I'm working on a environmental engineering report and need a sample draft to help me study.

I have attached the prompt and all the necessary documents to help complete this assignment. It is a small part of a bigger project, so there have been previous parts that have already been done, but they dont relate to this part. If you need them you can contact me and i will provide them. If any questions or complications arise, please contact me.

Requirements: 1 page + calculations and figures. | .doc file

Content

Settling

Purpose of Settling

Principle of Settling

Types of Settling

Type I Settling

Types of Settling Tanks

Inlet and Outlet Arrangement

Weir Overflow Rates

Settling Operations

Design Details

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| Settling Solid liquid separation process in which a suspension is separated into two phases –   * Clarified supernatant leaving the top of the sedimentation tank (overflow). * Concentrated sludge leaving the bottom of the sedimentation tank (underflow).   Purpose of Settling   * To remove coarse dispersed phase. * To remove coagulated and flocculated impurities. * To remove precipitated impurities after chemical treatment. * To settle the sludge (biomass) after activated sludge process / tricking filters.   Principle of Settling   * Suspended solids present in water having specific gravity greater than that of water tend to settle down by gravity as soon as the turbulence is retarded by offering storage. * Basin in which the flow is retarded is called settling tank. * Theoretical average time for which the water is detained in the settling tank is called the detention period.   Types of Settling  Type I: Discrete particle settling - Particles settle individually without interaction with neighboring particles. Type II: Flocculent Particles – Flocculation causes the particles to increase in mass and settle at a faster rate. Type III: Hindered or Zone settling –The mass of particles tends to settle as a unit with individual particles remaining in fixed positions with respect to each other. Type IV: Compression – The concentration of particles is so high that sedimentation can only occur through compaction of the structure.  Type I Settling   * Size, shape and specific gravity of the particles do not change with time. * Settling velocity remains constant.   If a particle is suspended in water, it initially has two forces acting upon it: (1) force of gravity: Fg=rpgVp (2) the buoyant force quantified by Archimedes as: Fb=rgVp If the density of the particle differs from that of the water, a net force is exerted and the particle is accelaratd in the direction of the force: Fnet=(rp-r)gVp This net force becomes the driving force. Once the motion has been initiated, a third force is created due to viscous friction. This force, called the drag force, is quantified by: Fd=CDAprv2/2 CD= drag coefficient. Ap = projected area of the particle. Because the drag force acts in the opposite direction to the driving force and increases as the square of the velocity, accelaration occurs at a decreasing rate until a steady velocity is reached at a point where the drag force equals the driving force: (rp-r)gVp = CDAprv2/2 For spherical particles, Vp=pd3/6 and Ap=pd2/4 Thus, v2= 4g(rp-r)d                                  3   CDr Expressions for CD change with characteristics of different flow regimes. For laminar, transition, and turbulent flow, the values of CD are: CD = 24  (laminar)           Re                                                    CD= 24 + 3     +0.34 (transition)        Re     Re1/2 CD= 0.4  (turbulent) where Re is the Reynolds number:  Re=rvd           m Reynolds number less than 1.0 indicate laminar flow, while values greater than 10 indicate turbulent flow. Intermediate values indicate transitional flow.  Stokes Flow  For laminar flow, terminal settling velocity equation becomes:            v= (rp-r)gd2                    18m which is known as the stokes equation.  Transition Flow Need to solve non-linear equations:  v2=   4g(rp-r)d                3   CDr CD= 24 + 3     +0.34            Re     Re1/2 Re=rvd           m   * Calculate velocity using Stokes law or turbulent expression. * Calculate and check Reynolds number. * Calculate CD. * Use general formula. * Repeat from step 2 until convergence.   Types of Settling Tanks   * Sedimentation  tanks  may  function  either  intermittently  or continuously.The intermittent tanks also called quiescent type tanks are those which store water for a certain period and keep it in complete rest. In a continuous flow type tank, the flow velocity is only reduced and the water is not brought to complete rest as is done in an intermittent type. * Settling basins may be either long rectangular or circular in plan. Long narrow rectangular tanks with horizontal flow are generally preferred to the circular tanks with radial or spiral flow.   