Treatability Study of Waste Water Using Activated Carbon, Sand Filter and Dual Media Filter

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Abstract: A treatability study was carried out at Common Effluent Treatment Plant (CETP), Koperkhairne, Navi Mumbai, Maharashtra by setting up a pilot plant using filters like Activated Carbon, Dual Media and Sand Filter. CETP receives effluent from approximately 3056 industries which include Large scale industries, Medium scale industries and Small scale industries. It includes a variety of industries like textiles, leather, paints, pharmaceuticals and many others whose effluents have a high load of COD, TSS, TDS etc. The aim of the research project was to check out which of the above mentioned filters give maximum colour and odour removal, COD reduction and TSS removal. After carrying out the study for seven days each on using effluent from clari-floculator it was found that Activated Carbon gives maximum colour and odour removal and maximum COD reduction.

Keywords: CETP, effluent, clarifloculator

Introduction:

The main objective of CETP is to make project feasible, techno-economical treatment cost which is to be borne by individual member unit to minimum while protecting the environment to a maximum.

CETP receives industrial waste water from industries of varying magnitude containing high load of Total Solids (TS), Total Suspended Solids (TSS), Mixed Liquor Volatile Suspended Solids (MLVSS), Mixed Liquor Suspended Solids (MLSS), Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), pH (varies from industry to industry). Treatment of such heavily polluted water is very essential before discharging it into the receiving water body. If such water is discharged in the receiving body, it will affect the flora and fauna of the water body and lead to its pollution.

At CETP preliminary, primary and secondary treatment is given to the effluent without significant change in color and odour. The preliminary treatment includes physical treatment; followed by primary treatment, which includes addition of chemicals and neutralization of the effluent. Further effluent is sent for secondary treatment which includes biological treatments, such as Activated Sludge Process. After all treatment processes, the parameters such as COD, TSS, TDS etc gets reduced within the permissible limits as prescribed by Maharashtra Pollution Control Board. But this treatment process is not sufficient to remove the colour and odor of the waste water.

In the present study, a pilot plant was set up at CETP using different filters like Activated Carbon, Sand Filter and Dual Media Filter to compare their efficiency in reducing the colour and odour component of waste water. The filters were changed after every 7 days. Various water parameters like COD, TSS, TDS, DO, BOD, MLSS, MLVSS etc were monitored. The color and odor were also visually checked regularly.

Sand Filter was selected because; it had been traditionally used as the filter medium in conventional water treatment plants owing to its wide availability, low cost and the satisfactory results. (Al-Rawi S. M., 2009).

Research also shows that, activated carbon filters are extremely effective as primary filters and have the added benefit of organic load reduction resulting in cost savings with reduced chlorine demand and safer water (Peta Thiel, 2006).

Materials and methods:

Waste water sources:

The effluent was taken from 12 MLD clarifloculator, quantity 12lit/day. The effluent at CETP is high in TS, COD, BOD and TSS.

Materials Used: To treat this heavily polluted water a pilot plant set up was made wherein three different filters were used to check which of the filters give maximum color and odor reduction, maximum COD and TS reduction etc. The filters used where Activated Carbon, Sand Filter and Dual Media Filter.

The set up was as followed: the effluent from clarifloculator was connected to the aeration tank wherein 24hrs aeration was supplied followed by the filter i.e Activated Carbon, Sand Filter and Dual media filter alternately. The flow rate was adjusted to 11.25ml/min.

Fig 1. Pilot plant set up

Result and Discussion

Each filter was analyzed for 7 days and parameters were assessed on daily basis.

Table1. Plant performance of Activated Carbon

DATE	CLF				ACTIVATED CARBON				AERATION TANK			% REDUCTION IN COD
	pH	COD	TSS	TDS	pH	COD	TSS	TDS	MLSS	MLVSS	DO	
24th May	7.30	1464	108	97	7.1	260	49	95	3961	1902	2.8	82.24%
25th May	7.32	1426	122	95	7.3	256	46	89	3957	1865	2.9	82.04%
26th May	7.8	1532	105	98	7.2	304	43	91	3869	1184	2.6	80.15%
27th May	7.2	1248	98	87	7.1	247	41	82	3752	1747	2.6	80.20%
28th May	7.1	1392	107	95	7.1	254	50	93	3652	1673	2.8	81.75%
29th May	7.3	1200	95	83	7.3	238	39	79	3450	1554	2.7	80.16%
30th May	7.3	1528	119	100	7.1	264	47	96	3261	1468	2.6	82.72%

