EFFECT OF POSITION OF JET MIXING IN FLOCCULATION PROCESS

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Abstract: Conventional drinking water treatment plants consist of coagulation, flocculation and sedimentation. Free jets device in a flocculation chamber can provide the requisite motion to suspended particles which help to form flocs. For small capacity water treatment plants the jet flocculator seems to be a viable design alternative devoid of operational problems associated with hand stirrers for 30 min. A minimum detention time of 15, 30, 45 & 60 min was found to give satisfactory results. The effects of design parameters like the length of the basin, the jet diameter, basin shape and the location of the outlet section have been investigated. This paper presents a review on optimization of convention drinking water treatment plant that eventually proposing a method of maximizes process efficiency with less risk. The new designs utilizing jet flocculation system may be advantageously used for sustained satisfactory services.

Introduction

A colourless, transparent, odourless, liquid which forms the seas, lakes, rivers and rain and is the basis of fluid of living organisms is called water. It is very important for life. We need water to drink, for

Washing purpose, to cook, to plants and many other things. Hence, we have to treat water because it may contain many impurities like suspended impurities, colloidal impurities, etc. which may affect the above parameters. Reasons for water treatment: The two main reasons for treating water are as follow: 1)To remove those contaminates that harmful to health 2)To remove the contaminants that makes the water look, bad taste, or bad smell.

Impellers are the conventional devices used for mixing purpose in industries. But they are very expensive for large storage tanks and underground tanks. Jet mixers have become alternate to impellers for over 50 years in the process industry. Bhatiya (1982) explain how an engineer can be develop jet fixing preliminary design for typical apparatus. Jet mixers are one of the simplest devices to achieve mixing. Recently many research work have be carried Out on it. Jet at various positions is used to achieve mixing in storage tanks and reactors.

In jet mixing, a part of liquid from the tank is circulated into the tank at high velocities with the help of pump through nozzles. The resulting jet of fluid entrains some of

the surrounding fluid and creates a circulatory pattern, which leads to mixing in the tank. Jet mixing leaves fewer dead spots in a shallow or rectangular tank than does agitators. If system needs shear besides mixing, then jet mixer is more efficient.

S M Dhabadgaonkar(2008): Suggest concept of jet flocculator for sustained satisfactory performance. Explain the need to develop water treatment plant design so as to minimize Mechanicals equipment much as possible. Flocculation is the process of gentle and continuous stirring of coagulated water for the purpose of forming flocs through the aggregation of the minute particles present in the water. It is thus the conditioning of water to form flocs that can be readily removed by settling, dissolved air flotation or filtration. The efficiency of the flocculation process is largely determined by the number of collisions between the minute coagulated particles per unit oftime. Terry L Engelhardt April (2010) Explain survey improve of important unit of Water treatment plant has coagulant flocculation clarification. There are mechanical and hydraulicflocculators. In mechanical flocculators the stirring of the water is achieved with devices such as paddles, paddle reels or rakes. These devices can be fitted to a vertical or horizontal shaft. Vertical shaft flocculators are usually placed in a square tank with several chambers (four or more). They have the advantage of having only bearing in the water, and no gland is necessary as the motor and gearing are above the water. With horizontal shaft flocculators having a traverse flow, one should provide at least four rows of shafts, with partitions of baffles (stop logs), so as to avoid short-circuiting. In hydraulic flocculators the flow of the water is so influenced by small hydraulic structures that a stirring action results. In this paper, an attempt have been made so as to compare efficiency of a jet mixing with the hand mixing through rectangular and circular orifices.

Experimental setup

Experimental set up consist of a rectangular tank of size 0.8x0.8x0.9m. The desirability of this project was about inserting jet inside the flocculation tank and analyzing its effect on the turbidity removal, thus we require one tank called flocculation tank. Intake source to this flocculation tank is necessary thus another tank we require can be called as overhead tank.. . Its position and dimensions in setup is as below.1) Overhead tank is kept at a height of 1.8m. 2) Flocculation tank is kept at height of 0.8m. 3) Sedimentation tank at bottom. 4) Intake in overhead tank is taken from source. 5) Proper outlets are made to every tank for water dispersion. 6) Pump is attached for circulation of water in flocculation tank. Jet mixing can be achieved using two orifices.
1) Circular orifice 2) Square orifice.

Figure 2.Circular orifice
Diameter=2cm

Fig 3 Square Orifice
Area=3cmx3cm

Figure 4.Experimental setup

METHODOLOGY

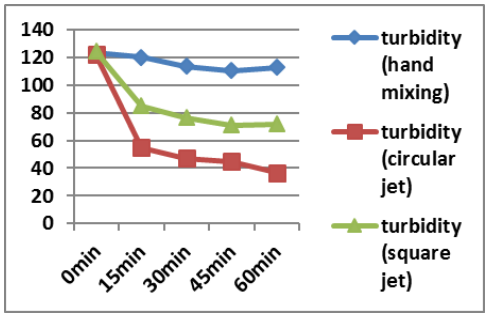
Experiments Investigation were carried out for two cases 1) low turbidity (<150) 2) High turbidity (>450).

