Evaluation of well organized water supply system using convolutional neural networks

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Abstract- **well-organized water supply scheme is required for effective utilization of water. water is essential for drinking, cooking, bathing, washing, watering, firefighting, etc. a well-organized sewage system is also important for proper disposal of waste water. Water is an essential element of life and must be treated properly. This study gives an overview of performance of various design and functional characteristics of the used hybrid system its was observed for the first week analysis as mall increase in the pH value was observed with average value of 1.33%.An incremental decrease in total solid within the range of nearly 85 to 90%.A considerable decrease in range of 75 to 80 %was observed in the BOD value for sample.2 For 2nd week an decrease of 1% was observed in the pH value for sample increase in total solids with the range of 80 to 90% was observed .An average decrease is observed in the BOD of range 70 to80 % value.**

1. INTRODUCTION

Water is most important portion in our life without food we can survive for number of days but water is such an essential element that without it we cannot. In the ancient times human required water for drinking, bathing, cooking etc. but with the advancement of civilization the utility of water enormously increased and now such a stage has come that without well-organized public water supply scheme it is impossible to run the present civic life and developed the towns. Everywhere water is required for various purposes such as for drinking, cooking, bathing, washing, watering of lawns, growing of crops, firefighting, etc. A well-organized water supply scheme is required for effective utilization of water without wastage, losses by pipe fittings and other water supply arrangement. After effective use of water, we know about 80%ofwater is go into sewer and for proper disposal of that water a well-organized sewage system is also important so that it cannot pollute the environment as well as protect the human beings from water borne diseases.

2. Importance of Environmental Engineering

In every town or city wastes of different types such as spent water from bathroom, kitchens, lavatory basins, house and street washings, from various industrial processes semi liquid wastes of human and animal excreta, dry refuse of house and street sweepings, broken furniture, crockery, wastes from industries etc. are produced daily.

If proper arrangement for the collection, treatment and disposal of all the wastes produced from the towns or cities are not made, they will go on accumulating and create such a foul condition that the safety of the structures such as buildings ,roads will be in danger due to accumulation of spent water in their foundation. In addition, the disease bacteria will bread up in the stagnate water and the health of the public will be in danger. All the drinkable water will be polluted. Total insanitary conditions will be developed in the town and it will become impossible for the public to live in the towns or cities.

Therefore, in the interest of community to collect, treat and dispose of all the waste products that it may not cause any residing in the town.

3. Necessity of Sewage Treatment

Sewage treatment is the process of removing contaminants from wastewater, primarily from household sewage. Physical, chemical, and biological processes are used to remove contaminants and produce treated wastewater (or treated effluent) that is safer for the environment. Various treatments are carried out to treat wastewater such as primary treatment, secondary treatment and tertiary treatment. Secondary treatment also called as Biological treatment is designed to substantially degrade the biological content of the sewage which is derived from human waste, food waste, soaps and detergent. The majority of municipal plants treat the settled sewage liquor us in 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 floc. Secondary treatment systems are classified as attached growth system, suspended-growth systems and constructed wetland.

A. Attached growth systems include trickling filters, bio-towers and rotating biological contactors (RBC), where the biomass grows on media and the sewage passes over its surface. The fixed-film principle has further developed into

Moving Bed Bio film Reactors(MBBR)and Integrated Fixed-Film Activated Sludge(IFAS)processes. An MBBR system typically requires a smaller footprint than suspended-growth systems.

B. 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.

C. Constructed wetlands are engineered systems that use natural functions vegetation, soil, and organisms to treat wastewater. Depending on the type of wastewater the design of the constructed wetland adjusted accordingly. Constructed wetlands have both centralized and on-site wastewater. Primary large number of suspended solids or soluble organic matter.

D.

a. Theme

Domestic wastewater sample was collected from near local area. The test will be conducted on that wastewater for study of performance of biological processes for that purpose a lab-scale model was developed.

The model consists of a large rectangular tank having 180 liters capacity. The size of tank is 1.21m*0.5*0.3m the tank is made of GI sheets provided with p various filter medias are being used so that they all together acts as a filtration unit. This system was provided with proper inlet and outlet arrangement for feeding influent and outgoing influent.

