UPGRADATION OF THE SEPTIC TANK TO SEWAGE TREATMENT PLANT FOR THE EDUCATIONAL INSTITUTE

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ABSTRACT

Use of fresh water for watering of garden and lawns of big premises like university, landscape irrigation of multinational companies, municipal corporations and townships at the outskirts of cities, gardens and golf course of military formations is becoming impracticable due to water crisis and is more true in summer. About 80 % of water supplied to consumers gets converted in to sewage. Sewage is rich in plant nutrients and when it reaches to water bodies like river, lake it encourages the growth of algae, water hyacinth and degrades the water quality. Recycle and re-use of wastewater is need of the time for water conservation. Nutrients from the sewage can be recycled back to soil by the use of treated sewage for gardening and agriculture where huge volume of water is required every day. Cluster of population have septic tanks for sewage treatment and disposal. Providing an engineering solution to environmental problems at optimum resources is a challenging task. The present paper makes an effort towards the sustainable development of sewage treatment by suggesting a methodology to upgrade an existing septic tank.

KEY WORDS: *Septic tank, COD, BOD, Water conservation.*

INTRODUCTION

About 20-30 years back for isolated premises like university campus, defence estates construction of septic tanks for collection of sewage at central place and disposal was a concept. Construction of such septic tank incurred lot of expenditure. Now, such septic tanks are absolute, not in use for several reasons like accumulation of silt in sewers and thereby no collection and transport of sewage up to septic tank and poor maintenance of septic tanks. Even after regular de-sludging of septic tank the effluent from septic tank still has BOD in the range of 100 to 150 mg/l or even more. The luxury of use of fresh water for gardening is no more affordable. Such big old and new premises have multiple scattered septic tanks for sewage disposal as per population deposits where septic effluent is disposed through leaching pit or discharged it in to the nearby drain or river.

The use of treated sewage for huge water requirements of gardens, lawns can be met by local treatment of generated sewage. Under such circumstances secondary treatment and hence BOD reduction of sewage effluent retaining nutrients gives the better solution. The aerobically treated sewage through upgraded septic tank effluent can be used for agriculture. The sewage has abundance of required plant nutrients and the same can be drawn from treated sewage. Recycle and re-use of nutrients rich treated sewage for watering of gardens reduces the load on municipal corporations to supply fresh water supply, closes the loop of natural nitrogen cycle and helps to reduce the eutrophication of water bodies like rivers.

The existing septic tank can be converted or upgraded for the treatment of generated sewage. Constructing a preliminary treatment unit, providing a base concrete layer to the bottom of tank, retrofitting of side surfaces, estimating and providing air blower, constructing a room for air blower, diffuse aeration grid will be the technical task that one has to do to convert the existing septic tank.

SEPTIC TANKS: PRESENT SCENARIO

A septic tank is designed to provide what is known as primary biological treatment to crude sewage produced in a normal domestic environment. Septic tanks are designed for detention period of 16 to 24 hrs. It retains solids and allows them to settle out, where they can be partially broken down by biological action so that only the settled sewage is left to flow down to the outlet drain. Any septic tank constructed 20-30 years back is hydraulically overloaded due to additional population deposits in the catchment. The reduction in detention period is leading to poor performance. The septic tank effluent is malodorous; containing sizable portion of dissolved organic content,BOD in the range of 100 to 150 mg/l and pathogenic organisms. Obviously septic tank effluent neither meets disposal standardsnor can be usedfor gardening, watering of lawns and golf course and hence need to be treated further by suitable aerobic process to minimize the health risks and reuse.

MATERIAL AND METHOD

Sewage from sanitary blocks will be screened and collected in Aeration tank which will be equipped with Jet Aerator. Sewage collected will be processed by Activated Sludge Process using Jet Aerator. In this process microbial activity will degrade the organic matter in the effluent into minerals and water. Microbial activity will be enhanced by using organic culture in aeration tank. This will help in reduction of all the effluent parameters like BOD, COD, Suspended Solids, etc. to enable us reuse this water selectively. The treated water parameters will be far better than effluent parameters specified by MPCB.

The stages of treatment are as follows,

1. Aeration Tank will be 2.4 m in height to reduce space and also to optimize diffused aeration process. Sewage will be aerated by Jet Aerator.
2. After aeration, sewage will be settled in a settling tank provided with sludge pumps.
3. Overflow from the settling tank will be collected in the Filter Feed tank.
4. Filtered water will be further filtered through a Dual Media Filter & disinfected by UV to obtain clear water for use as gardening purpose.
5. During operation of the plant, after some time, it is necessary to remove sludge from the system. This is achieved by a sludge drying pot provided for this purpose. Dry cake from the drying pot can be used as manure where as clear filtrate is recycled back to plant.

TREATMENT PLANT UNITS

1.1(One)	Bar Screen chamber of 0.5m x 0.5m x 0.5m swd,
2.1 (One)	Jet Aerator of cap. 10 m^3/hr @ 0.3kg pressure
3.1 (One)	Aeration tank of 2.75m x 1.66m x 2.4m swd,
4.1 (One)	Settling tank of 2.75m x 1.9m x 2.2m swd

5.1 (One)	Sludge pumps 2 m3/hr @ 6m head
6.1 (One)	Filter Feed tank of 2.75m x 1.7m x 2.1m swd
7.2 (Two)	Filter feed pumps of 2 m^3/hr @ 25m head
8.1 (One)	Dual Media Filter of 400mm dia x 1600mm HT,
9.1(One)	Ultraviolet (UV) System,
10. Set	Interconnecting piping for the above system
11. Set	Electrical fitting of the plant

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SR. No.	PARAMETERS	DOMESTIC SEWAGE
1	pH	6 to 8
2	Suspended solids	150 to 300 mg/l
3	5 day's 20^O C BOD	300 to 400 mg/l
4	COD	600 to 800 mg/l
5	Oil and Grease	40 to 50 mg/l

Note: - All parameters except pH are expressed as mg/l.

