

Study of the Effect of Length and Inclination of Tube settler on the Effluent Quality

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Abstract-- Installation of new treatment plants to meet the increased demand is beyond the reach of most of the local bodies and government as well. Hence ways and means are to be explored to augment water treatment capacity and to improve the performance of existing water treatment plants. Tube settler systems are inexpensive solution for drinking water and wastewater plants to increase treatment capacity of clarifier, improve effluent water quality, and decrease operating costs. Tube settlers use multiple tubular channels sloped at an angle of about 45° to 60° and adjacent to each other, which combine to form an increased effective settling area. This is combining to form an increased effective settling area. Current study focuses on the study made to understand the effect of length and inclination of tube settler on the effluent quality through the pilot plant study. The circular tubes of 45mm diameter were used with inclination of 45° and 60°. Length of tube was varied as 60cm, 50cm and 40 cm.

Key words: Clarification, Tubesettler, removal of turbidity, inclination, length.

I. INTRODUCTION

Most of the municipal towns have been covered with drinking water supply schemes and conventional treatment plants. Due to increased population, urbanization and industrialization, demand for water supply is increasing for almost every town. Installation of new treatment plants to meet the increased demand is beyond the reach of most of the local bodies and government as well. Hence ways and means are to be explored to augment water treatment capacity and to improve the performance of existing water treatment plants.

Tube settler systems are inexpensive solution for drinking water and wastewater plants to increase treatment capacity of clarifier, reduce new installation footprints, improve effluent water quality, and decrease operating costs. Constructed of lightweight PVC, tube settler modules can be easily supported with minimal structures that often incorporate effluent troughs and baffles. Modules are available in a variety of sizes to fit any tank geometry and tube lengths to accommodate a wide range of flows. The work focuses on the study made to understand the effect of length and inclination of tube settler through the pilot plant study. The pilot scale model was installed at Ichalkaranji municipal water treatment plant and the flocculated water was used for analyzing the effect of length and inclination of Tube settler.

A. THE OBJECTIVES OF THE STUDY WERE:

- i. To design and construct pilot scale model.
- ii. To study the effect of length of tubes (60, 50, 40cm) and inclination of tubes (45, 60 degree) on removal of turbidity.

B. MATERIALS AND METHODS:

- i. The pilot scale model was prepared and installed at Ichalkaranji municipal water treatment plant.



Fig.1 Pilot scale model installed at Ichalkaranji WTP

The model had one closed base tank which was connected to influent water, which was the aerated and coagulated water. The base tank was connected to the bottom of four PVC tubes of 4.5cm diameter, representing the tubesettler. The length and inclination of these pipes were adjustable. The direction of flow was kept similar to that of conventional clarifier i.e. upward. The effluent water was collected by small collector basin and finally stored in small collector drum.

The turbidity of influent as well as effluent water was measured using Nephelometer. Lengths of tubes were kept as 40cm, 50cm and 60cm, while the inclination was kept as 45° and 60°. Thus there were six combinations tried.

Combinations-

Length 40cm- with inclination of 45° and 60°.

Length 50cm- with inclination of 45° and 60°.

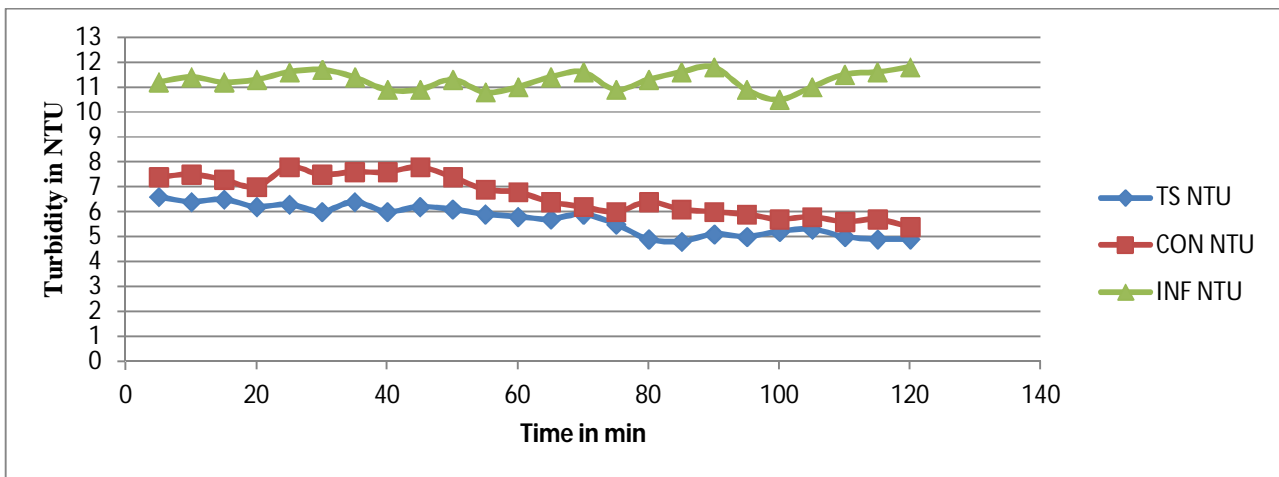
Length 60cm- with inclination of 45° and 60°.

