

# Fluidized Bed Flocculator

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Location: HLS 251

Skills: design and fabrication of experimental apparatus, fluids, flocculation, filtration

Number of students: 3

Flocculation using mechanical mixers requires 30 minutes of residence time. AguaClara hydraulic flocculators use approximately 10 minutes of residence time and approximately 25 cm of head loss. The residence time in the AguaClara sedimentation tank is approximately 30 minutes and that is the slowest process used by AguaClara. Flocculation is the 2nd slowest and hence 2nd largest AguaClara process. The goal of the fluidized bed flocculator is to explore alternative reactor configurations that could accelerate the flocculation process. At low turbidities the time between particle collisions is extended because the particles are so far apart. Aggregation of particles could be accelerated if there were additional surfaces for collisions with raw water particles. The floc blanket is one technology for increasing the concentration of particles to increase the collision rate. A floc blanket is a fluidized bed of flocs. Why not use a fluidized bed of sand as a flocculator? Primary particles could collide with and attach to sand grains. A layer of primary particles could adhere to each other and then when they become too thick the surface shear will remove the attached particles. If the removal process removes an aggregate of primary particles, then the process will have resulted in flocculation. The size of the shed flocs will be a function of the shear on the sand grain surface. The shear on the sand grain surface is set by the buoyant density of the sand grain and the diameter of the sand grain. High density and large sand grain diameters result in high surface shear. Thus the size of flocs shed from a fluidized bed flocculator is expected to increase for lower density media and for smaller grain sizes. The energy dissipation rate for a fluidized bed can be calculated by the energy loss through the fluidized bed divided by the residence time. For a rapid sand filter in backwash mode the energy dissipation rate is approximately 150 mW/kg. This is much higher than the energy dissipation rate currently used in AguaClara flocculators, but it is low enough to produce flocs that should be removed efficiently by the plate

settlers given a capture velocity of 0.12 mm/s (see figure below).