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Symmetrical Analysis of Low-Cost Filter Media and Their Efficiency in Treatment of Water

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Abstract: ***Separating is a compelling procedure in expelling particles from water because utilization of sand become nowadays is very challenging in filtration process. It is a necessity to find an alternative media which must satisfy the low cost, easy availability, high durable with less zone required and discharge of water. Many ponds are contaminated mostly in high level of turbidity. In this work it is identified the various synthetic filter media taken examined for the replacement sand. The high level of turbid water may contain slit, dissolved organic compounds, and other microscopic organisms. So, in this method all contaminants are removed. The filtration procedure was created to break down and filtration of lab scale arrangement was planned. The performance as concerns lab scale reactor was optimized by using HDPE (High Density Polyethylene) granules are easily available in all polymer industries are used as a filter media. A proportional study of natural filter media sand and synthetic filter media HDPE granules was undergone for investigation. This two-filter media were selected because of its locally available and two different size of media (sand 2.5 mm, HDPE 3.5 mm) were evaluated. Bentonite (20mg/l ≈ 120 NTU). Identified two parameters were influenced the filtration recital i.e. media depth, filtration velocity. The outcomes uncovered to evacuate turbidity in best conditions where start to be low filtration rate (10.62 l/m² min), extended media midst (240mm). The removal of turbidity in sand was 70% and in plastic media was 55%. Nevertheless, headloss was achieved in higher manner comparing to plastic media. The treated water used as agriculture purpose.***

Keywords: Filtration, Plastic media, treatment of water, sand scarcity, HDPE.

I. INTRODUCTION

The utmost recognized performance for reject turbidity and suspended solids (SS) from narrow water is filtration. Discarding of SS existing in water are exploited comprehensively in SSF and RPF. Until sand filters have numerous limits and downsides. for instance, the partial preservation volume and high vitality necessities for liquidating. Perhaps the crucial subject comprises preservation bed homogeneity in commotion. In communication in the bed epicenter to creation of channels in the couch, deprived scattering of the unsolidified particles runs over the bed, and sideways these lines are remarkably less impure close [1,2,3].

In all respect authors have utilized elective fixings with a few thicknesses so as to recover the presentation of the conundrums [4.5]. Other authors are castoff polymers resources, with two dissimilar bed layer of polymer materials described operation in Water Treatment Plant (WTP)

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contained in the year of 2008 [6]. A Floating Media Filters (FMF) to utility a floating medium such as changed plastic resources have been done by Juliana et al. [9]. Besides, the material is run down with high density polyethylene beads, produce a water quality is similar agreeing to the gravel layer. The HDPE form that lowest specific gravity than filtered to the high turbid water [7,8]. Bruno S. Pizzolatti et al. watched the utilization of plastic granules channel medium (HDPE, EPS) drastically measurements both prime and working expense and offer incredible prospects for channel the low quality of water [10].

Middling turbidity and suspended solids confiscation productivities was above 95% as well as tiny head loss growth nearly 40 cm. The action of floating plastic media bed in manufactured raw water, petite, extended-term turbidity removal competences were around 97% and 80% for raw water holding 40 NTU turbidity of maximum was detected [9]. It may perhaps yield that run-off with low turbid level 5NTU while partaking below 1.0 m head loss. Preliminary testing was attempted by the results shows that turbid water could be treated successfully with conventional filtration when a deep-bed one-track medium filter was used. Even with a high turbidity raw water, turbidity and rendering areas were met and its observed by. Thought about the size thickness relationship for assembled particulates in suspension are moved into model outlining the aggregating of particulates stores in the pore space of granule media channels considering broadening of existing head occurrence models the impact of specific size particulate thickness filtration rate and media grain size on head affliction movement during molecule promise were endure [10].