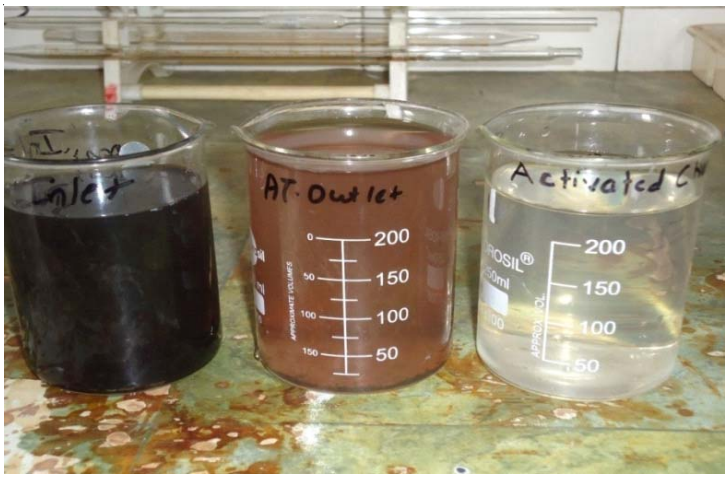

Fig 2 : Colour reduction on using activated carbon

Table 2. Plant performance of Dual Media Filter

DATE	CLF				DUAL MEDIA				AERATION TANK			% REDUCTION
	pH	COD	TSS	TDS	pH	COD	TSS	TDS	MLSS	MLVSS	DO	
1st JUNE	7.3	1532	112	98	7.2	356	58	97	3961	1435	2.8	76.76%
2nd JUNE	7.4	1248	109	97	7.2	304	54	95	4026	1255	2.6	75.64%
3rd JUNE	7.3	1392	105	87	7.1	287	52	84	4050	1740	2.8	79.38%
4th JUNE	7.3	1256	98	95	7.1	298	58	90	4027	1695	2.7	76.27%
5th JUNE	7.4	1528	120	101	7.3	348	67	118	3869	1597	2.9	77.22%
6th JUNE	7.3	1458	116	84	7.1	324	59	82	3359	1438	2.0	77.77%

Table 3 . Plant performance of Sand Filter

DATE	CLF				SAND FILTER				AERATION TANK			% REDUCTION IN COD
	pH	COD	TSS	TDS	pH	COD	TSS	TDS	MLSS	MLVSS	DO	
17th May	7.30	1464	150	430	7.1	260	112	301	3250	1607	2.5	82.24%
18th May	7.32	952	380	790	7.3	256	250	523	3977	1694	2.3	73.10%
19th May	7.8	796	300	370	7.2	304	198	178	4039	1703	2.6	61.80%
21nd May	7.2	1256	280	500	7.1	445	156	345	4021	1609	2.7	64.57%
22rd May	7.1	1392	135	365	7.1	304	86	193	4119	1740	2.0	78.16%
23th May	7.3	1200	277	355	7.3	248	132	175	4027	1695	2.8	79.33%

Sand filter can remove turbidity of water and also reduce the microbial load (Al.Rawi S.M., 2009). After pilot plant study using sand filter the results obtained were on the similar lines. The effluent was efficiently treated to reduce the turbidity of water and also give good COD reduction.

On completing the treatability study using different filters each for seven day study, it was found that Activated Carbon is the best adsorbent. It gives maximum reductions in colour and odor (Thiel P., 2006), in his pilot plant study also found the similar results. The effluent from approximately 3056 industries was treated using Activated carbon which gave 80-85% COD reductions and treated the water to drinking water quality.

There should also be organisms present in the aeration tank so that there is maximum treatment of water. Presence of *Sphaerotilus* (sewage fungus), *Beggiatoa species, Diatoms, Paramecium spp, Vorticella spp,* Nematodes, *Trypanosomes* etc. indicates that the aeration tank is functioning properly.

The observed results of the pilot plant after carrying out 7 days study for each are as follows:

PARAMETERS (% reduction)	ACTIVATED CARBON	SAND FILTER	DUAL MEDIA FILTER
COD	80-85	75-80	70-75
TSS	55-60	35-40	40-45
TDS	45-50	40-45	45-50

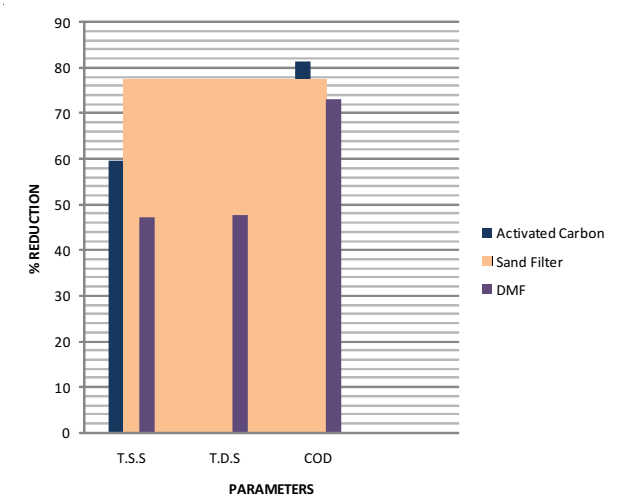

Fig 3: Graphical Representation Of The Plant Performance

Conclusion

The study showed that Activated carbon filter was the most efficient in reducing COD, colour and odor of the effluent sample.

The treatment of such heavily polluted water is essential because the untreated effluent will affect the biota severely by significantly reducing dissolved oxygen and light penetration capacity of the receiving water body i.e. Trans Thane Creek.

The iodine content in the activated carbon is responsible for treatment of water. The efficiency of the filter reduces as the iodine content decreases with time. Further research can be carried out to increase durability and efficiency of the filters.

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