MODIFIED MULTI – MEDIA FILTER FOR DOMESTIC WASTEWATER TREATMENT

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Abstract**: Water is one of the most vital elements involved in the creation and development of healthy life. Since water is such a important resource for survival of both plants and animals, it is our responsibility to manage this resource, not only as a social, industrial and commercial good but also for the sustainable benefit of all living matter. Increasing pressure to get more stringent discharge standards or not being allowed to discharge treated effluent has led to Implementation of a variety of advanced biological treatment processes in recent years. Current and future fresh water demand could be met by enhancing water use efficiency and demand management. Thus, wastewater is emerging as potential source for demand management after essential treatment. Biological treatment is an good and important part of any wastewater treatment plant that treats wastewater from either municipality or industry having soluble organic impurities or a mix of the two types of wastewater sources. The main advantage of attached growth systems is that they maintain a high concentration of microorganisms resulting in high removal rates at relatively small hydraulic retention times. The basic design and operational characteristics of various systems are presented in terms of packing materials, organic loading rates, treatment temperature, as well as achieved removal rates. Filtration technology is a low cost treatment technology based on physical process to treat wastewater by removing contaminant like COD, BOD, turbidity and suspended solids for a wide range of applications in domestic as well as industrial applications. Research on alternate filtration media, has expanded the options available for improving effluent quality.**

***Keywords*— Filtration, Domestic Wastewater, Packing materials, Multi – Media Filters.**

I. INTRODUCTION

Wastewater is any water that has been adversely affected in quality by anthropogenic influence. It comprises liquid waste discharged by domestic residences, commercial properties, industry, and/or agriculture and can encompass a wide range of potential contaminants and concentrations. In the most common usage, it refers to the municipal wastewater that contains a broad spectrum of contaminants resulting from the mixing of wastewaters from different sources. Wastewater also known as sewage originates from residential commercial and industrial area. Wastewater engineering is that branch of environmental engineering in which the basic principles of science and engineering are applied to solving the issues associated with the treatment and reuse of wastewater. The ultimate goal of wastewater engineering is the protection of public health in a manner commensurate with environmental, economic, social, and political concerns. When untreated wastewater accumulates and is allowed to go septic, the decomposition of the organic matter it contains will lead to nuisance conditions including the production of malodorous gases. In addition, untreated wastewater contains numerous pathogenic microorganisms that dwell in the human intestinal tract.

Wastewater also contains nutrients, which can stimulate the growth of aquatic plants, and may contain toxic compounds or compounds that potentially may be mutagenic or carcinogenic. For these reasons, the immediate and nuisance-free removal of wastewater from its sources of generation, followed by treatment, reuse, or dispersal into the environment is necessary to protect public health and the environment. Wastewater facilitates treatment and reduces risk. Strengthening institutional capacity and establishing links between water delivery and sanitation sectors through inter-institutional coordination leads to more efficient management of wastewater and risk reduction. Filtration is one of the oldest and simplest methods of removing those contaminants. Generally, filtration methods include slow sand and rapid sand filtration. Reliable operation for sand filtration is possible when the raw water has low turbidity and low suspended solids. For this reason, when surface waters are highly turbid, ordinary sand filters could not be used effectively. Therefore, the roughing filters are used as pre-treatment systems prior to sand filtration. Furthermore, roughing filters could reduce organic matters from wastewater. Therefore, roughing filters can be used to polish wastewater before it is discharged to the environment.

Besides that, the purpose of wastewater treatment is to remove pollutants that can harm the aquatic environment if they are discharged into it. Because of the deleterious effects of low dissolved oxygen concentrations on aquatics life, wastewater treatment engineers historically focused on the removal of pollutant that would deplete the DO in receiving waters. Biological treatment is an important and integral part of any wastewater treatment plant that treats wastewater from either municipality or industry having soluble organic impurities or a mix of the two types of wastewater sources. The obvious economic advantage, both in terms of capital investment and operating costs, of biological treatment over other treatment processes like chemical oxidation; thermal oxidation etc. has cemented its place in any integrated wastewater treatment plant. There are several opportunities for improving wastewater irrigation practices via improved policies, institutional dialogue, and financial mechanisms, which would reduce risks in agriculture. Effluent standards combined with incentives or enforcement can motivate improvements in water management by household and industrial sectors discharging wastewater from point sources.

II. EXPERIMENTAL WORK

The proposed Multi – media filter model will be based upon the concept of attached growth process. The study will be carried out to study the behaviour of the attached growth system and to study the performance of the various packing material used in the media filter. The model will be fabricated with GI sheet and will consist of three reactors placed in series with the total reactor volume 90 litres. The model will be packed with different packing media. The depth of the media will be kept accordingly. The Inlet and outlet arrangement were provided at appropriate locations. A inlet chamber will be provided before the three reactors so that the wastewater will first get collected in the collecting chamber and then enter the reactors. A perforated system will be provided in the reactors to facilitate the uniform distribution of wastewater throughout the reactor. The wastewater will be collected in the collection chamber and finally be removed through the outlet.

