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LAMELLAR SETTLER Patent RO 130154/2018

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Addressed sector / Applications

Wastewater treatment. In the technological flux of a wastewater treatment plant, the sedimentation tank stands out as principal equipment for the removal by sedimentation or gravitational separation, of the suspended solids.

General description

The principal characteristic of multiphase fluids (mixture) is the fact that, in static conditions, due to different specific weight, the phases will separate by gravity in two vertical directions: phases heavier than water will separate in a descending direction - in a process called sedimentation, and phases lighter than water will separate in the ascending direction, with floating materials rising to the surface - flotation. A new model of clarifier was designed by Ioana Corina Moga. The settler is equipped with flotation / aeration and coagulation-flocculation systems. The clarifier consists of two superposed compartments. The lower one is mainly designed for the coagulation-flocculation process and for the majority removal of the suspended solids, while the upper compartment is a lamellar one and was designed to finish the removal process of the suspended solids, which have a close-to-water specific mass.

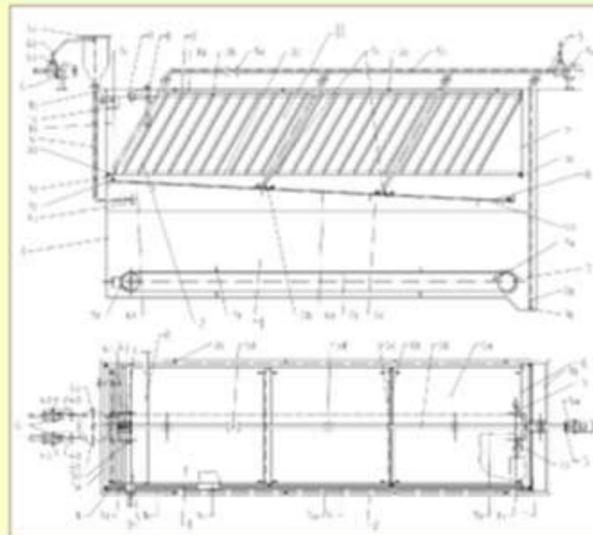


Figure 1. Side and top view of the superposed lamellar settler

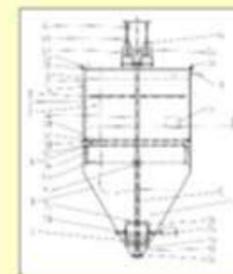


Figure 2. Section through the superposed lamellar settler

Results

It has been proved that, in conventional tanks, small depths lead to an increase in separation efficiency. For this reason, solutions have been adopted for the development of lamellar setting tanks using counter-current, one way and cross-current flows. The operation of lamellar tanks is based on dividing the inflow flow rate in superposed layers. Principally, the lamellar tank can be considered to be a multiplied version of the same construction, each element or compartment containing an identical water - sludge separation surface (Figure 1).

Flotation is a process of phase separation of a multiphase mixture, based on the specific weight on the constituents. In the process, the lighter phase rise to the surface, separating from the mixture. Flotation is also used in order to remove insoluble substances from water such as fats, grease, oils etc. By adding chemical reactants or flocculants, other suspended elements can be removed along with the surface foam. The procedure is carried out by diffusion of compressed air in the water by using porous diffusers, perforated pipes etc.

Figure 1 also presents the air-diffusion scheme used. The wastewater flows through the lamellas and passes over the aeration system (8 in Figure 1 and 2). The compressed air is pumped through the perforated pipe 8 and is diffused in the body of water in the form of bubbles. The foam generated in the process discharges into skimmer 9. The clarified water is discharged into a launder/overflow 1.c, mounted at the downstream end of the horizontal compartment.

The resulted sludge is collected from the bottom of the tank and from the inclined plate 6, which separates the 2 chambers.

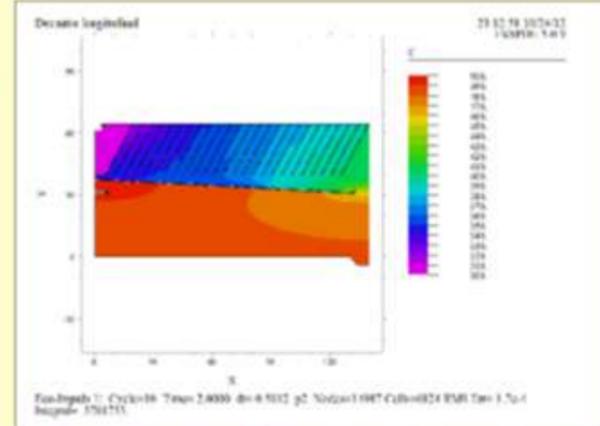


Figure 3. Total suspended solids - concentration profiles - numerical simulations

To prove the lamellar settler efficiency several numerical simulations were realized, of which one result is presented in Figure 3. The majority of suspended solids are removed in the lower compartment as a result of the coagulation-flocculation process. Sedimentation finishing is realized in the upper part, where are the lamellar and flotation system.

The reagent used for coagulation is introduced in the settler with the help of a mixing device 4.c - Figure 4 - in which reagent and wastewater are pumped (through 2 pipes, 4.b). Membranes are inserted inside the mixing chambers and they create a turbulent flow inside the device. The wastewater-reagent mixture is introduced in the lower compartment of the settler.

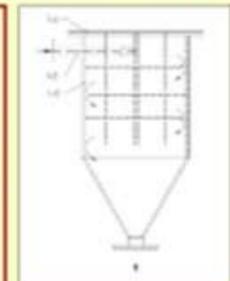


Figure 4. Mixing device

Advantages

Most existing lamellar clarifiers have some major disadvantages: clogging, improper collection of sludge, inefficiency of solids separation or poor elimination of the colloidal suspended solids. The new clarifier eliminates these inconvenients and it is designed for wastewaters with high solids load. Being a very compact equipment is recommended to be used in the compact industrial wastewater treatment plants.