The surface over flow rate was kept similar to that of conventional clarifier i.e 35000Lit/m²/hr.

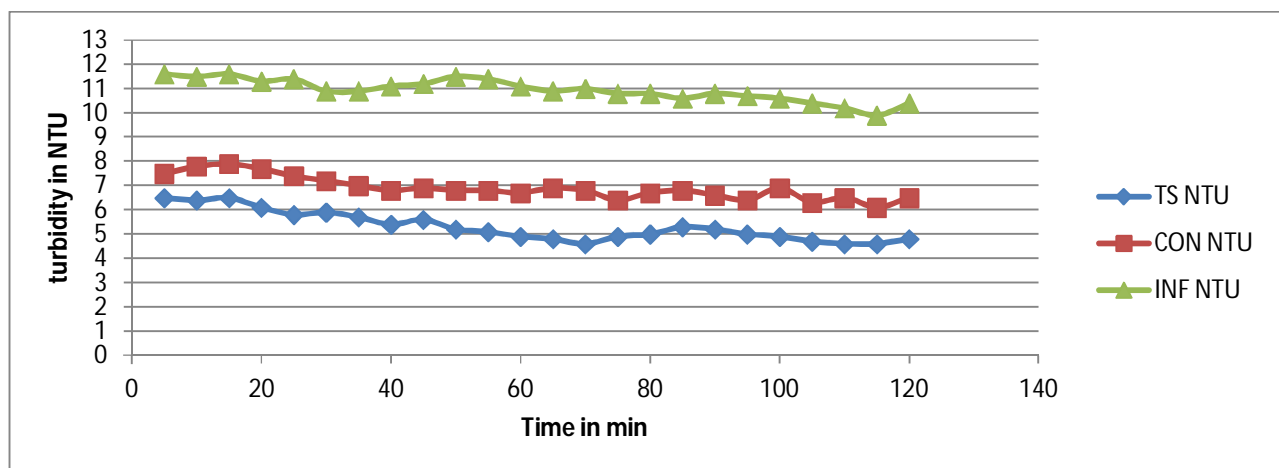
The turbidity of influent as well as effluent was measured and compared with the turbidity of effluent produced by conventional clarifier used at Ichalkaranji WTP. The each run tried was of 120min.

II. RESULTS AND DISCUSSION:

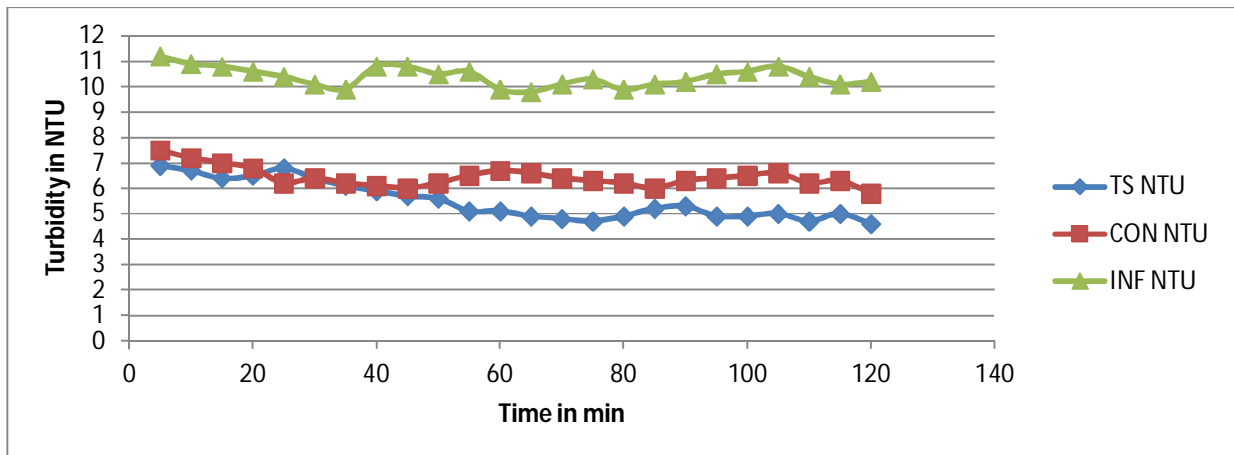
For each combination the turbidity of influent and effluent with and without tube settler were measured. The observations of various combinations are as follows:



