

Waste water conditioning and treatment

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Abstract—Waste-water treatment consists of different processes which protect the environment and human health through cleansing the water pollutants. In the past people used to have different methods for this treatment which has been passed over or developed through history, due to the advancement of technology and the growing needs of society. Wastewater treatment is a vital process in the modern industrial world, alongside this, more than 97% of water is stored in Saline (Oceans) and only 3% in fresh water, however only less than 1% is available for consumption.. As time goes by, there will be population growth for which the government would have to provide more useable water for society. Wastewater treatment uses chemical, physical, and biological processes to cleanse wastewater in order to protect the environment and public health.. Wastewater is the water which has been released to the environment that is defined as a combination of the water plus wastes that have been added to the water from a variety of uses, such as industrial, commercial, residences and there are two sources which release the wastewater into the environment.

Keywords— biological process, industrial commercial residential waste in water, public health, saline water, waste water

I. INTRODUCTION

Wastewater treatment is a vital process in the modern industrial world, alongside this, more than 97% of water is stored in Saline (Oceans) and only 3% in fresh water, however only less than 1% is available for consumption.. As time goes by, there will be population growth for which the government would have to provide more useable water for society. Wastewater treatment uses chemical, physical, and biological processes to cleanse wastewater in order to protect the environment and public health.. Wastewater is the water which has been released to the environment that is defined as a combination of the water plus wastes that have been added to the water from a variety of uses, such as industrial, commercial, residences and there are two sources which release the wastewater into the environment. MITHI River in Mumbai city, is a confluence of tail water discharges of Powai and Vihar lakes. Mithi River originates at Powai and meets Arabian Sea at Mahim Creek flowing through residential and industrial complexes of Powai, Saki Naka, Kurla and Mahim over a distance of about 15 km. This river is treated like an open drain by the citizens who discharge raw sewage, industrial waste and garbage unchecked. Besides this, illegal activities of washing of oily drums, discharge of unauthorized hazardous waste are also carried out along the course of this river. The organic waste, sludge and garbage dumping has reduced carrying capacity of the Mith river. The water with mixture of sewage and Industrial waste is a threat to marine life and the river is showing sign of total loss of such support system. Therefore it is necessary to design a waste-water treatment plant and implement the conditions prevailed by the Indian Government for maintaining a cleaner eco-system. Although this assignment paper explains the methods of designing a wastewater treatment plant, the factors which have to be considered before and during the design, relation between these factors and finally answers to some common questions in this field.

II. OBJECTIVES

- To design a waste-water treatment plant on MITHI river.
- To take samples on the river at various intervals.
- To study the samples and the effects of the waste on the surrounding environment as well as on the aquatic life.
- To reduce the effect of the waste-water on environment.

- To make the treatment plant design such that it is economic for construction.
- To make the environment more eco-friendly.
- To use new & advanced methods of treatment like electro-flocculation and coagulation.

III. MATERIAL AND METHOD

Sewage treatment generally includes three stages, called primary treatment, secondary treatment and tertiary treatment.

Primary treatment consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface. The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment. Some sewage treatment plants that are connected to a combined sewer system have a bypass arrangement after the primary treatment unit. This means that during a very heavy rainfall event, the secondary and tertiary treatment system can be bypassed to protect them from hydraulic overloading, and the mixture of sewage and storm-water only receives primary treatment.

Secondary treatment removes dissolved and suspended biological matter. Secondary treatment is typically performed by indigenous, water-borne micro-organisms in a managed habitat. Secondary treatment may require a separation process to remove the micro-organisms from the treated water prior to discharge or tertiary treatment.

1. Pretreatment

Pretreatment removes all materials that can be easily collected from the raw sewage before they damage or clog the pumps and sewage lines of primary treatment clarifiers. Objects commonly removed during pretreatment include trash, tree limbs, leaves, branches, and other large objects.

The influent in sewage water passes through a bar screen to remove all large objects like cans, rags, sticks, plastic packets etc. carried in the sewage stream. This is most commonly done with an automated mechanically raked bar screen in modern plants serving large populations, while in smaller or less modern plants, a manually cleaned screen may be used. The raking action of a mechanical bar screen is typically paced according to the accumulation on the bar screens and/or flow rate. The solids are collected and later disposed in a landfill, or incinerated. Bar screens or mesh screens of varying sizes may be used to optimize solids removal. If gross solids are not removed, they become entrained in pipes and moving parts of the treatment plant, and can cause substantial damage and inefficiency in the process.

1.1 Grit removal

Pretreatment may include a sand or grit channel or chamber, where the velocity of the incoming sewage is adjusted to allow the settlement of sand, grit, stones, and broken glass. These particles are removed because they may damage pumps and other equipment. For small sanitary sewer systems, the grit chambers may not be necessary, but grit removal is desirable at larger plants. Grit chambers come in 3 types: horizontal grit chambers, aerated grit chambers and vortex grit chambers. The process is called sedimentation.