The performance of this tank was analyzed based on various parameters such as BOD, PH, Odour, Turbidity and TS. To study efficiency of proposed unit the study was carried out with various combinations.

b. Objectives

Considering the requirement of domestic treatment system to be economical and simple in operation. The present is undertaken with following objectives is as follows:

1. To study effect of hybrid system or operation of contaminant removal.
2. To study the effect of different media one fluent quality.
3. To treat the domestic waste water in the utilization of hybrid treatment of attached to suspended.
4. To study the selected parameters .E.g.: BOD, PH, Odour , Turbidity and TS for untreated and treated effluent.
5. Comparing the results of the effluent to study the performance of treated units with different combinations.

4. LITERATURE REVIEW

a. General

In this chapter various papers related to attached growth and suspended growth system and various media were referred various website, journals or various text books. The purpose of this literature review chapter was to get an overview of available different techniques related to treatment of waste water. The review of literature importance the alternative to be adopted for various effective treatment of wastewater by hybrid system.

b. Literature Review

G.R.Shivakumaraswamyet.al. (2013) states that the most important aspects in the design of an anaerobic fixed bed reactor is selecting an adequate support material. An ideal packing material for the attached-growth process should not only be inexpensive, light weight, durable, and easy to ship and install, it should also have a large specific surface area for bacterial growth and high porosity to prevent clogging by the increased biomass. It has also been reported that the organic matter removal efficiency in fixed-bed reactors is directly related to the characteristics of the support materials used for the immobilization of anaerobes. The use of fibrous material is effective in increasing the surface area of the support media in fixed film reactors. Several fibrous biomass support mediums such as coir (coconut husk fiber or areca husk fiber) sisal fiber are available for use in attached growth system.

Valerii ORLOV, Serhii MARTYNOV, Serhii KUNYTSKIY stated in a case study on, Energy saving in water treatment technologies with polystyrene foam filters. In the article we considered the problem of treating groundwater and surface water for drinking purposes. The efficiency of whole system work depends on filtration installations in the technological schemes of drinking water preparation. A floating granular filling with expanded polystyrene was first proposed at the Department of Water Supply and Drilling (National University of Water Management and Natural Resources).In article we showed the structure of polystyrene filters and principle of their work. The authors suggested technological schemes clarifying and discoloration of the surface water in single-stage and two-stage reagent schemes and contact groundwater iron removal with polystyrene foam filters. Described principles of work, parameters and conditions of use the technological schemes. We proposed scheme with hydraulic automatic device with switching modes.

Javid,A.H.,etal,(2013)investigated feasibility of upgrading and retrofitting municipal wastewater treatment

plants at laboratory scale using Moving Bed Biofilm Reactor (MBBR) process. For this purpose, an aerobic pilot was operated for nearly one year in different conditions, in which a moving bed carrier with a specific bio film surface area of 500 m2 / m3 and a filling rate of 60% was utilized. System efficiency in removal of BOD 5 and COD was examine date differently hydraulic retention times (HRTs) of 1, 1.5, 2, 2.5, 3 and 4 h. The obtained results indicated high ability of the system to tolerate Organic loading and to remain stable at a high food to microorganism (F/M) ratio .The system produced effluents with good quality at low HRTs and led to an average BOD5 removal efficiency of nearly 88% during the operational period. The Organic Loading Rate (OLR) applied to the system had a range of 0.73-3.48 kgBOD5/m3.day and 2.43-
11.6g BOD5/m2.day,at which the reactor showed a good performance and stability

Atif Mustafa,(2013)conducted treatment performance of a pilot-scale constructed wetland (CW) commissioned in in Karachi, NED University of Engineering & Technology, was evaluated for removal efficiency of biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), ammonia-nitrogen(NH4- N), ortho- phosphate (PO4-P), total coliforms (TC) and faecal coliforms (FC) from pretreated domestic wastewater. Monitoring of wetland influent and effluent was carried out for a period o f8 months. NED waste water treatment plant (WWTP) treats waste water from campus and staff colony. The wastewater contains domestic sewage and low flows from laboratories of various university departments. The constructed wetland is planted with common wetland plant (Phragmites karka).The key features of this CW are horizontal surface flow. Treatment effectiveness was evaluated which indicated good mean removal efficiencies; BOD(50%), COD(44%), TSS(78%), NH4-N(49%), PO4-P(52%), TC
(93%) and FC(98%).