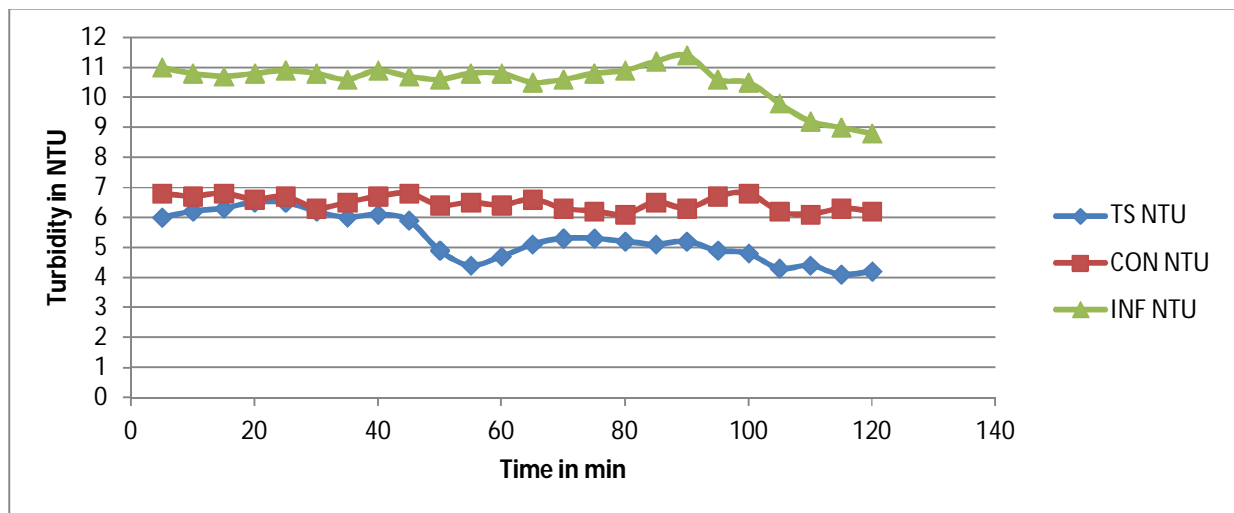
Graph No. 1. The graph showing Turbidity Vs Time for Length 60 cm Inclination 60°



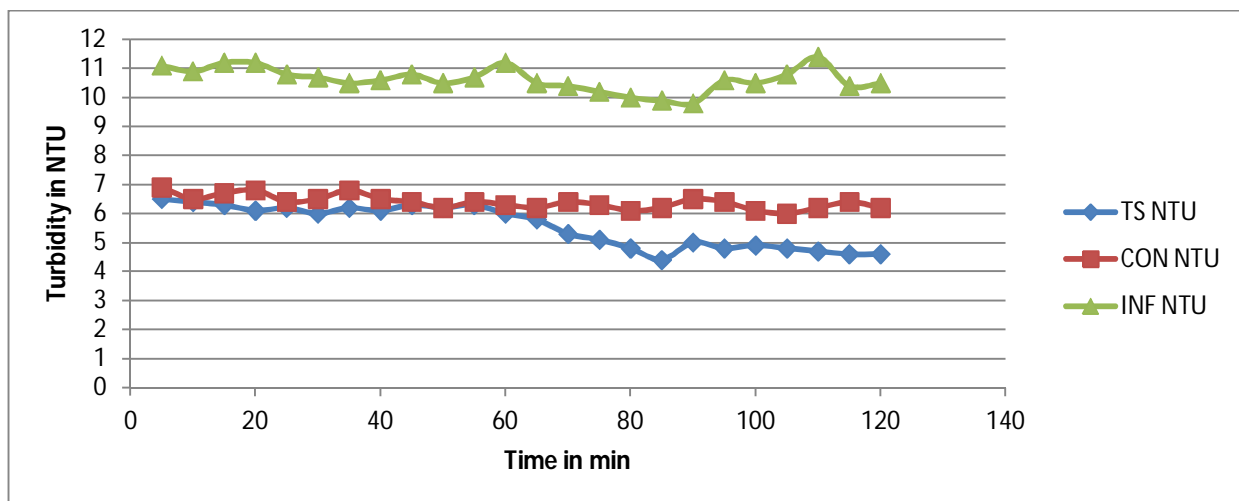
Graph No.2. The graph showing observations for Length 60 cm Inclination 45°