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SR. No.	PARAMETERS	Treated Water as per MPCB Standards
1	pH	6 to 8
2	Suspended solids	<10
3	5 day's 20^O C BOD	<100
4	COD	<250
5	Oil and Grease	< 10

Note: - All parameters except pH are expressed as mg/l.

DISCUSSION OF TREATMENT PLANT

To have eco-friendly & natural treatment, this plant is designed based on the biological treatment concept. This means naturally occurring microbes (which are present in influent water itself) removes or degrade the organic matter present in the influent & at the end clean water is available for the non potable usage or to dispose safely in the drainage or river bodies as per the norms.

Pre – Treatment

Screening: This is the first unit of the plant in which large or floating materials in the influent gets arrested and blockage or choking of the downstream equipments can be avoided. This arrested material will be removed manually and then it will be disposed of suitably.

Equalization: To absorb variation in quantity and quality of influent and to provide uniform flow at the downstream treatment process, a collection or equalization tank is provided. This will avoid shock loading and process upsets of the treatment plant. To avoid settling of suspended solids in this tank, continues air agitation is provided. If at site, septic tank is provided then collection tank as well as air agitation is not required.

Secondary Treatment Biological Treatment:

This is the main section of the plant where degradation of organic pollutants with the help of aerobic microorganism takes place. To maintain the aerobic condition in the bioreactor, air supply arrangement is provided by means of aeration equipment which has high oxygen transfer efficiency.

Tube Settler: Gravity overflow from the bioreactor is collected in the tube settler tank. In this settling tank, generated sludge from the bioreactor undergoes a gravity settling. Clear supernatant from settling tank will flow by gravity to a chlorine contact tank. To reduce the plan area of settling tank, tube modules are placed in this tank to increase the settling area of the tank. Since this tank is a hopper bottom tank due to which there is no need of sludge scrapping mechanisms.

Disinfection: Supernatant from Tube settler, flow by gravity to the chlorine contact tank. To disinfect the harmful bacteria in the treated water as well as to remove the refractory organics from treated water, in this tank hypo chlorite solution is dosed with the help of dosing system.

Sludge disposal system: Settled sludge from tube settler will be removed by pumping to the sludge holding tank **Tertiary treatment:**

Secondary treated water will be further passed through sand media filter followed by activated carbon filter. Filtered water will be collected in the Irrigation water tank from where it will be taken for desired non potable application. Backwashed water from filters will return back to equalization tank.

ADVANTAGES OF TREATMENT SCHEME

This plant will produce the treated water which can be recycled back.

- This plant is based on biological principle hence no need to use of any excessive hazardous chemicals for the main degradation process.
- Due to efficient aeration system, electrical power requirement is very low.
- Due to user friendly equipments, plant maintenance is very less.
- Due to inbuilt automation, plant machinery life is high & ensures trouble free operation all process rotating electromechanical equipment is provided with standby equipment to ensure the uninterrupted operation.
- If influent treated & operated properly this effluent treatment plant will give enormous benefits such as
- It will avoid the water pollution
- It will help us to give hygienic surrounding
- After required treatment, treated water can reduce our 60-70 % fresh water requirement, which otherwise we use for toilet flushing, gardening, construction, etc. Thus we can save a lot on water expenditure as well as provide us a remedy on present water crises.
- Being a water recycling & conservation system, commercial establishment gets depreciation benefits for promoting green & eco friendly development.
- Filtered water will be collected in the Final Collection water tank from where it will be pumped to the Gardening or Toilet Flushing. Above all, we will be ensuring safe & hygienic environment to our society.

REFERENCES:

1. Carucci A., ChiaolaMajone, M Rolle E., (1999), "Treatment of tannery wastewater in a sequencing batch reactor". Journal of Water Science Tech., 40(1); 253-259.
2. Chang C.H., Hao, O.J, (1996),"Sequencing batch reactor system for nutrient removal:ORPand pH profiles". Journal of Chem tech. Biotech. 67:27-38.,
3. Keller J. Subrmaniam, K. Gosswein J., Greenfield P.F(1997), "Nutrient removal from industrial waste water using single tank sequencing batch reactors", Journal of Wat. Sci. Technology 35(6); 137-144.
4. Mahvi A H, Mesdaghinia A, Karakani F (2008), "Sequencing Batch Reactor: A promising Technology in Wastewater treatment", Iran Journal of Environ. Health Science Engineering, Vol 5, No2, pp. 79-90.
5. Medhat M Saleh, Usama F. Mahmood, "Modified Sequential Batch Reactor (MSBR) A New Process of Wastewater Treatment" Nineth International Water Technology Conference, IWTCC9 2005, Sharm El-Sheikh, Egypt. Pp.105-113.
6. Metcalf & Eddy, Inc. Revised by George Tchobanoglous, "Wastewater Engineering Treatment, Disposal and Reuse" Second Edition, Tata Mc Graw-Hill.
7. Sam Jeyanayagam, "True Confessions of the Biological Nutrients Removal Process". Florida Water Resources Journal, January 2005. pp 37-46.
8. United States Environmental Protection Agency, Office of Water, "Biological Nutrient Removal process and Costs" .Washington, DC20460 (4305T), June 2007.