Sharjeel Waqas study on presents an oval membrane rotating biological contactor (MRBC) that combines a conventional rotating biological contactor (RBC) with membrane filtration. MRBC combines conventional RBC with the membrane filtration placed in between two adjacent rotating disks to offer inherent control over membrane fouling. The disks rotations provide some degree of foulant removal, maintain membrane permeability, and potentially save a substantial amount of energy. The biological and hydraulic performance of MRBC was compared with a series of RBC and external membrane filtration (RBC+ME) where the membrane is treated as a post-treatment unit. Results show that the MRBC enhances not only the biological performance but also offers advantages for inherent membrane fouling control through the rotation of the disk. Membrane fouling control primarily originates from the enhanced shear rate from higher disk rotation and minimum membrane-to-disk gap. The hydraulic performance is 92.4%higher than literature, which further enhanced at smaller membrane-to-disk gaps and higher disk rotations. The highest steady-state permeability of 297 L/(m2.h.bar) and 288 L/(m2.h.bar) results at 40 rpm disk rotational speed and 0.5 cm membrane-to-disk gap, respectively. A projected full-scale MRBC consumes 0.18 kWh/m3 permeate, one-fourth of the energy for the referenced MBR system thanks to the active role of disks rotation for membrane fouling control which eliminates the need of extensive aeration like in the traditional MBRs. MRBC offers a promising alternative for traditional wastewater treatment as a low energy foot-print process, which is in line with the requirements of sustainable development and promotes the development of cleaner production.

Onyeka I. Nkwonta and George M. Ochieng studied that Waste water treatment using local available materials such as grave land charcoal was investigated. The removal of TDS from roughing filters was evaluated for roughing filtration treatment system. Achieved results showed that roughing filters could be considered as a major pre- treatment process for wastewater, since they efficiently separate fine solids particles over prolonged periods without addition of chemicals. A pilot plant was designed at delcoal. The waste water used was from delcoal. The design and sizing of the pilot plant was guided by wegelin design criteria. Gravel was used as a control medium since it is one of the most commonly use droughing filter media and because it was used in developing these criteria. In order to improve the performance of roughing filters, this process has been modified by applying local available material such as charcoal as an alternative filter media. The pilot plant was monitored for a continuous 90 days from commissioning. The overall function of the filter in removing parameters such as TDS is accepted using charcoal as an alternative filter media. Achieved results in this study showed that roughing filters might be considered as an efficient pre-treatment process for mine water. It was also observed that in general performance, charcoal performed better than gravel. This observation could have resulted from the reason that charcoal has a slightly higher specific surface area and porosity respectively to enhance sedimentation and other filtration processes like adsorption, compared to gravel.

Kim, Jung, and Han (2019) study showed that water purification can be achieved by using ABFT system (autotrophic biofloc technology). The power of ABFT system at the remaining stages (seedling to adult farming) was demonstrated for industrial-level implementation. An excellent water purification effect and about 97% reduction of water conservation were presented two by microalgae. The wastewater from the ABFT system can be reused by use for the growth of different plants.

In **Feyzbakhsh, Telvari, and Lork** (2017) study, it is presented the delay in some project in Tehran City regarding to the three factors which are quality, cost and time. As some circumstances happed in the last decades such as climate change, enhancement of population, decrease of raining, as well as increasing in water harvesting from ground water, thus the importance of water is intensified as the project of water and waste water treatment. Based on this study, it is verified that some factors contributed in the delay of waste water treatment projects such as uncertainty and buying project site and failure in paying to contractor and employers.

c. Other Related Research

i. Normal Waste Water Treatment Unit.

There are many different kinds of sewage treatment plants which vary in the process by which they treat wastewater. Generally, they can be classified into the following types of system.

1. Activated sludge plant (ASP);
2. Rotating Biological Contactor (RBC);
3. Constructed Wetland (CW);
4. Suspended Growth System (SGS);
5. Polypropylene Material (PP);
6. Moving Bed Biofilm Reactor(MBBR); and
7. Role of Biofilm.

All of these wastewater treatment plants operate in different ways and produce effluent of varying quality. Moreover, they all cope with different kinds of usage to differing degrees os success; some can tolerate being under loaded where some do not function as effectively. Some most here others are not able effectively process high levels of sewage.

A. Activated sludge plant (ASP)

The Activated Sludge Process (ASP) is a sewage treatment process in which air or oxygen is blown into raw, unsettled sewage to smash the solids and develop a biological 'soup' which digests the organic content and pollutants in the sewage. These plants do not have a primary settlement chamber which is the chamber that needs emptying by tanker on a regular basis with most three stage sewage treatment plants.