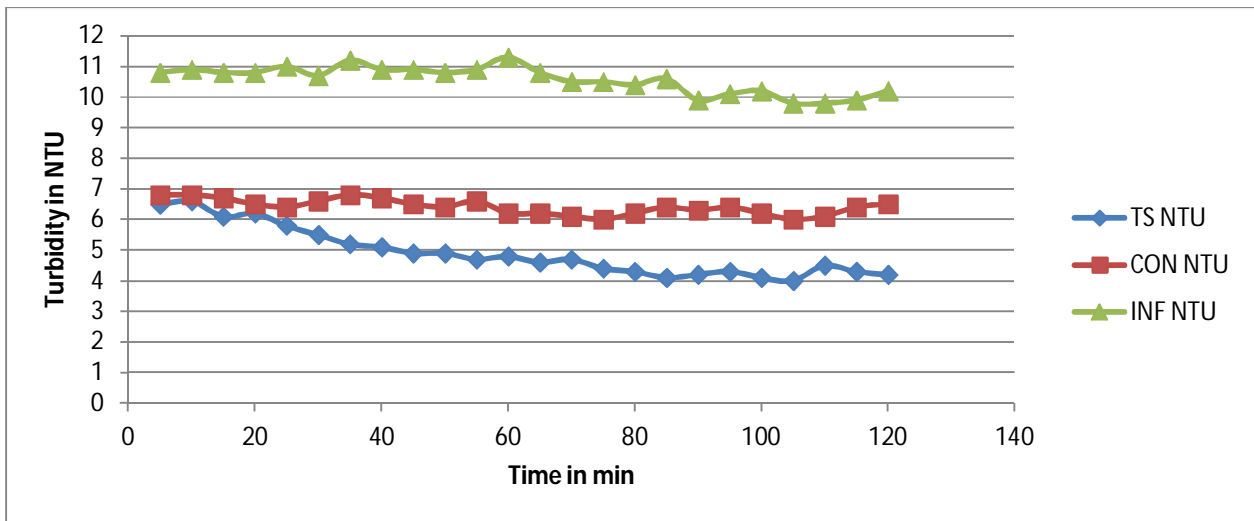
Graph No. 3 The graph showing observations For Length 50cm Inclination 60°



Graph No. 4. The graph showing observations for Length 50cm Inclination 45°



Graph No. 5 The graph showing observations for length 40cm Inclination 60°



Graph No.6. The graph showing observations for Length 40cm Inclination 45°

III. SUMMARY OF RESULTS:

Sr. No.	Inclination	Length in cm	Removal of Turbidity in % (Conventional)	Removal of Turbidity in % (Tube Settler)	Remark
1	45°	40	60	70	-
2	45°	50	60	76	-
3	45°	60	60	80	Optimum combination
4	60°	40	60	68	-
5	60°	50	60	74	-
6	60°	60	60	78	-

Table no.01 shows the results of turbidity with different inclinations & lengths.

IV. CONCLUSIONS

After successful completion of project we come to the following conclusions:

1. Increasing the length of tube settler, results in higher turbidity.
2. Decreasing the inclination of tubes, results in higher turbidity
3. Out of 6 combinations tried, the optimum result was observed for the length 60 cm and inclination 45°.

V. FUTURE SCOPE

1. Various shapes of tube are currently available in market and also used to improve capacity as well as performance of clarifier so those shapes should be used in comparison with circular pipes.
2. Higher length as well as steeper inclination can also results in higher head loss so proper pilot scale studies to find out the limiting length and appropriate inclination should be studied.

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