II. EXPERIMENTAL

A. Design of filtration unit

The pilot scale filter reactor as shown in the Fig. 1. The filtration unit is designed by the material of acrylic sheet and inward distance of 0.2m and depth of 0.56m. This filter consists of three subdivisions. The cross-sectional territory of segment channel stayed in the size of 0.060 m², volume was 3.9m³, water height of 0.39m. The filtration process of the media opinion is allowed to the transparently in the column. The three piezometers were installed in the column one and second column have three piezometers at different heights. Each piezometer has distance of 60mm. The initial head was calculated at maximum water level of column. During filtration stream was in ascendant and discharging descending way.

A synthetic suspension of bentonite clay in fine size (10 to 20 mesh) and distilled water was prepared. Add bentonite clay in the prepared distilled water in the range of 20 mg/L. It can be stirred for 30 min on high proportion mixer (300 rpm) and 10 min for low rate mixer (70 rpm) and it can be transferred to feed tank. The initial turbidity of synthetic water is 172 NTU. The raw water tank was continuously stirred with the help of motor to avoid settling SS.

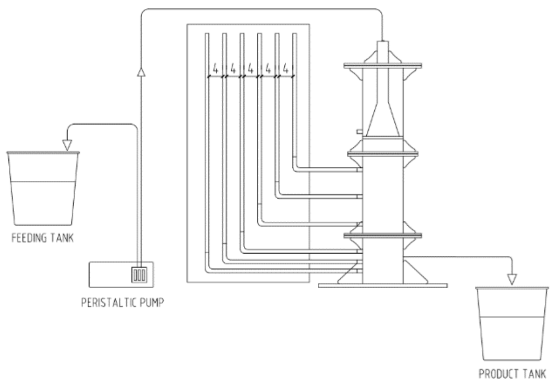

Fig. 1. Diagram of pilot scale filtration column

B. Investigation conditions

In filtration structures were worked at different media profundities and filtration rates. They observed filtration rates was 0.5,0.7,1.0 $m^3/m^2/h$ were scrutinized and media depth was 0.12,0.18,0.23m were verified. This ranges can be selected due to available conveniences. By using peristaltic pump 12.3L/h (filtration rate) is to be pumped to feed tank. Furthermore, all other parameters are not allowed above this value of rate. The maximum level of media depth of 230 mm and chosen the natural media as sand, synthetic media as HDPE granules because of this plastic material is available in local market and low cost efficient. Using sand and HDPE granules was experimentations directed. This polymer can be used because of its commercially available on local market. In these two types of different media was examined only turbidity removal and then compared which one is more competent. Two experiments were directed using this above-mentioned media: 70% of turbidity removal from sand and 55% from HDPE granules. The working states of the investigations are appeared in reachable Table I. The presentation of lap scale plant was resolved the nature of channel and effectiveness of media bed. The quality of filtration was measured in standings of turbidity and examined headloss development laterally the filtration.

III. RESULTS AND DISCUSSION

At different operating conditions using different media was evaluated the performance of media. Turbidity removal and headloss development are showed in the table III. In 0.23m of depth in sand media was filtered at low turbidity (70%) and higher water creation with high headloss changed in the scope of 30 to 40 mm.

A. Result of physical constraints on purification velocity growing

In this study, three various velocity rising was examined selected two media. At percolation rate of 1.0 m/h, water production as well as filter run time is high compared to other filtration rates with respect to other media. In all-around, the velocity of filtration rate of 1.0 m/h gave better results in turbidity removal, filter run time, water production. The performance of two media at speed diverse is appeared in Figs 3 and 4.

Fig. 2. Size of the filter media were used in this study. From left-handed to right-handed (HDPE granules 3.5 mm, sand media 2.5 mm).

Table-I: Working states of the empirical runs

Empirical run	Filtration velocity(m/h)	Media depth (m)
1	0.5	0.12
2	1.0	0.18
3	0.5	0.23
4	1.0	0.23
5	0.7	0.18
6	0.7	0.12

Table-II: Execution of various media at numerous working conditions

Filter media	Tentative run	Breakthrough time (h)
Media (i)	Run 1 Run 3 Run 6	0.5 1.0 1.5
Media (ii)	Run 2 Run 5 Run 4	2 1.5 3

Table-III: Achieved lowest turbidity

Lowest turbidity (NTU)	Maximum headloss revolution (mm)	Water Production (L)
127 108 115	40 34.5 41	3.5 4.7 5.7
110 133 90	39 39 44	3.2 4.9 7.0

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The headloss increased in all types of filtration velocity as shown in Figs. 5 and 6. Through run time of filtration is expanded the headloss was practically immediate as for filtration time. The filter bed specifies the removal of particle. From Figure. 5 and 6, the channel assigns headloss is scattered over the total profundity. Fig. 7. Shows achieved the lowest turbidity of filtration rate and their media depth comparing to another media.