The term "activated" comes from the fact that the particles are actively teeming with beneficial, sewage digesting bacteria, and protozoa. Activated sludge is different from the smelly anaerobic sludge that you have to remove from the primary settlement chambers of other types of sewage treatment plants and septic tanks in that this sludge contains many living organisms which can feed on the incoming wastewater. It is also odourless.

B. Rotating Biological Contactor (RBC)

A rotating biological contactor (RBC) is an attached growth bio reactor that offers an alternative technology to the conventional activated sludge process**.** RBC systems due to their advantages constitute a very unique and superior alternative for biodegradable matter and nitrogen removal. Over the years RBCs have been successfully used to provide secondary treatment to municipal waste- water from small units serving residential dwellings to large ones treating flows of up to several million liters per day. They have also been used to nitrify municipal wastewater, either in combined carbon oxidation and nitrification applications or in separate stage nitrification applications, denitrification and phosphorus removal.

In addition, decolourization of wastes like textile dyes and coloured sugar refinery effluents; bioremediation of land fill leachates or organ pollutants such as of chlorophenols and trichloroethylene; treatment of effluents from wineries, bakeries, food processors, pulpand paper mills, leather tanner-ies and other biodegradable industrial discharges can be performed by the RBC system.

C. Constructed Wetland (CW)

A “constructed wetland” is defined as a wetland specifically constructed for the purpose of pollution control and waste management, at a location other than existing natural wetlands. Wetlands can be used for primary, secondary, and tertiary treatments of domestic wastewater, storm wastewater, combined sewer overflows (CSF), overland runoff, and industrial wastewater such as landfill leachate and petrochemical industries wastewater. The most common systems are designed with horizontal subsurface flow (HF CWs) but vertical flow (VFCWs) systems are getting more popular at present. The most commonly used species are robust species of emergent plants, such as the common reed, cattail and bulrush.

Constructed wetlands are based upon the symbiotic relationship between the microorganisms and pollutants in the wastewater. These systems have potential to treat variety of wastewater by removing organics, suspended solids, pathogens, nutrients and heavy Metals. Systems have been designed with bed slopes of as much 8 percent to achieve the hydraulic gradient. Newer systems have used a flat bottom or slight slope and have employed an adjustable outlet to achieve the hydraulic gradient.

D. Suspended Growth System (SGS)

In Suspended growth system coconut rope can be used. The materials used as the substrate for fouling organisms in the process of biological wastewater treatment. Microcosm experiments on a coconut-fibre biofilm treatment system were carried out to evaluate wastewater treatment efficiencies in the laboratory using two waste waters, synthetic sewage and leachate, with different pollutant loads. Three coconut-fibre conditions were set as a single bundle (low fibre density: LFD), two bundles (high fibre density: HFD), and no coconut fibre (blank). The wastewater was first circulated in the system for six weeks (circulation stage) and then discharged from the treatment tank for 7–24 weeks (treatment stage).

Coconut fibre has a very high lignin content so it is very tough. Despite this toughness, it is also elastic. The fibre hardly deteriorates at all over time. fibre was used as microorganism adhesion and biofilm formation because of its rich in hard organic matter with high specific surface area and wetting ability. This material used as the substrate for fouling organisms in the process of biological wastewater treatment.

E. Polypropylene Material (PP)

Polypropylene is a tough, rigid and crystalline thermo plastic produced from propene (or propylene) monomer. It is a linear hydrocarbon resin. In this we have used plastic bottle. Bacteria can be generated on the plastic surface It is sensitive to microbial attacks, such as bacteria.

F. Moving Bed Biofilm Reactor (MBBR)

Moving bed biofilm reactor (MBBR) is a biological technology used for wastewater treatment process suitable for municipal and industrial application. Another common name is moving bed film reactor. MBBR waste water treatment system enables efficient results of the disposal using low energy. The technology is used to separate organic substances, nitrification and denitrification. MBBR design is made of an activated sludge aeration system. The sludge is collected on the plastic carriers which have a large internal surface area. The surface area in the carriers optimizes the contact of water, air, and the bacteria. Moving bed biofilm reactor (MBBR) incorporates benefits provided by both attached and suspended growth systems. It is an advanced high-rate wastewater treatment technology with high treatment efficiency; low capital, operational, maintenance and replacement cost; single reliable and robust operation procedure.

