Energy Efficient Rapid Mixing in Water Plant

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Abstract

Flash or Rapid mixing are used in both water and waste water treatment plants for dissolution of flocculant aids, chlorine or sulfur dioxide. Normal design consists of a vertical mixing chamber with a rectangular cross section. The flow will typically enter at the bottom and discharge over a weir at the top. The characteristic of this application is its extremely short residence time ranging from 10 to 90 seconds and chemicals must be dispersed as uniformly as possible through the flow stream. The traditional sizing technique is based on velocity gradient "G" which is a measure of energy dissipation over the volume of the entire vessel.

$$G[\frac{1}{s}] = \sqrt{\frac{P}{\mu \times V}}$$

Typical G values range from 400 1/s to 1000 [1/s]. The G value depends not only on applied power, vessel volume and viscosity but also on the number and location of chemicals injection points and chamber geometry. The paper shows how different chambers geometry and injection points affect mixing quality and how to save on mixing energy. This is entirely CFD exercise where the mixing quality is determined by the signal variation from five virtual sensors located at vessel outlet.

keywords: mixing, impeller, water, energy, G-value, rapid mixing, flash mixing

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