

TECHNI/TIPS

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CLARIFIERS IN THE WASTEWATER TREATMENT PROCESS



Wastewater clarification involves the removal of turbidity, sediment and floating material. It is usually the first step in treatment since these impurities interfere with any subsequent treatment. Pretreatment processes in the clarifier may include screening, comminuting and degritting as well as degreasing and scum removal. Clarifiers are the heart of the wastewater processing system.

Overview

The primary function of clarifiers includes some degree of pretreatment to remove large and fine solids, grease and scum and a large percentage of suspended solids. The dissimilar nature of the suspended and floatable material in wastewater flows is the source of much of the difficulty and expense of treatment. The solids fraction can range in density from sand and gravel to feathers and rags. To remove all materials sufficiently, a wide range of liquid/solids separating devices and processes are applied. Conventional pretreatment and clarification of wastewater is restricted to screening, comminution or solids grinding and differential settling or clarification points in grit chambers, flotation tanks or large stilling basins. Flocculators are also used to hasten the settling operations and thickeners to increase sludge density.

Screening

The liquids/solids separation step may include processes such as static sieves, high speed centrifuges and use of countercurrent baffling of clarifiers. Screening is the simplest way to remove suspended matter and oversized material which might damage equipment or disrupt the treatment process.

Fine screening, in the primary clarification process, is applicable to a wide range of industrial and commercial wastes, and for domestic wastewater that has been stabilized by biological or chemical procedures. Fine screens are effectively utilized in industrial waste pretreatment for removal of solids not easily handled by sedimentation basins. Waste that is of a fibrous character, or particulate matter easily separated from water, are widely subjected to treatment with fine screens.

Disc screening is sometimes used. These are made of stainless or alloy wire cloth mounted on a rigid circular frame which rotates on a shaft in a channel perpendicular to the direction of the flow. The lower half is submerged so that solids impinge on the surface of the screen and are lifted - in the rotation cycle above the level of flow, where they can be continuously removed by water or effluent spray.



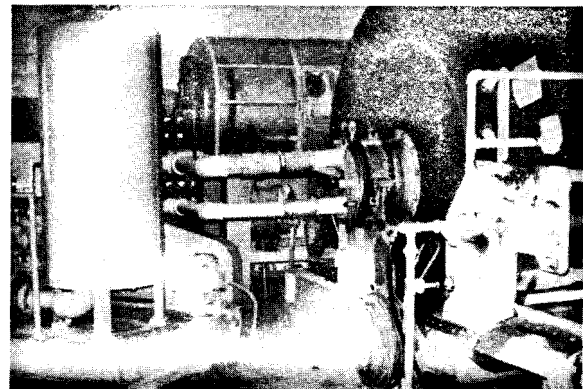
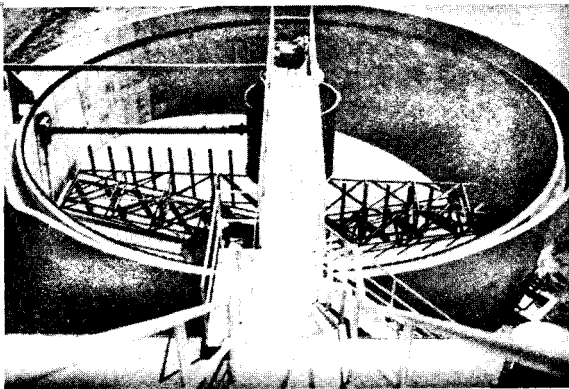
The drum screens sometimes used have the straining fabric mounted on a cylinder which rotates in the flow channel. provision is made for continuous removal of collected solids, by means of washing by water sprays to keep the fabric clean.

Settling & Centrifuging

Gravity basins and centrifugal separators are the two basic types of equipment normally used for removal of grit. Other chambers depend on gravity for solids separation. Aerated grit chambers are frequently used to obtain a clean separation of grit containing a minimum of settled organic solids. Grease and scum can be removed at extremely high overflow rates by vacuum flotation. They are skimmed from the surface while grit bearing sludge is discharged at the bottom.

Sedimentation in the primary clarifier removes the remaining settleable suspended solids to produce an effluent wastewater which may be discharged directly to a receiving watercourse or given additional treatment. The degree of solids removal depends on the character of the raw waste and whether or not flocculation and chemical coagulation are employed.

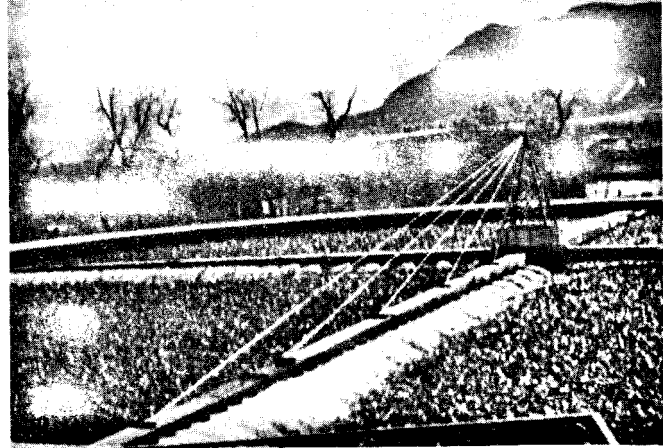
Flocculation, as part of primary clarification, is the agglomeration of finely divided suspended matter and floc caused by gently stirring or agitating the wastewater. The resulting increase in particle size increases the settling rate and improves suspended solids removal. Mechanical flocculation uses paddles slowly rotating on a horizontal or vertical axis. Air flocculation systems have diffusers along one side of the basin near the bottom to produce a gentle roll-over action perpendicular to flow. Many clarifier designs combine mixing, flocculation and coagulation in one tank.