III. WORK OF MODEL

The effluent will be fed into the inlet tank/pre-sedimentation tank having capacity of 50 litres. The wastewater will then enter the inlet chamber. The wastewater from the inlet chamber will flow in sequence i.e. from the first reactor to the last reactor, passing through the packed media and then enter the collecting chamber and will be collected from the outlet. The wastewater from the inlet chamber will enter the first reactor through the perforated PVC pipes. The perforated PVC pipes are provided to provide uniform distribution throughout the reactor. The wastewater will thus pass uniformly through the first reactor and will get partially treated and enter the second reactor. The wastewater partially treated in the first reactor will move to the second reactor in upflow regime. The wastewater will thus rises uniformly at the same time it will get treated. The wastewater from the second reactor will enter the third reactor in a uniform manner through the perforated PVC pipes. The wastewater will thus pass uniformly through the third reactor and get treated and will enter the collecting chamber by the upflow movement. Thus, the wastewater will pass through all the three reactors in the downflow - upflow – downflow path and will get collected in the collecting chamber and after reaching the outlet level the treated effluent will collected in the outlet tank.
The model will be operated for varying detention time. Sampling will be done at the end of the detention period and the various characteristics of the influent and the effluent will be checked. The working of the experimental model will also be observed by varying the packing of the filter media. Different filter media such as burnt bricks, aerocon media, plastic media etc will be used.

IV. EXPERIMENTAL RESULTS

It is proposed that the materials such as burnt bricks and porous aerocon media may prove to be more effective in upgrading the effluent output quality in terms of its BOD and suspended solid content. It is forecasted that the experimental model will significantly assist in the removal of BOD, COD, TSS and will help the pH quality of the effluent.

Table 1: Shows the performance of the model for pH at 18, 21 & 24 hours hydraulic retention time.

	PRE-TREATMENT HRT : 0 hrs	POST-TREATMENT HRT : 18 hrs	POST-TREATMENT HRT : 21 hrs	POST-TREATMENT HRT : 24 hrs
1	7.243	7.735	8.122	8.192
2	7.111	7.692	7.835	7.891
3	7.462	7.671	7.917	8.231
4	7.324	8.015	8.015	8.162
5	7.421	7.868	8.127	8.312
6	7.361	8.014	8.062	8.144
7	7.294	8.144	8.233	8.343
8	7.417	7.77	8.11	8.292
9	7.013	7.621	7.772	7.891
10	7.31	7.784	8.019	8.032

Table 2: Shows the performance of the model for BOD at 18, 21 & 24 hours hydraulic retention time.

	PRE-TREATMENT HRT : 0 hrs	POST-TREATMENT HRT : 18 hrs	% REMOVAL	POST-TREATMENT HRT : 21 hrs	% REMOVAL	POST-TREATMENT HRT : 24 hrs	% REMOVAL
1	174	112	35.61	98	43.67	80	54.02
2	207	103	33.81	108	47.82	94	54.58
3	193	119	46.63	97	49.74	81	58.03
4	213	116	44.13	93	56.33	84	60.56
5	245	104	52.65	107	56.32	110	55.10
6	188	121	44.68	99	47.34	76	59.57
7	192	112	36.97	105	45.31	81	57.81

8	205	130	45.36	109	46.82	94	54.14
9	232	154	43.96	98	57.75	91	60.77
10	243	154	36.62	149	38.68	94	61.31
Avg.% removal		42.04%		48.98%		57.59%	

Table 3: Shows the performance of the model for COD at 18, 21 & 24 hours hydraulic retention time.

	PRE-TREATMENT HRT : 0 hrs	POST-TREATMENT HRT : 18 hrs	%REMOVAL	POST-TREATMENT HRT : 21 hrs	%REMOVAL	POST-TREATMENT HRT : 24 hrs	%REMOVAL
1	753.41	299.27	60.27	254.23	66.25	198.51	73.65
2	819.8	316.38	61.44	270.45	67.01	228.51	72.12
3	930.34	360.14	61.28	297.39	68.03	252.08	72.90
4	730.4	284.21	61.08	235.18	67.80	180.32	75.31
5	870.45	335.52	61.45	263.78	69.69	230.53	73.51
6	798.01	295.76	62.93	245.96	69.17	228.5	71.36
7	1420.32	544.93	61.63	476.42	66.45	369.54	73.98
8	1278.23	502.04	60.72	410.49	67.88	333.71	73.89
9	1034.62	379.33	63.33	308.1	70.22	290.28	71.94
10	972.49	362.07	62.76	301.41	69.00	262.4	73.01
Avg.% remov			61.69 %		68.15 %		73.17 %

V. CONCLUSIONS

Multi – Media Filtration technology has potential for employed to small-sized systems. Multi – media filters is also a latest invention in the filtration technology which involves use of media other than the conventional media as opposed to sand used in the conventional sand filters. It can also be concluded from the study that the Multi – Media filter may be considered as good option for pre-treatment process for wastewater treatment. The recent invention in the media types such as porous aerocon media and plastic media has expanded new areas for study. Also, the above media may enhance the performance of the treatment system. Hence, this technology is environment friendly and cost effective.

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