Long Rectangular Settling Basin   * Long rectangular basins are hydraulically more stable, and flow control for large volumes is easier with this configuration. * A typical long rectangular tank have length ranging from 2 to 4 times their width. The bottom is slightly sloped to facilitate sludge scraping. A slow moving mechanical sludge scraper continuously pulls the settled material into a sludge hopper from where it is pumped out periodically.  |  | | --- | |  | | A long rectangular settling tank can be divided into four different functional zones: ***Inlet zone:*** Region in which the flow is uniformly distributed over the cross section such that the flow through settling zone follows horizontal path. ***Settling zone:*** Settling occurs under quiescent conditions. ***Outlet zone:*** Clarified effluent is collected and discharge through outlet weir. ***Sludge zone:*** For collection of sludge below settling zone. |   Inlet and Outlet Arrangement  Inlet devices: Inlets shall be designed to distribute the water equally and at uniform velocities. A baffle should be constructed across the basin close to the inlet and should project several feet below the water surface to dissipate inlet velocities and provide uniform flow;  Outlet Devices: Outlet weirs or submerged orifices shall be designed to maintain velocities suitable for settling in the basin and to minimize short-circuiting. Weirs shall be adjustable, and at least equivalent in length to the perimeter of the tank. However, peripheral weirs are not acceptable as they tend to cause excessive short-circuiting.  Weir Overflow Rates  Large weir overflow rates result in excessive velocities at the outlet. These velocities extend backward into the settling zone, causing particles and flocs to be drawn into the outlet. Weir loadings are generally used upto 300 m3/d/m. It may be necessary to provide special inboard weir designs as shown to lower the weir overflow rates.  Inboard Weir Arrangement to Increase Weir Length  https://nptel.ac.in/content/storage2/courses/105104102/images/pot-filt.jpg  Circular Basins   * Circular settling  basins have  the same functional zones as the long rectangular basin, but the flow regime is different. When the flow enters at the center and is baffled to flow radially towards the perimeter, the horizontal velocity of the water is continuously decreasing as the distance from the center increases. Thus, the particle path in a circular basin is a parabola as opposed to the straight line path in the long rectangular tank. * Sludge  removal mechanisms in  circular  tanks are  simpler and require less maintenance.  |  | | --- | |  |     Settling Operations   * Particles falling through the settling basin have two components of velocity: 1) Vertical component: vt=(rp-r)gd2                                                 18m  2) Horizontal component: vh=Q/A  The path of the particle is given by the vector sum of horizontal velocity vh and vertical settling velocity vt. * Assume that a settling column is suspended in the flow of the settling zone and that the column travels with the flow across the settling zone. Consider the particle in the batch analysis for type-1 settling which was initially at the surface and settled through the depth of the column Z0, in the time t0. If t0 also corresponds to the time required for the column to be carried horizontally across the settling zone, then the particle will fall into the sludge zone and be removed from the suspension at the point at which the column reaches the end of the settling zone. All particles with vt>v0 will be removed from suspension at some point along the settling zone. * Now consider the particle with settling velocity < v0. If the initial depth of this particle was such that Zp/vt=t0, this particle will also be removed. Therefore, the removal of suspended particles passing through the settling zone will be in proportion to the ratio of the individual settling velocities to the settling velocity v0. The time t0 corresponds to the retention time in the settling zone. t= V = LZ0W              Q     Q   Also, t0= Z0                v0  Therefore,  Z0 = LZ0W and v0=  Q                  v0      Q                 LW                               or v0=  Q             AS Thus, the depth of the basin is not a factor in determining the size particle that can be removed completely in the settling zone. The determining factor is the quantity Q/As, which has the units of velocity and is referred to as the overflow rate q0. This overflow rate is the design factor for settling basins and corresponds to the terminal setting velocity of the particle that is 100% removed.  Design Details   1. Detention period: for plain sedimentation: 3 to 4 h, and for coagulated sedimentation: 2 to 2.5 h. 2. Velocity of flow: Not greater than 30 cm/min (horizontal flow). 3. Tank dimensions: L:B = 3 to 5:1. Generally L= 30 m (common) maximum 100 m. Breadth= 6 m to 10 m. Circular: Diameter not greater than 60 m. generally 20 to 40 m. 4. Depth 2.5 to 5.0 m (3 m). 5. Surface Overflow Rate: For plain sedimentation 12000 to 18000 L/d/m2 tank area; for thoroughly flocculated water 24000 to 30000 L/d/m2 tank area. 6. Slopes: Rectangular 1% towards inlet and circular 8%. |