VTA Technical Update

July 2010 Issue

Topic: Orientation: Horizontal or Vertical?

In my last newsletter, I discussed the various types of rotors found in agitated film evaporators. In this edition, I will address the issue of when a horizontal orientation is preferred and when a vertical orientation is the optimal design.

What is the best type to use? In most cases, the answer is based on whether you have more headroom or floor space. Below I will describe the benefits and limitations of vertical and horizontal evaporators.

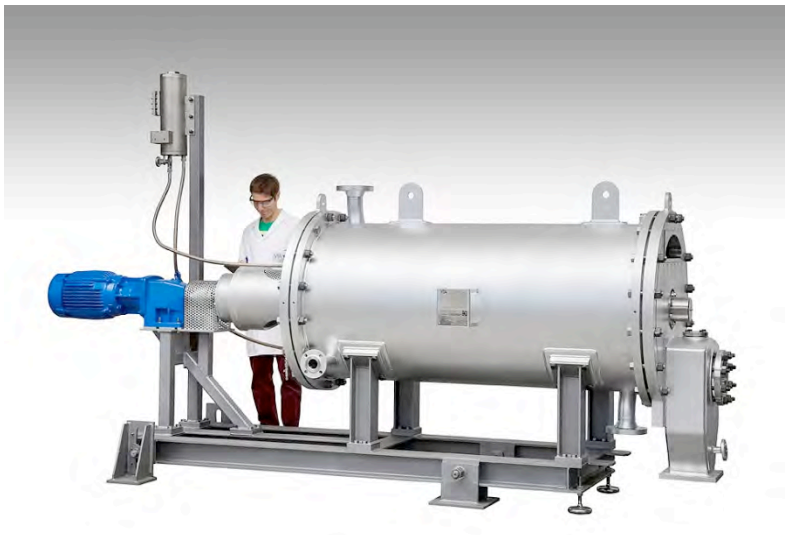

Figure 1: Horizontal Production Evaporator

The horizontal evaporator operates in a similar fashion to a vertical thin-film (rigid rotor) evaporator. It is a very rugged design, but can be more expensive than a vertical evaporator primarily because the body diameter is larger, the rotor is very robust to eliminate rotor sagging, and the bearings and seals at the ends are larger than on a vertical evaporator. Also, the maximum size for a horizontal evaporator is limited to about 12 M^2 (compared to 80 M^2 for a vertical evaporator) due to potential for rotor sag in the larger evaporators.

Figure 2: Vertical Production Evaporators

There is a common variation of the horizontal evaporator that is very useful. The wall can be tapered at a small angle, approximately 2º, which allows the rotor clearance to be adjusted by slightly moving the rotor in or out of the body.

Although rarely utilized, the adjustable rotor clearance can have benefits for products that require high wall shear, or for very high distillate ratios where the specific wall wetting is very low. The wall clearance also affects the residence time, a useful feature if chemical reactions are taking place in the evaporator.

The tapered body is an excellent design for high distillate ratios. One can think of the tapered wall in either of two ways. First, the rotor is also machined with a corresponding taper so the force of the liquid on the wall can be divided into two components, a vertical force and an axial force in the direction of the feed nozzle. The net effect of this is to increase the hold-up in the evaporator and allow the product to “fill the gap” between the rotor and the wall. Another way to visualize this is to think of the liquid as “flowing uphill” and the material that is being pumped in through the feed nozzle will eventually “push” the material out the discharge. If you can picture this, you may see how the taper and the gap can work together to vary the residence time. So, not only is the horizontal tapered evaporator useful for high distillate ratios, it is also useful when longer residence time is advantageous, as when chemical reactions are taking place.

When do I specify a Horizontal Evaporator?

- High Distillate Ratios (>95%)
- More floor room than vertical height available
- Concentrates that stick to a bottom bearing support
- Longer residence time requirement: e.g., for chemical reactions

Figure 3: Horizontal Laboratory Evaporator

When do I specify a Vertical Evaporator?

- Highly sensitive materials (requiring the lowest residence time)
- Application requiring a wiped film rotor
- Low operating pressure requirement (<1 torr)
- Limited floor space

Figure 4: Vertical Laboratory Evaporator

Summary: For most applications, either vertical or horizontal evaporators can be used successfully. If you have questions about your specific application, please call me. I will be happy to discuss the details of your application with you.

Bob Schavey, Business Development Manager