Effect of Depth of Filter Media on Filtration Process on Effluent Water Qulity: Review

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Abstract- *The filter performance has improved by providing media deeper i.e. depth filtration or byproviding additional layers of filter material i.e. dual media filter. Dual filter media improves the filter performance of the same depth of filter bed as that of single media filter. This research focuses on the performance of a deep sand filter in water treatment. Sand is used for filtration media with size of 0.7 -1.0mm and sand depth from 80cmto 140cm then removal of turbidity level and head loss is a function of sand depth and filtration rate. In this paper, it is also studied that the impact of loading rate on rapid depth filtration system. The flow rate of 4 m/h and 8 m/h for 2coagulator effect loading rates also results in the elimination of the particles adopted on the deeper filter bed. Depth filtration concept for the solid-liquid separation of process by granular media was useful in removal of large sized particle.*

Keywords- Depth Filtration , Head Loss , Filter Media , Turbidity Removal, Flow Rate

I. INTRODUCTION

With an exponentially increasing of population, better and more economical water treatment methods and strategies have become the need of the hour. One such sustainable water treatment method is using deep bed filters which has great potential for treating of contaminants in drinking water.

Deep bed filtration is an effective process in removing particles from water. This is achieved by passing the suspension through a deep layer of granular material, typically sand. The suspension particles are retained within the depth of the filter media. This removal may be achieved by different mechanisms.

In filtration process, there are different stages, ripening, working, and breakthrough stage. The removal efficiency during ripening stage increases, while this efficiency is nearly constant during working stage. Then the removal starts to deteriorate in breakthrough stage.

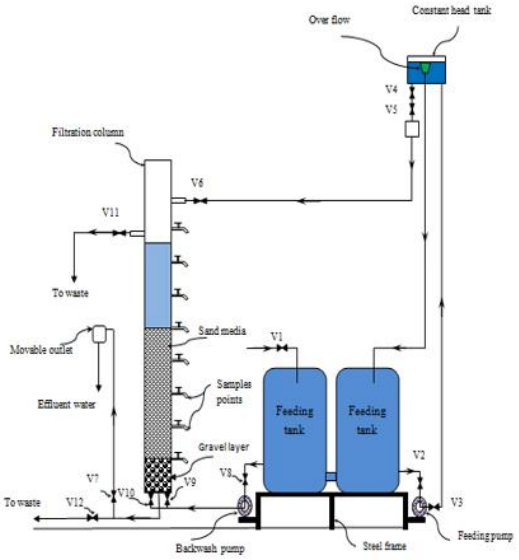
During ripening period, the effluent turbidity is relatively high. It takes some minutes to be allowable.

The effluent water during this period is mostly wasted thus this period has significant effect on the quantity of water. This period has been studied in many researches, but the effect of different operational conditions on this period was not clear. So, this paper will study that effect.

II. MATERIALS AND METHODS

2.1 Pilot Plant Operation-

This study was extended to the diffrent conditions under which the sand filter works.In this research, diffrent positions for aluminium sulphate have been tested in the coagulation process.The operation of the laboratory's pilot plant was checked by 12 valves.Thesecondary effluent from the full-scale clarifying well was pumped to the pilot plant.



FigureNo.01:- Pilot Plant Operation

It consisted of the following main parts: -

a. **Feeding tanks**: The synthetic turbid (raw) water was prepared in four plastic feeding tanks. The four tanks

divided into two groups each group consist of two tanks.

b. Feeding pump: The synthetic turbid water was transported from feeding tanks to a constant head tank by feeding pump.

c. Constant head tank: The raw water has been fed from the feeding tanks to the sand filter via a constant head tank. Constant head tank has confirmed a constant discharge to the plantwhatever the difference in water levels before and after it.

d. Filtration column: The major part of the laboratory pilot plant was the filtration column. The filtration columnwas made from galvanized steel and it has square cross sectional.

e. Backwash Pumps: Two pumps were used for backwashing. The horsepower of each pump was 0.45 HP (Discharge of each pump 0.45 m3/hr).

2.2 Filtration Mode-

The tests were performed under conditions of direct constant filter speed. The suitable rapid sand filter changed had a filtration rate of 4 m/h at 8 m/h. Each different depths measured has effluent turbidity in 1 minute for the first 30 minutes and then it has measured each one hour through the remaining part of the run . Measurements of effluent turbidity at various depths will help determine the effective depth of sand and develop simplified models for filter effectiveness.

2.3Backwash Mode-

Various runs have conducted under different operational conditions varying the media depth, filtration rate, influent turbidity and alum dose to study the performance and get the effective depth for deep bed sand filter. The backwash period has extend to 18 minutes and this period during the wasted backwash water turbidity have measured each 1 minute to appraise the required backwash duration . The filters were backwashed all the filters reached a head loss of 3.4 m and head loss at the large-scale processing plant.

2.4Filter Media-

The filtration medium has a uniform sand medium based on the gravel layer. The depth of sand in the filtration column was raised from 80 cm to 140 cm. Their size is 0.7 to 1mm and its porosity is 0.38. The dry density of sand is 1.65 gm/cm^3 and their specific gravity 2.55. The measured particle removal was compared to that predicted by the clean bed model. The empty volume of filter bed chamberis17.7cm^3.

III. RESULTS

Filtration Rates (m/h)	Filtration Depth(cm)	Ripening Period (min)	Turbidity Removal (NTU)	Head loss (cm)	Efficiency(%)
4	80	20	30	74	95
4	100	12	20	65	97.05
4	120	8	10	59	98
5	80	40	30	85	92
5	100	30	20	72	94
5	120	13	10	68	95
6	100	40	10	82	86
6	120	35	20	92	89
6	140	32.5	30	110	92

Note:- In head loss Alum Dose is constant [20 mg/lit]

Discussion-

In this study, the effluent turbidity has measured Initially 30 minutes during each tried filtration rates similar to 4m/hr, 5m/hr, 6m/hr, and different filtration depths like 80,100,120 Furthermore 140 cm. The outcomes might have beenacquired 3 distinctive influent turbidity 10, 20, 30 NTU.In this study, the head loss throughout channel filtrationfor different depths measured to separate filtration rates also constant alum doses with Different influent turbidity 20mg/lit. Different sand bed described by filtration efficiency, the level of claim to discharge claim to feature particles out of the influent water. Turbidity removal efficiency will be measured according to different operational conditions. Then the evacuation of the turbidity efficiency with different rates.

IV. CONCLUSION

Improved filter performance of the same filter bed depth through an extra layer of filter materials.This study also shows the effective depth for different rate and it was proportional with turbidity and filtration rate directly.For the constant alum dose 20mg/lit Filtration rate increases also head loss increases. When ripening time decreases filtration depth and efficiency increases.Using dipper sand filter help in treatment of high turbidity water under high filtration rate, it can reduce the area of filter. Retention and removal efficiency of solids is improving the filter deeper but developed head loss in limiting factor with increase in depth.

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