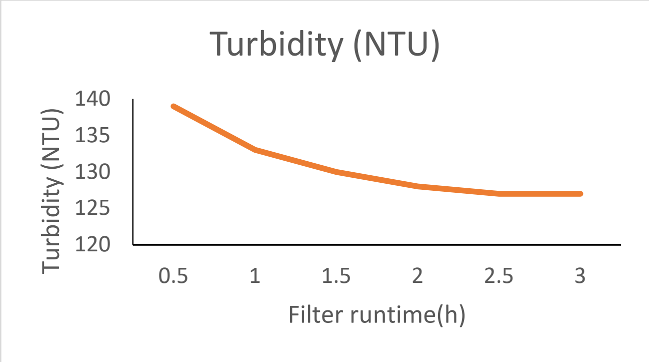

Fig. 3. Turbidity vs. Filter run time (media depth 0.12m and filtration velocity 0.5 m/h)

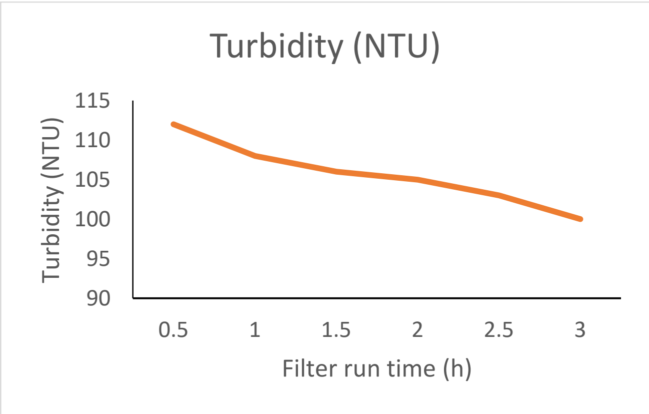

Fig.4. Turbidity vs. filter run time for HDPE (media depth 0.18m and filtration velocity 0.25 m/h)

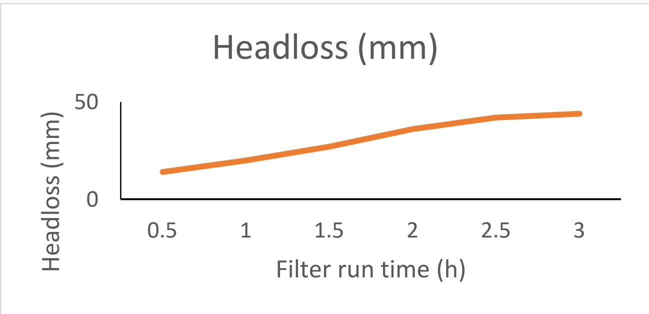

Fig. 5. Filter run time vs. Headloss (mm) with the media thickness of 0.12m and percolation of 0.12 m/h

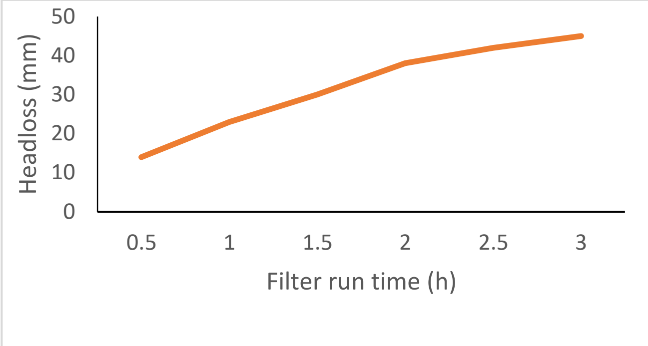

Fig. 6. Filter run time vs. Headloss (mm) with the media thickness of 0.18m and percolation of 0.25 m/h

