

SLUDGE THICKENING :

This is to thicken the concentration of sludge solids generated in the clarifier to make sludge digestion and sludge dewatering more effective. Sludge to be thickened may be primary sludge or combined sludge from primary and excess sludge. Thickening may be broadly classified into three types namely, gravity, centrifugal and floatation. The floatation can further be dissolved-air floatation or dispersed-air floatation. When the thickening of sludge is inadequate, the filtrate from dewatering will have large amounts of suspended solids returning to the STP and affect the water quality.

Hence, excess sludge is increasingly being mechanically thickened using centrifugal thickening machines or floatation thickeners. Moreover, when performing sludge treatment for sludge collected from various STPs, sludge with varying properties is likely to be treated; therefore, forced sludge thickening process such as by using mechanical thickening equipment is indispensable. De gritting and debris removal equipment preferably be installed as the pre-treatment process before thickening unless the STP itself has such facilities in the raw sewage stage.

Gravity Thickening:

Gravity thickening is the most common practice for concentrating the sludge. It is adopted for primary sludge or combined primary and activated sludge, but is not successful in dealing with excess sludge independently. Gravity thickening of combined sludge is not effective when excess activated sludge exceeds 40% of the total sludge weight. In such cases, other methods of thickening of the excess activated sludge have to be considered.

Gravity thickeners are either continuous flow or fill and draw type, with or without addition of chemicals. Use of slowly revolving stirrers improves the efficiency. Continuous flow tanks are deep circular tanks with central feed and overflow at the periphery. They are designed for a hydraulic loading of 20,000 to 25,000 lpd/m². Loading rates less than 12,000 lpd/m² are likely to give too much solids to permit this loading hence, it is necessary to dilute the sludge with plant effluent and it is referred to as dilution water. Better efficiencies can be obtained for gassy sludge by slow revolving stirrers.

Air Floatation Thickening:

Air floatation units employ floatation of sludge by air under pressure or vacuum and are normally used for thickening the waste activated sludge. These units involve additional equipment, higher operating costs, higher power requirements, and more skilled maintenance and operation. However, the removal of oil and grease, solids, grit and other material as also odour control are distinct advantages.

In the pressure type floatation units, a portion of the subnatant is pressurized from 3 to 5 kg/cm² and then saturated with air in a pressurization chamber. The effluent from this is mixed with influent sludge immediately before it is released into the flotation tank. Excess dissolved air then rises up in the form of bubbles at atmospheric pressure attaching themselves to particles which form the sludge blanket. Thickened blanket is skimmed off while the un-recycled subnatant is returned to the plant.

The vacuum type employs the addition of air to saturation and applying vacuum to the unit to release the air bubbles which float the solids to the surface. The efficiency of air floatation units is increased by the addition of chemicals like alum and polyelectrolytes. The addition of polyelectrolytes does not increase the solids concentration, but improves the solids recovery rate from 90% to 98%.

Centrifugal Thickening:

Thickening by centrifugation is applied only when there is space limitation or sludge characteristics will not permit the adoption of the other two methods. This method involves high maintenance and power costs. Centrifuges employed are of either disc or solid bowl type. Disc centrifuges are prone to clogging while the latter gives a lower quality of effluent.

Sludge Feed Pump:

Decide the sludge feed pump after considering the following:

1. Select a pump with adequate capacity.
2. Install separate pumps for each centrifugal thickener.

Appurtenances:

Decide the appurtenances after considering the following:

1. If necessary, install de-gritting and debris removal equipment before thickening.
2. Install sludge feed tank.
3. Install thickened sludge storage tank.
4. Install water supply system for internal cleaning of the centrifugal thickener and for cooling the bearing.
5. Install equipment for controlling the water content of thickened sludge.
6. If necessary, install chemical dosing equipment.