There are several key benefits of an MBBR wastewater treatment system. These advantages make a biofilm reactor process the best choice for some facilities over traditional processes such as membrane bioreactor or activated sludge. Considering the pros and cons of MBBR waste water treatment can help companies determine whether this option is the best fit for their facility.

G. Role of Biofilm

Biological waste water treatment technologies have been gaining much at tension in recent years. They offer low operational costs, provide easy handling and have comparatively less harmful effects on the corresponding environment. On the basis of structural configuration of biomass, biological wastewater treatment processes can be divided into two basic configurations: dispersed growth system and attached growth system.

1) Dispersed growth system

In dispersed /suspended growth systems, biomass grows in suspended or dispersed form in liquid medium without any attachment to the surface Microorganisms in biomass absorb organic matter and nutrients in their vicinity, which allows them to grow and reproduce to form microcolonies. These microcolonies settle as sludge, which is the neither removed or treated in a sludge treatment process or reused in the process 122 Microbial Biofilms.

2) Attached growth system

In attached growth systems the biomass grows attached to a support medium to create a biofilm. Attachment to the support medium is influenced by composition of the media used, cell-cell interactions and the presence of polymer molecules on the surface [7]. The support medium can be immersed in the liquid medium or receive continuous or intermittent discharges. The support medium can be of any nature, such as solid natural (rocks, stones, gravels, sand and soil), artificial (rubber, plastic) or agglomerates of the biomass itself (granules).

5. SYSTEM DEVELOPMENT

General

Waste water treatment is a process that coverts waste water from its unusable state into an effluent that can be either returned to the water cycle with minimal environmental issues or reused for another purpose. It's a treatment that, given its important, more and more governments are finally realizing that they need to take action able steps to improve their wastewater treatment processes.

Water scarcity is the major problem that is faced all across the world. Although 2/3rd of the earth's crust is made up of water but all this water is not available for drinking and for other human activities as either it is locked in the form of ice or present in the form of vast saline oceans and seas. It has been found out that 97% of the total water is salty that is of no use to human and animals (except marine animal) and the remaining three percent is available as freshwater. More than half of this three percent is locked in glacier and less than 0.01% is available as fresh water. So, water resources are less as compare to human demand for water.

Above this, the major part of water that can be consumed is getting polluted because of human activities. This polluted and untreated water is causing abundant water borne diseases. Then the world is facing a huge climatic change which is further aggravating the water problem. Some of the regions are getting more rain water than earlier and some are getting almost negligible. Expert seven believe that the next World War would not be for oil or land but it will be for water.

Also because of improper use of water and lack of water treatment, the problem of water crisis will further increase where 884 million people are already not getting easy access to safe drinking water. And a further 2.5 billion people are getting difficult access to water for disposable and sanitation. Agriculture is also overusing and polluting the ground water thus depleting the natural source of water. So here water treatment plants will play important role.

6. Sources

Sources of waste water include the following domestic or house hold activities:

a. Human excreta (feces and urine) often mixed with used toilet paper or wipes; this is known as black water if it is collected with flush toilets.

b. Washing water (personal, clothes, floors, dishes, cars, etc.) also known as grey water or sullage.

7. Remedies

A. Bio diesel from fats, oil and grease in waste water: Fats, oil and greases are collected from waste water and converted to biodiesel through esterification and hydrogenation.

B. Electricity and heat from co-generation: Biogas fuelled co-generation systems allow wastewater facilities to utilize energy from treatment process itself. Co-generation produces electricity and hot water from biogas, a naturally occurring by-product of sludge dewatering. The electricity produced can be used to supply power to anaerobic digesters in the plant thereby offsetting electricity purchases.

C. Water source heat pumps: Water-source heat pumps are being used to extract residual heat energy from wastewater, after treatment and before discharge by outfall. Similar heat extraction technology is now developing for extracting heat from wastewater in sewer pipelines.

a. Characteristics of Waste water

The characteristics of waste water are given as follows:

i. Odour

It depends on the substances which arouse human receptor cells on coming in contact with them. Pure water doesn't produce odour or taste sensations. Thus, waste water which contains toxic substances has pungent smell which makes it easy to distinguish. Odour is recognized as a quality factor affecting acceptability of drinking water. The organic and inorganic substance contributes to taste or odour. The ultimate odour tasting device is the human nose. The odour intensity is done by threshold test.

