

# CENTRIFUGAL SEPARATION CONTROL

Installing in-line concentration monitors in the inlet and outlets of a centrifuge provides real time measurements to help increase product yield/reduce product loss, provide consistent product quality and increase separation efficiency.

A centrifuge is a piece of machinery that uses high rotational speed to separate components of different densities in mixed fluids. There are two main uses of centrifuges in industrial applications: fluid clarification and solids concentration. Centrifuges are used widely across many industries for a wide variety of applications. Examples of applications where centrifuges are used are milk separation, wastewater clarification, [olive] oil degassing and clarification, beer haze removal, solids removal from slurries in the food, oil and chemical industries.



Centrifuges greatly accelerate the natural process of gravitational settling where denser components sink to the bottom of a liquid mixture while less dense materials float on the top. Centrifuges achieve this by spinning internal bowl mechanisms at very high



speed, creating forces in excess of 4000x normal gravity. Rapid, almost instantaneous separation is achieved within centrifuges.

## LIQUID CLARIFICATION

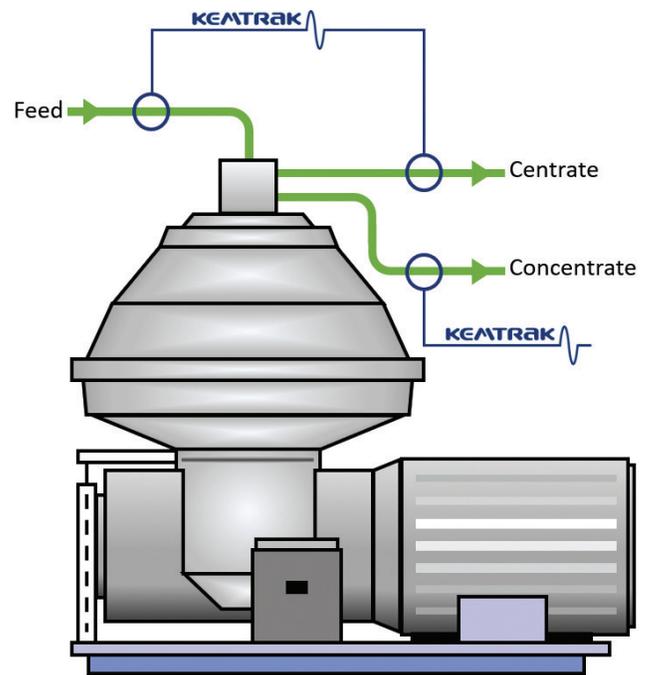
When removing solids using centrifugation, solids from the influent fluid build up in the centrifuge bowl. This build up continues until the centrifuge bowl is completely full. At this point, further separation is impossible without the removal of the solids from the centrifuge. When discharging solids from the centrifuge bowl, some centrate is lost. There are three main practices employed for discharging centrifuge solids:

**Manual** - Periodically, or when the centrifuge is full of solids, a manual discharge is initiated on the bowl, clearing all of the solids out. This method relies upon an operator watching the machine at all times and triggering a discharge of the solids in the bowl in order to maintain a clarified stream. However, triggering too early can lose valuable [centrate] product, while leaving it too long can cause solids carryover that can affect further clarification and filtration equipment downstream and/or product quality.

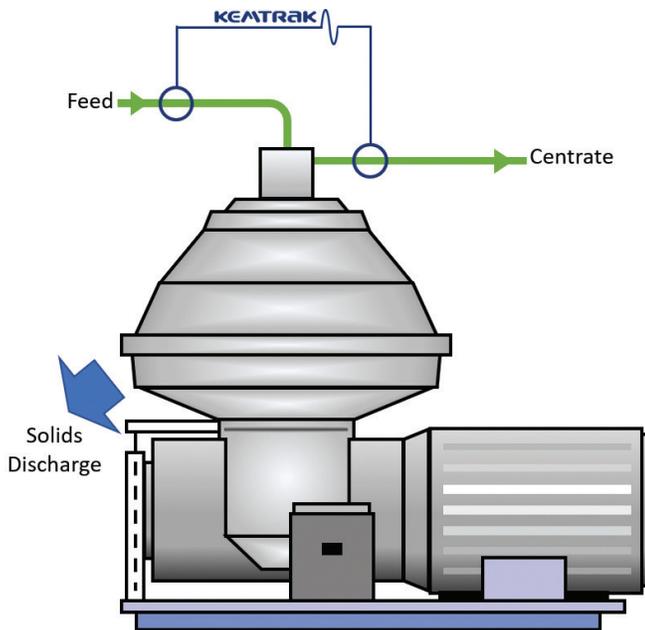
**Timed** - This is a semi-automatic method that triggers a bowl discharge on a timed basis. The timing of the discharge is often based upon empirical performance over time but it is common practice to add a “safety margin” to ensure a clarified stream is always achieved, leading to loss of liquid and/or product in the solids stream. One strategy to combat this loss of liquid is to use short duration discharge cycles. However, a short cycle does not guarantee that the bowl is completely clear and solids can compact and build up within the centrifuge. Over time, the efficiency of the centrifuge will be affected by the built-up solids.