Kaolin clay (Al2Si2O5(OH)4) is to make water turbid in overhead tank were mechanical string is done for required amount of coagulant dose. Water is transfer to flocculation chamber and mix with effect of jet created by circular and rectangular orifice respectively The sample is allow to detent in sedimentation chamber for 15, 30,45,60min, Respectively.Maximum turbidity removal and pH was recorded for this detention time.

RESULTS

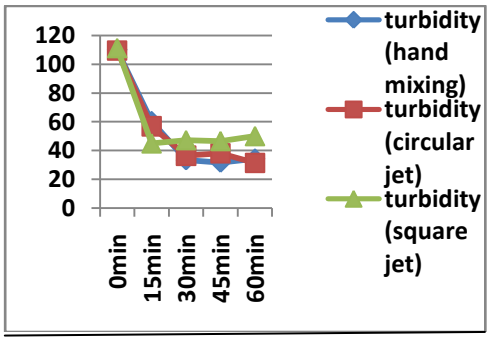
The following table shows the result of turbidity. The following are results of parameters turbidity and pH of hand mixing, jet mixing i.e. circular and square jet mixing for low and high clay concentration. First graph shows turbidity results for first sample of 90 gm clay for hand mixing, 180gm clay for circular jet and 180gm clay sample for square jet and second shows 450gm for hand mix, 500gm for circular jet and 500 gm for square jet mixing

Graph 1 shows the Turbidity comparison of hand mix, circular jet mix, square jet mix in which Circular jet give the better result than other as time increases. We observed that at initial turbidity was 122.2 and after 60 min is decreases to 36.8



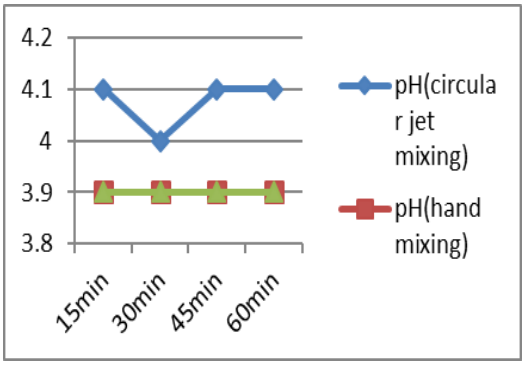
Graph 1 .Turbidity comparison in low turbidity

Graph 2 shows the comparison of hand mix, circular jet mix and square jet mix for high concentration in which square jet give the minimum result at 15min but as time increase the turbidity increases



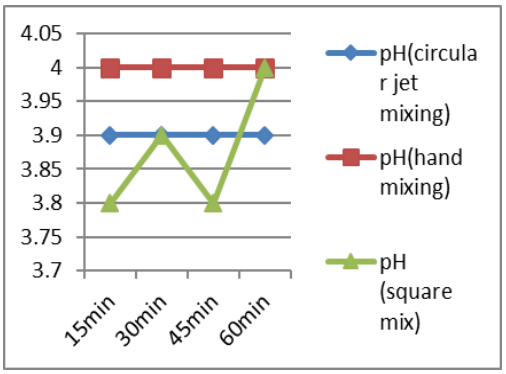
Graph 2 . Turbidity comparison in high concentration

Graph 3 shows the Comparison of pH results for hand mix, circular jet mix, square jet mix for low concentration in which hand and square gives the constant result.



Graph 3 . Comparison of pH results for hand mix, circular jet mix, square jet mix (Low concentration)

Graph 4 shows the Comparison of pH results for hand mix, circular jet mix, square jet mix for high concentration in which at initial square give the low turbidity 3.8 but at 30min it increases to 3.9 and again in decreases to 3.8 and at 60min it increases to 4



Graph 4. Comparison of pH results for hand mix, circular jet mix, square jet mix (high concentration)

CONCLUSIONS

In this paper mixing process in flocculation chamber is done in conventional way. Jet can increase the rate of mixing rapidly. Thus immersion of jet inside the flocculation chamber will increase the rate of mixing. This technique can be useful in increasing the mixing rate and save the processing time in water treatment plant and will perform its time saving effect on further units of water treatment plant.

From the project work and results we concluded that

The impact of jet on flocculation process increases the rate of flocculation as compared to hand mixing. As we used two categories of jet outlets, we conclude from result that mixing was done efficiently by circular jet compared to square jet as turbidity measurements found for circular jet is less at 45min of detention time. It is found that in hand mixing process turbidity removed maximum as the time increases but in jet mixing it is efficient for circular jet. Thus we conclude that further mixing time if increased there will be no changes in result for jet mixing. Due to immersion of jet in flocculation tank, the time will be saved in further units of treatment plant. Rapid mixing results in formation of larger amount of flocs as compared to hand mixing and hence removal of turbidity is more.

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