

Conservation of waste water by designing filter and supplying to cooling tower

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Abstract - The Unit consists of a steam generation plant. For the aim of steam generation clean water is to be equipped to the boiler. For the aim of purification of feed water gravity sand filters are used. But, when continual use the filters get exhausted as fine sediments gets suspended within the filter and therefore the potency of the filter decreases. Therefore, to once more improve the potency of the filter the filters are to be backwashed which ends within the wastage of huge quantity of water. The main aim of the project is to effectively utilize this waste water exploitation out there resources and therefore minimize wastage of resources.

Key Words: Backwash, Sand filter, filtration, utilization, conservation, resources

1. INTRODUCTION

The water treatment plant 1 & 2 of unit are having 4 & 5 nos. of pressure sand filters and 2 nos. of activated carbon filters in each plant connected in parallel in each plant. After these filters get completely exhausted, they are backwashed for the purpose of cleaning and also to improve the efficiency. During this process a large volume of water is wasted as it gets contaminated with sediments and impurities. But the pH value of the water is such that it can be utilized again after filtration. Thus, the main purpose of the project is to effectively use this waste water by designing the filter and this improving the efficiency of the plant.

1.1 FILTRATION

Filtration is any of various mechanical, physical or biological operations that separate solids from fluids (liquids or gases) by adding a medium through which the fluid will be the only thing that can pass through. The fluid that passes through is called the filtrate. In physical filters oversize solids within the fluid are retained and in biological filters particulates are trapped and eaten and metabolites are retained and eliminated. Filtration is used to separate impurities and fluid in a suspension,

where the fluid can be a liquid, a gas, or a supercritical fluid. Depending on the application, either of the components may be isolated. There are too many different methods of filtration; all aim to attain the filtration of matter. Filtration is achieved by some form of interaction between the matter or particulates to be removed and the filter.

1.2 BACKWASH

After the long and continues use of filter for filtration the filter gets exhausted and finally the efficiency of the filter decreases. This is due to the sedimentation of deposits in the filter. In order to keep filter efficient and to clean the filter; the filter is backwashed. In terms of water treatment, including water Purification of water and sewage treatment, backwashing means to pumping water backwards through the media of filters. Backwashing is a form of preventive maintenance for the purpose of the filter media can be reused. In water treatment plants, backwashing may be an automated process that is run by local programmable logic controllers (PLCs). The backwash cycle is done after a set time interval, when the filter outlet turbidity is greater than a treatment guideline manual or when the differential pressure (head loss) across the filter exceeds than a set value. For the purpose of backwashing the filter, clean water is used. Thus the clean water becomes dirty after mixing with effluents and sediments and cannot be used again after filtration. However, the pH value of the water is such that it can be utilized again after filtration.

2. METHODOLOGY

We sent the waste water in process of backwashing the working gravity filter to the standby filter whichever is nearest to the application. Even after filtration from standby filter, quality requirements of water are not met, that is why another filter will be designed to further filter water to meet requirements. After final filtration, water will be sent to cooling tower where it would be used for cooling steam from steam generation plant. Standby filter used after backwash is already the slow sand filter, hence there is no point to use it again alone. Disadvantage for Activated carbon filter[4] is that, it cannot be reused and need to be replaced after filtering about 150L of water, so it

get very costly. Disadvantage ceramic filter [1] is that, it is brittle and required high maintenance in comparison with other filters. Since sediments fills up the pores on the filter surface, they are needed to be cleaned regularly. To clean ceramic filters, scrubbing the surface with a brush or reverse flow would be the most effective. Flow rates of 1-3 L/hr. can be achieved. So to overcome all these disadvantages; we decided to combine more than one filtration process and to achieve synergetic combination by integrating advantages of all the process.

3. UTILISATION

We used this clean water in cooling tower and as physical location of cooling tower is nearest to stand by filter, piping required would be minimum. Cooling water is used to cool the condensate coming from the condenser. It brings the temperature of the condensate to atmospheric temperature from very high temperature.

4. DESIGN OF FILTER

We are using multimedia filter. These filters use sand and crushed anthracite coal on a graded gravel base. Media layers are arranged in a course to fine gradation in the direction of flow, which allows greater depth of penetration of floc particles. Multimedia filters are selected with specific gravities so that moderate intermixing between media layers occurs during backwashing.

From table below,

We take the standard height of each medium

Anthracite = 460 mm

Sand = 230 mm

Garnet = 75 mm

Filtration rate = 4.08 L/sec-m² = 14688 l/hr-m²

Discharge = 50000 l/hr.

V = 15 m/hr.

Area of cross section of top surface of filter = 50000/14688
= 3.4 m²

Assume the cross section is square,

Therefore, the dimension of square is 1.85 m

Table -1: Multi-media filter characteristics for water[2]

Multi-media filter characteristics for water		
CHARACTERISTIC	VALUE	
	Range	Typical
Anthracite:		
Depth		
Inches	16.5-21	18
(mm)	(420-530)	460
Effective size (mm)	0.95-1.0	10
Uniformity coefficient	1.55-1.75	<1.75
Sand:		
Depth		
Inches	6.0-9.0	9
(mm)	(150-230)	230
Effective size (mm)	0.45-0.55	0.5
Uniformity coefficient	1.5-1.65	1.6
Garnet:		
Depth		
Inches	3-4.5	3
(mm)	(75-115)	75
Effective size (mm)	0.20-0.35	0.2
Uniformity coefficient	1.6-2.0	<1.6
Filtration Rate:		
gpm/ft ²	4.0-10.0	6
(l/s-m ²)	(2.72-6.80)	4.08

5. RESULTS

- Water saved per day - 50 m³
- Approx savings - 7 lacs/year

BIOGRAPHIES

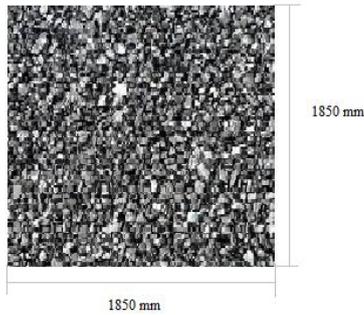
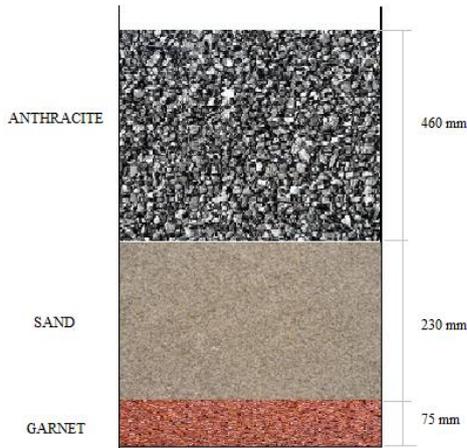


Fig -1: Designed filter



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6. CONCLUSIONS

- By re-filtration of backwashed water, huge amounts of water can be saved in industries
- This method can be very profitable
- This can be a very effective method for industries seeking to operate on zero emission basis
- This could be a effective way for industries in area where there is scarcity of water.

REFERENCES

- [1] https://en.wikipedia.org/wiki/Ceramic_water_filter
- [2] <https://www.scribd.com/document/261851180/Water-Treatment-Lecture-5-EENV>