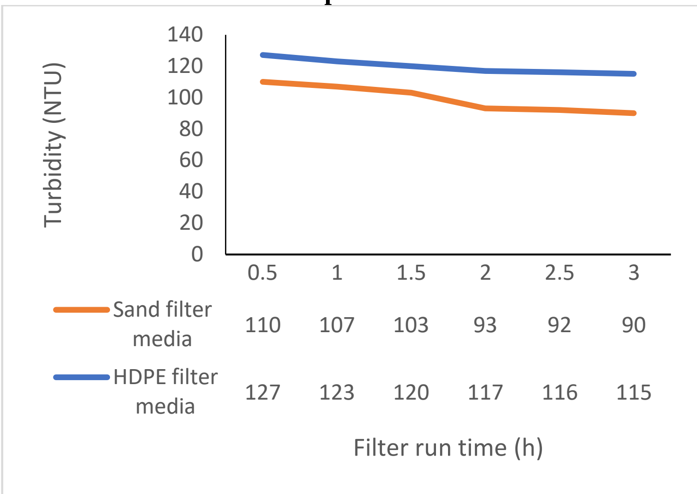

Fig. 7. Comparison of two media of turbidity removal (media thickness of 0.23m and separation rate of 1.0 m/h)

B. Headloss variation

The discussion of headloss difference sideways screen media, a piezometer was associated at various statures along the channel media. In filter media headloss development is accessible in Figs. 8 and 9. The maximum headloss obtained in the piezometer one because its fix in the lowest height so pressure would be increased. In the column one, each piezometer should be variation in 0.04mm and 0.07mm in second column.

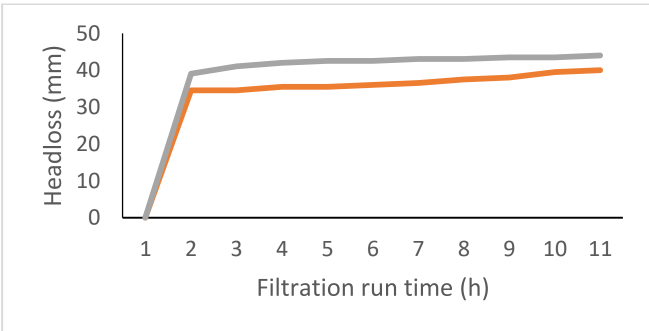

Fig. 8. Comparison between sand and HDPE filter media (filtration velocity 0.18mlh, media depth 0.23mm)

IV. CONCLUSION

In this study, headloss development included the filter depth, filtration rate was investigated. The filtration rate 1.0 m²/h were initiate the super conditions to remove particles. The super condition to eliminate particles(turbidity) is 1.0 m²/h, permitting more longer filter run time. This method can be removed 70% in sand in maximum experimental run time also HDPE granules eliminate 55% in the size of 3.5mm.

Increasing the surface area and decrease filter media size can be effectually result. These particles are more efficiency to filter the synthetic water. Furthermore, the headloss development is counterbalanced during this experimental run between two filter media. Headloss development experienced media (i) was 41 cm and media (ii) was 44cm. In this experimental run gets lowest turbidity in overall. There is Headloss readings are taken at breakthrough time. In addition, reduces the filter depth and media size to produce the best water quality.

Results and experimental runs showed the maximum depth that produce the best quality water as taken. The media was taken 0.23m in the filtration rate as 1.0 (m/h) for media (ii), media (i) is achieved lowest turbidity in the filtration rate of 0.5 (m/h) and media is 0.23m. The effective media depth is increases and size is decreases then it comes more quality water. However, these results showed this size of the particle, HDPE granule media size is reduced then results shows better. In spite of the fact that the size of media tested right now conflicting. Be that as it may, these findings ought to be additionally explored with steady medium size so as to confirm the previously mentioned end.

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