**Automatic** - The clarified output is continuously monitored for turbidity or suspended solids. At the point where the bowl becomes full, the solids content in the outlet line will immediately rise. A photometer or turbidimeter installed in the outlet line will measure the sudden rise in solids, and this measurement can be used by a connected control system to initiate a discharge cycle.

a centrifuge. When a mixed fluid passes through a centrifuge, the heavier components (i.e. water or skimmed milk) will collect at the outer wall of the centrifuge, forcing the lighter components of the fluid (i.e. oil or cream/fat) towards the center of the bowl. Using a simple weir arrangement, the heavier and lighter components can be drawn off of the centrifuge independently. In addition, solids, if present in the stream, will be forced against the outer wall of the centrifuge bowl, further clarifying the outgoing streams.



## LIQUID SEPARATION



Separating liquids of differing density i.e. oil and water or milk and cream, can also be achieved using

## MEASUREMENTS TO IMPROVE EFFICIENCY AND QUALITY

Product yield, product loss, separation efficiency, and product quality can all be improved by installing in-line concentration monitors in the inlet and outlets of a centrifuge.

The **feed stream** of a centrifuge will often vary in content. Varying liquid mixes and/or solids concentration in the feed stream can adversely affect separation performance. By monitoring changes in feed concentration, overloads can be prevented by

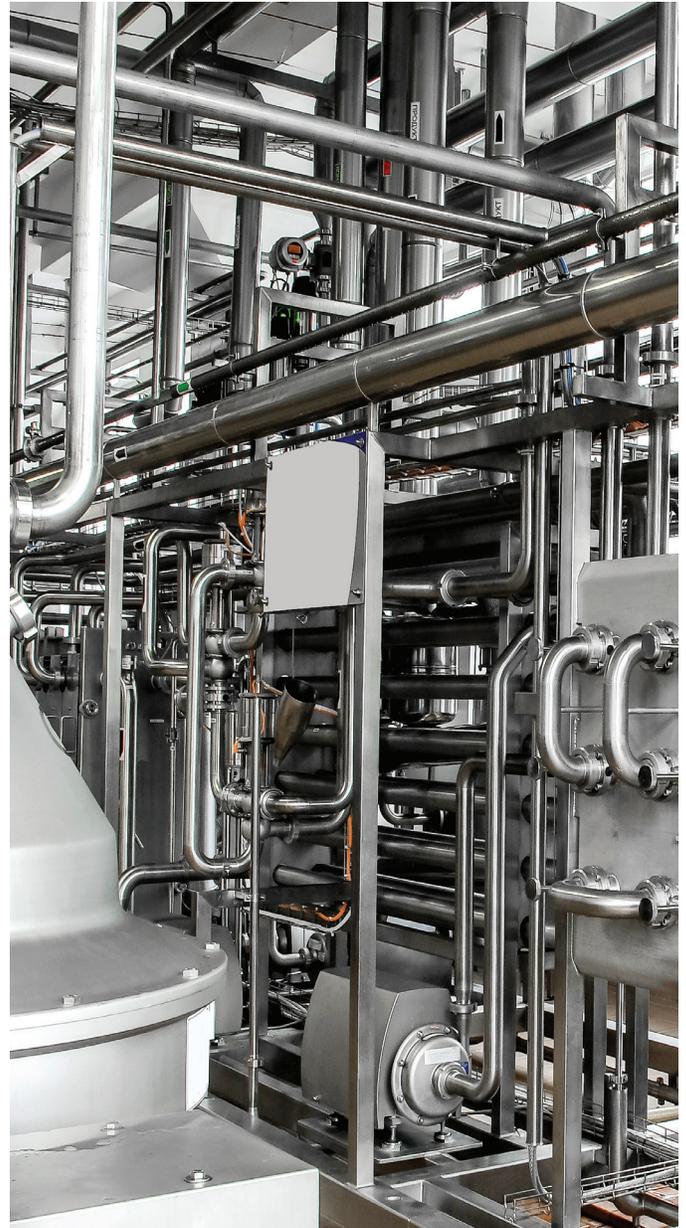
reducing incoming flow rate and bowl speed can be optimized.

The **centrate** line is a common location to install a concentration monitor or turbidimeter. Monitoring the centrate for increases in solids or concentrate carryover provides input to the centrifuge control system to keep it operating at its optimum level and protects downstream filtration and processing equipment.

Monitoring the **concentrate** in a liquid/liquid separator provides real-time data on separation performance and purity. Deviations in the concentrate trend are used by the separator control system to vary feed rates, initiate bowl discharge, even adjust bowl speed as needed to maintain concentrate quality.

Some control schemes mix control strategies to improve efficiency. For instance, it is quite common to operate with a timed short bowl discharge cycle to maximize in-service time and throughput while monitoring the solids concentration/turbidity of the centrate/clarified product with a Kemtrak analyzer. When the measured solids/turbidity within the clarified product stream gets too high, a full discharge can be automatically triggered. This strategy minimizes product loss while keeping centrifuge efficiency and clarified stream quality high.

Kemtrak Turbidimeters and Solids Concentration Monitors are ideal for monitoring centrifuge performance. Compact sensors take up very little room on what is often a crowded equipment module. Fiber optic connections, rather than electrical connections make for high reliability of the measurement. A wide variety of sizes and configurations are available to suit all industries and applications.



## GET IN TOUCH

South Fork Instruments  
3845 Buffalo Road  
Auburn, CA 95602

[southforkinstruments.com](http://southforkinstruments.com)

**CALL US TODAY!**  
**(866) 953-4668**