

Centrifuge Monitoring/Control in Wastewater Treatment Plants

Introduction

A centrifuge applies centrifugal force to sludge to separate solids from liquids. Centrifuges are typically used to thicken primary sludge – by mixing with waste activated sludge (WAS) to create thickened sludge – or dewatering primary sludge to create sludge solids (cake). The cake must be disposed of by the wastewater treatment plant (WWTP).

Monitoring feed solids concentrations before dewatering, and suspended solids concentrations in the centrate after dewatering, can significantly increase efficiencies; see *Figure 1*.

Critical factors

Critical variables that determine the efficiency of a centrifuge are feed solids characteristics, solids concentration, flocculant dosage and temperature.

Feed solids comprised of relatively large particles – heavier and have greater surface area – floc readily and

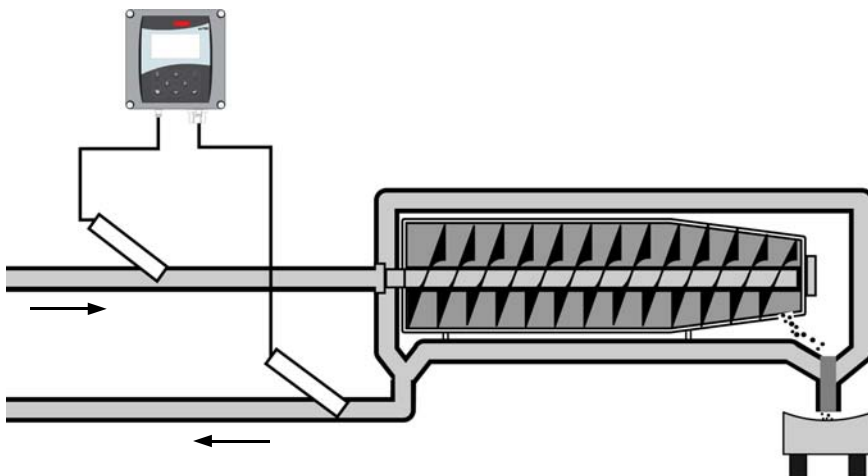
are more easily separated from water within the centrifuge. Stale sludge, often associated with WAS, produces higher cake moisture, which presents a disposal problem for WWTPs.

Influent

The sources of centrifuge feed solids are primary sludge and thickened primary sludge mixed with WAS. The primary/WAS sludge ratio affects the capacity of the centrifuge, the output concentration, and the flocculant dosage.

Winter to summer output concentrations may vary as much as 2% to 4% suspended solids by weight (or 20 g/l to 40 g/l). While warm sludge thickens or dewateres better than cold sludge, centrifuge feed solids are seldom heated.

Figure 1 – A SOLITAX™ highline sc sensor monitors the feed solids, while a SOLITAX inline sc sensor monitors the centrate of a centrifuge dewatering sludge. Both sensors input to the same sc100™ Controller module. In some applications, immersion sensors such as the SOLITAX hs-line sc sensor and SOLITAX ts-line sc sensor may be used.



Retention time

Sludge flows through a centrifuge in minutes. Fluctuations in the flow-through time depend on the feed rate. If the feed solids concentration drops, operators must slow the feed rate to give the sludge more time in the centrifuge.

Effluent

Centrate, the liquid by-product of centrifugation, is returned to the head of the plant. It must be monitored for suspended solids to identify deviations from the expected concentration. Such deviation might flag the need to adjust polymer dosing or check the feed flow.

Sludge solids (cake) are the end-product of dewatering in a centrifuge. Cake concentrations typically range between 15% and 34% suspended solids (150 g/l and 340 g/l), depending on the feed solids, polymer dosage, or centrifuge setup. Cake is incinerated or disposed of as landfill or fertilizer. Cake concentration, wetness, and chemical content are important issues for disposal.

Thickened sludge, the end-product of thickening in a centrifuge, is stabilized in an anaerobic digester before being dewatered. Thickened sludge concentrations are typically between 3% and 7% suspended solids (30 g/l and 70 g/l).



Product Application

To adequately monitor a centrifuge system, both feed-forward and feedback data are needed. For feed-forward data, a SOLITAX™ highline sc sensor with a sc100 Controller™ has the necessary range

(0.001 to 150 g/l) to monitor the feed solids concentration. The sensor can be mounted to the feed pipe through a ball valve.

For feedback data on the centrate, use a SOLITAX inline sc sensor connected to the same sc100 Controller. Depending on the requirement, the sensor can be pipe-mounted through a ball valve, mounted to a PVC pipe for suspension in a channel, or inserted in a degassing tank.

With influent flow rate data (customer-supplied flow meter not shown in *Figure 1*) combined with the solids concentration data, an operator can adjust the polymer dosage accordingly to achieve a consistent cake yield.

This application solution is one of several Hach documents describing wastewater process control based on continuous suspended solids/turbidity measurement. For more detail, refer to:

“Belt Filter Press Monitoring/Control in Wastewater Treatment Plants,” Hach Application Solution AS-SS4

“Mixed Liquor Suspended Solids in Wastewater,” Hach Application Note AS-SS7



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