The principle of flotation may be applied if the waste being treated contains appreciable concentrations of oil, grease or fibrous materials. Flotation is basically sedimentation in reverse to remove floatable materials and solids. The principle of air flotation is based on the fact that when the pressure on a liquid is reduced, dissolved gases are released as extremely fine bubbles. Pressure floatation units dissolve air in the water under pressure and then release into the atmosphere in the floatation tank. Pressure floatation is widely used for a variety of industrial waste, while vacuum floatation is commonly used to remove grease and scum from sewage. Most plants are so designed that skimmings may be swept into a trough which discharges into the digester or into a pump sump so that further handling is not necessary.

Clarifiers are sized on the basis of settling rate (area) and the detention time (volume) required. A variety of clarifier designs drop suspended solids from the solution.

Circular clarifiers for removal of settleable solids from waste using motor driven revolving mechanisms to collect and concentrate settled sludge. Fresh sludge leaves the tank floor through uptake pipes attached to the rake mechanism and



collects in the center launder. Fine silt or other inorganic compounds drop out at the bottom sump. Clarified effluent is discharged at the overflow around the outer rim.

A combination design uses a double compartment circular tank to handle grit removal, preaeration and clarification. Incoming waste in the center column enters the top of the inner section and air comes in at the bottom through diffusers. As grit and inorganics settle, they are scraped to a grit hopper. Settled solids are raked into a sludge trough.

Peripheral feed clarifiers uniformly distribute incoming waste around the outside rim metering orifices along the bottom of the feed channel. Once in the settling zone, the solids drop out of suspension and clarified wastewater is collected at the center launder. A rotating arm removes the sludge at the bottom.

Suggested lubrication of the grit removal, grinding and clarifying equipment is as follows:

GRIT REMOVER

Pump & Motors	
Oil Bearings	300 MONOLEC Industrial Lubricant 6403/6404 MONOLEC Turbine Oil 6803/6804 MULTILEC Industrial Oil
Grease Bearings	4622 MONOLEC MULTIPLEX Lubricant 4701 MONOLEC Industrial Lubricant 1275 ALMAPLEX Industrial Lubricant 3751/3752 ALMAGARD Vari-Purpose Lubricant
Grinder & Rake Bearings	3751/3752 ALMAGARD Vari-Purpose Lubricant 1275 ALMAPLEX Industrial Lubricant
Gear Reducers	6403/6404 MONOLEC Turbine Oil 6803/6804 MULTILEC Industrial Oil 300 MONOLEC Industrial Lubricant 607/68 ALMASOL Vari-Purpose Gear Lubricant
Chain Drivers & Sprocket	9102 SYNTEMP Synthetic Lubricant 9200 ALMASOL Dry Film Lubricant 9901 ALMASOL SYNTEMP Lubricant
Conveyor Bearings	3751/3752 ALMAGARD Vari-Purpose Lubricant 1275 ALMAPLEX Industrial Lubricant

GRINDERS/DELUMPERS Drum Motors:

Oiled Bearings	300 MONOLEC Industrial Lubricant 6403/6404 MONOLEC Turbine Oil 6803/6804 MULTILEC Industrial Oil
Greased Bearings	4622 MONOLEC MULTIPLEX Lubricant 4701 MONOLEC Industrial Lubricant 1275 ALMAPLEX Vari-Purpose Lubricant 3751/3752 ALMAGARD Vari-Purpose Lubricant
Oil Reservoir	300 MONOLEC Industrial Lubricant 6403/6404 MONOLEC Turbine Oil 6803/6804 MULTILEC Industrial Oil
All Gear Reducers	6403/6404 MONOLEC Turbine Oil 6803/6804 MULTILEC Industrial Oil 300 MONOLEC Industrial Lubricant 607/608 ALMASOL Vari-Purpose Gear Lubricant

CLARIFIERS**Pumps & Motors:**

Oiled Bearings	300 MONOLEC Industrial Lubricant 6403/6404 MONOLEC Turbine Oil 6803/6804 MULTILEC Industrial Oil
Greased Bearings	4622 MONOLEC MULTIPLEX Lubricant 4701 MONOLEC Industrial Lubricant 1275 ALMAPLEX Vari-Purpose Lubricant 3751/3752 ALMAGARD Vari-Purpose Lubricant
Drive Chain	9102 SYNTEMP Synthetic Lubricant 9200 ALMASOL Dry Film Lubricant 9901 ALMASOL SYNTEMP Lubricant
Open Gears	3083 ALMASHIELD Open Gear Lubricant 5182 PYROSHIELD 9901 ALMASOL SYNTEMP Lubricant
All Enclosed Gears	6403/6404 MONOLEC Turbine Oil 6803/6804 MULTILEC Industrial Oil 300 MONOLEC Industrial Lubricant 607/608 ALMASOL Vari-Purpose Gear Lubricant
All Grease Fittings	1275 ALMAPLEX Vari-Purpose Lubricant 3751/3752 ALMAGARD Vari-Purpose Lubricant 4622 MONOLEC MULTIPLEX Lubricant
Valves & Sluice Gates:	
Grease Fittings	1275 ALMAPLEX Vari-Purpose Lubricant 3751/3752 ALMAGARD Vari-Purpose Lubricant 4622 MONOLEC MULTIPLEX Lubricant
Screw Threads & Nuts	3083 ALMASHIELD Open Gear Lubricant 9102 SYNTEMP Synthetic Lubricant 9901 ALMASOL SYNTEMP Lubricant



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