURERS OF EVAPORATORS & CENTRIFUGES

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MVR EVAPORATORS

BEST POSSIBLE ENERGY EFFICIENCY

Compared to multiple-effect evaporators, MVC evaporators consume considerably less energy.

BENEFITS

1. Very low specific energy consumption
2. Less or No steam & cooling water required
3. Not necessary to integrate with existing evaporators
4. Location can be chosen relatively freely
5. Excellent condensate segregation
6. Easy capacity control

EVAPORATION TECHNOLOGY USING MECHANICAL VAPOUR COMPRESSION

Thermal separation processes such as evaporation and distillation are energy intensive. In the course of their development, the aim of efficiently using energy and of reducing costs first led to multiple-effect evaporators (MEE), then to thermal vapour compression (TVC), and finally, to the use of Mechanical Vapour Compression (MVC) systems.

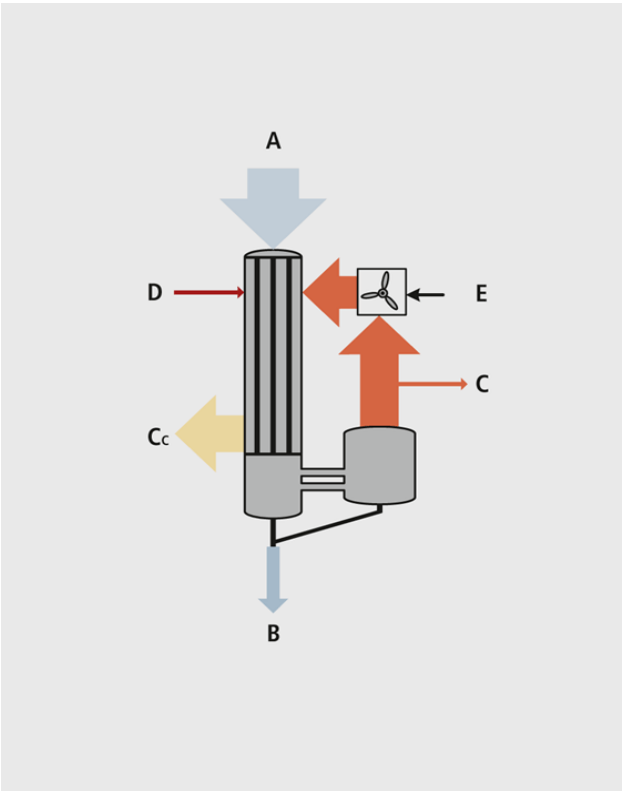
In conventional evaporators, the energy content of the vapour stream produced is lost to a large extent in the cooling tower or is only partially used. In comparison, mechanical vapour recompression permits the continuous recycling of this energy stream by compressing the vapour to a higher pressure. Instead of live steam, electric energy is used indirectly to run the plant.

MECHANICAL VAPOR COMPRESSION

MVC evaporators operate on a “heat pump” principle. The evaporated water vapor is compressed with a simple, centrifugal fan or roots blower which increases the saturation temperature of the vapor. After the compression, vapor can be used as heating steam in the same unit. The compressed vapor condenses and releases its latent heat through the heat transfer surface for further evaporation of the liquor or effluent.

Mechanical vapor compression is the process most commonly applied on a commercial scale. Electricity can be the sole energy input so that it renders the technology suitable for locations removed from sources of process steam.

The below given figure describes a scheme of the process, showing how the compressor and evaporator heat exchanger constitute a single unit. The evaporator heat exchanger has falling-film vertical heat exchange tubes, a vapor liquid separator and a Vapor Compressor.



A - Feed inflow

B - Concentrate outflow

C - Vapour flow

Cc Condensate flow

D - An evaporator heat exchanger

E - Vapor compressor

The heat necessary to boil feed water is provided by steam passing through the outside of a tube bundle. Spraying feed water on the inside of the heated tube bundle causes it to boil and partially evaporate. A compressor extracts vapor and pressurizes it so that it condenses outside the tube bundle housed in the same vessel.

A vent or vacuum pump is used to withdraw non-condensable gases from the steam condensation space. An initial supply of steam is provided to induce the process. This is generally achieved using electrical heating, although other heat sources may be used as well.

The vapor compressor is the central unit in the vapor compression process. Generated vapor is compressed, which raises its temperature, thus allowing it to condense and transfer latent heat to the feed water, resulting in boiling. Thus, electrical energy supplied to the compressor motor constitutes the major energy input for driving the process.

The MVC process does not incorporate a condenser, because all vapor formed is routed to the mechanical compressor. This eliminates the need for a cooling water stream and associated accessories, including pumping and treatment units.

ENERGY REQUIREMENT FOR MECHANICAL VAPOUR COMPRESSION

Using mechanical vapour compression, a mechanically operated compressor compresses practically the complete vapour of an evaporation effect from a lower evaporation pressure and temperature level to the heating pressure of the same evaporation effect.

The required power input of the mechanical vapour compressor is nearly proportional to the pressure and temperature difference that has to be overcome so that it directly depends on the installed heat exchanger surface. With increasing surface, the required power input will decrease. Pressure drops and in particular, boiling point increase determine the compressor capacity to be installed and thus the specific energy requirement of an evaporation plant.

TYPES OF CONSTRUCTION OF MECHANICAL VAPOUR COMPRESSORS

A temperature difference on the heating surface is required to heat an evaporation plant. This means that temperature and pressure of the heating steam are higher than boiling temperature and pressure of the product to be evaporated. In plants with mechanical vapour compression, this temperature and pressure increase is achieved by compressing the evaporated vapour in a compressor.

In principle, all common compressor types are suitable as mechanical vapour compressor. In evaporation plants, however, the following three types are used:

- Centrifugal fans
- Centrifugal compressors
- Roots blowers

For medium and high capacities, the centrifugal fan is the most commonly used type. The field of application of rotary blowers is restricted to small evaporation rates.