1.2 Flow equalization

Clarifiers and mechanized secondary treatment are more efficient under uniform flow conditions. Equalization basins may be used for temporary storage of diurnal or wet-weather flow peaks. Basins provide a place to temporarily hold incoming sewage during plant maintenance and a means of diluting and distributing batch discharges of toxic or high-strength waste

which might otherwise inhibit biological secondary treatment (including portable toilet waste, vehicle holding tanks, and septic tank pumps). Flow equalization basins require variable discharge control, typically include provisions for bypass and cleaning, and may also include aerators. Cleaning may be easier if the basin is downstream of screening and grit removal.

1.3 Fat and greaseremoval

In some larger plants, fat and grease are removed by passing the sewage through a small tank where skimmers collect the fat floating on the surface. Air blowers in the base of the tank may also be used to help recover the fat as a froth. Many plants, however, use primary clarifiers with mechanical surface skimmers for fat and greaseremoval.

1.4 PrimaryTreatment

In the primary sedimentation stage, sewage flows through large tanks, commonly called "pre-settling basins", "primary sedimentation tanks" or "primary clarifiers". The tanks are used to settle sludge while grease and oils rise to the surface and are skimmed off. Primary settling tanks are usually equipped with mechanically driven scrapers that continually drive the collected sludge towards a hopper in the base of the tank where it is pumped to sludge treatment facilities. Grease and oil from the floating material can sometimes be recovered for saponification (soap making).

2 Secondarytreatment

Secondary treatment is designed to substantially degrade the biological content of the sewage which are derived from human waste, food waste, soaps and detergent. The majority of municipal plants treat the settled sewage liquor using aerobic biological processes. To be effective, the biota require both oxygen and food to live. The bacteria and protozoa consume biodegradable soluble organic contaminants (e.g. sugars, fats, organic short-chain carbon molecules, etc.) and bind much of the less soluble fractions into flocks.

Secondary treatment systems are classified as fixed-film or suspended-growth systems.

- Fixed-film or attached growth systems include trickling filters, constructed wetlands, bio-towers, and rotating biological contactors, where the biomass grows on media and the sewage passes over its surface. The fixed-film principle has further developed into Moving Bed Biofilm Reactors (MBBR) and Integrated Fixed-Film Activated Sludge (IFAS) processes. An MBBR system typically requires a smaller footprint than suspended-growth systems.
- Suspended-growth systems include activated sludge, where the biomass is mixed with the sewage and can be operated in a smaller space than trickling filters that treat the same amount of water. However, fixed-film systems are more able to cope with drastic changes in the amount of biological material and can provide higher removal rates for organic material and suspended solids than suspended growth systems.

Some secondary treatment methods include a secondary clarifier to settle out and separate biological flocks or filter material grown in the secondary treatment bioreactor.

3 Tertiarytreatment

The purpose of tertiary treatment is to provide a final treatment stage to further improve the effluent quality before it is discharged to the receiving environment (sea, river, lake, wet lands, ground, etc.). More than one tertiary treatment process may be used at any treatment plant. If disinfection is practiced, it is always the final process. It is also called "effluent polishing."

3.1 Filtration

Sand filtration removes much of the residual suspended matter. Filtration over activated carbon,

3.2 Lagoons or ponds

Lagoons or ponds provide settlement and further biological improvement through storage in large man-made ponds or lagoons. These lagoons are highly aerobic and colonization by native macrophytes, especially reeds, is often encouraged. Small filter-feeding invertebrates such as Daphnia and species of Rotifera greatly assist in treatment by removing fine particulates.

3.3 Biological nutrient removal

Biological nutrient removal (BNR) is regarded by some as a type of secondary treatment process, and by others as a tertiary (or "advanced") treatment process.

Wastewater may contain high levels of the nutrients nitrogen and phosphorus. Excessive release to the environment can lead to a buildup of nutrients, called eutrophication, which can in turn encourage the overgrowth of weeds, algae, and cyanobacteria (blue-green algae). This may cause an algal bloom, a rapid growth in the population of algae. The algae numbers are unsustainable and eventually most of them die.

The decomposition of the algae by bacteria uses up so much of the oxygen in the water that most or all of the animals die, which creates more organic matter for the bacteria to decompose. In addition to causing de-oxygenation, some algal species produce toxins that contaminate drinking water supplies. Different treatment processes are required to remove nitrogen and phosphorus.

3.4 Nitrogen removal

Nitrogen is removed through the biological oxidation of nitrogen from ammonia to nitrate (nitrification), followed by denitrification, the reduction of nitrate to nitrogen gas. Nitrogen gas is released to the atmosphere and thus removed from the water.

De-nitrification requires anoxic conditions to encourage the appropriate biological communities to form. It is facilitated by a wide diversity of bacteria. Sand filters, platooning and reed beds can all be used to reduce nitrogen, but the activated sludge process (if designed well) can do the job the most easily.

3.5 Phosphorus removal

Every adult human excretes between 200 and 1000 grams of phosphorus annually. Studies of Indian sewage in the late 1980's estimated mean per capita contributions of 500 grams in urine and feces, 1000 grams in synthetic detergents, and lesser variable amounts used as corrosion and scale control chemicals in water supplies. Source control via alternative detergent formulations has subsequently reduced the largest contribution, but the content of urine and feces will remain unchanged. Phosphorus removal is important as it is a limiting nutrient for algae growth in many fresh water systems. (For a description of the negative effects of algae, see Nutrient removal). It is also particularly important for water reuse systems where high phosphorus concentrations may lead to fouling of downstream equipment such as reverse osmosis.

Phosphorus can be removed biologically in a process called enhanced biological phosphorus removal. Once removed, phosphorus, in the form of a phosphate-rich sewage sludge, may be dumped in a landfill or used as fertilizer. In the latter case, the treated sewage sludge is also sometimes referred to as bio-solids.

4 Sampling

The purpose of this procedure is to document both general and specific procedures, methods and considerations to be used and observed when collecting wastewater samples for field screening or laboratory analysis.

Wastewater sampling studies focus primarily on collecting wastewater samples of the influent or effluent at domestic and non-domestic facilities. Sampling activities are usually conducted for National Pollutant Discharge Elimination System (NPDES) compliance, compliance assistance, civil and criminal investigations, and water quality studies. Collection of wastewater samples is necessary in order to obtain reliable data that can support compliance or enforcement activities.

The main considerations in developing a wastewater sampling strategy are:

- Type of study (Compliance Sampling Inspection, Diagnostic Evaluation, etc.).
- Regulated or target pollutants in the wastewater stream to be sampled.
- Selection of the projected sampling locations to satisfy the study objectives.
- Quality control criteria of the parameters to be sampled (oil and grease samples need to be collected as grab samples, trip blanks are taken into the field for the collection of samples for volatile organic compound analyses, etc.).

Depending on the sample analysis the following treatment procedure are planned. The sampling analysis gives readings about the characteristics of the waste-water. The characteristics of waste-water are further divided into different types, they are as follows:

4 Physical parameters

The physical characteristics of wastewater include those items that can be detected using the physical senses. They are temperature, color, odor, and solids.

Temperature

Temperature of wastewater varies greatly, depending upon the type of operations being conducted at your installation. Temperature of sewage the sewage is slightly more than that of water, because of the presence of industrial sewage. The temperature changes when sewage becomes septic because of chemical process. The lower temperature indicates the entrance of ground water into the sewage.

Color

Color of fresh sewage is yellowish grey to light brown. While that of the septic is black or dark due to oxidation of organic matter.

Odor

Smell of the fresh sewage is oily or soapy while the septic sewage develops an objectionable. H₂S is the major source of pollution.

Total suspended solids

All matter except the water contained in liquid materials is classed as solid matter. The usual definition of solids, however refers to; "the matter that remain as residual upon evaporation and drying at 103 ± 20C". Those solids that are not dissolved in wastewater are called suspended solids. When suspended solids float, they are called floatable solids or scum. Those suspended solids that settle are called settle-able solids, grit, or sludge.

All solids that burn or evaporate at 500°C to 600°C are called volatile solids. These solids serve as a food for bacteria and other living forms in a wastewater treatment plant. Most organic solids in municipal waste originate from living plants or animals.

IV. CONCLUSION

Today the world is under the effect of pollution which is causing a boon to the society. Problems such as global warming, extinction of animal species and plants, effect on the environment etc. are being caused which are because of such problems such as waste disposal into the sea, incineration etc.

Hence it is necessary to treat these wastes. We have taken an initiative to treat the Mithi River. The present project work emphasis on the construction and design of waste water treatment plant using advanced techniques such as electro-flocculation and coagulation. By designing a treatment plant on the Mithi River, the following things can be achieved:

- Waste-water can be treated
- Hydrology and Ecology of the nearby areas will be replenished
- Waste can be properly disposed of without disturbing the environment
- Treated water can be reused again for different purposes
- Decompose and manure & biogas is generated which can be used
- Will be a role model for other states and countries
- The treatment plant will clean the effect of foul odor and clean the surrounding creating a good area for the citizens to utilize
- It will generate job opportunities for the people
- The gardens near the plant will flourish the flora-fauna which will attract tourists as well as the Indian citizens.
- For the betterment of the country

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