ii. Colour

Colour in water results from the presence of natural metallic ions such as Fe or Mg, humus and peat materials, planktons and weeds. It is removed to make water suitable for general and industrial applications. After turbidity is removed the apparent colour and that due to suspended matter is found out.Tristimulus, Spectroscopic and Platinum cobalt method is used.

iii. Total solids

It refers to matters suspended or dissolved in water and waste water. Solids affect the water or effluent quality adversely in a number of ways. Water with highly dissolved solids is not palatable and may cause physiological reaction in transient consumer. A limit of 500 mg dissolved solids/ L is desirable for drinking waters. Evaporation method
Is used to separate total solid sand their weight is found out.

iv. Turbidity

Clarity of water is important in producing products destined for human consumption and in many manufacturing uses. It is caused by 6suspended matters such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds. Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through the sample. The standard method for determination of turbidity has been based on the Jackson candle turbid meter and Nephlometer.

v. **pH**

The term pH refers to the measurement of hydrogen ion activity in the solution. Determination of pH plays an important role in the wastewater treatment process. This test is used for determination of wastewater either acidic or alkaline. The pH of wastewater can be measured by pH meter.

vi. **Biochemical Oxygen Demand (BOD)**

The Biochemical Oxygen Demand (BOD), also called Biological Oxygen Demand) is the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period. The BOD value is most commonly expressed in milligrams of oxygen consumed per liters of sample during 5 days of incubation at 20°C and is often used as a surrogate of the degree of organic pollution of water.

vii. **Total Suspended Solids**

TSS of a water or wastewater sample is determined by pouring a carefully measured volume of water (typically one liters; but less if the particulate density is high, or as much as two or three liters for very clean water) through a pre-weighed filter of a specified pore size, then weighing the filter again after the drying process that removes all water on the filter. Filters for TSS measurements are typically composed of glass fibers. The gain in weight is a dry weight measure of the particulates present in the water sample expressed in units derived or calculated from the volume of water filtered (typically milligrams per liters or mg/L).

b. **Laboratory test**

i. **Test for pH**

Apparatus: pH meter, 500 ml Beaker.

Chemicals used: Buffer solution of known pH value (i.e. pH=7.0) Procedure:

1. Take 100 ml distilled water and add 10ml of buffer solution of known pH value switch on the pH. Meter.
2. Adjust the unit and the meter as per need.
3. Put the electrode of meter in the buffer solution and check the ph. value.
4. Rinse off the electrode and put it in sewage waste water sample of 400 ml and note the ph. value.
5. Rinse off the electrode and switch off the ph meter

Test for pH Using pH Meter

8. **Test for total solids** Apparatus: crucible, measuring jar, oven, desiccators, Procedure:

1. Clean the crucible and take its empty weighW1;
2. Take 50 ml of sample using measuring jar and put it in the crucible
3. Put the crucible in an oven at103c for about 1 hour
4. Take out the sample and put it in the desiccators to cool it up to the room temperature.
5. After cooling put the sample again in the crucible and note down the weight W2

Calculation

Total solid=(W2-W1)*1000/sample volume in ml W1- empty weight of crucible=92.140*1000 mg W2- oven dried sample+ crucible.

8.1 Test for BOD

aratus:Incubation Bottles of 250 to 300 ml capacity with ground glass stopper, Air Incubator thermostatically controlled at 20±1ºC

Chemical used: Magnesium Sulphate, Alkali ioditeazide, Sulphuric acid, Starch indicator, Sodium trio sulphate

Procedure:

Sample preparation

10 ml waste water + 290 ml clean water

=300 ml Dilution Factor D.F.=300/10=30

A) Dissolve oxygen (D.O.)

1) Take 15 ml of prepared sample. Add 2 ml of Magnesium Sulphate.
2) Add 3 ml Alkali iodite azide and observed the colour of precipitate.
3) If precipitate is of white color, no d.o. is present, if brown color is observed, D.O. is present.
4) Add 2 to3mlof sulphuric acid (H_2SO_4) in the brown precipitate.

5) Add 2 to 3ml starch indicator. The precipitate will now turn blue in colour.

B) Now titrant this blue precipitated Sodium trio sulphate until it turns colorless. Note the amount of titrant used in ml. B.O.D.

1) Take 300 ml of prepared sample. Note down the initial D.O. of the sample.
2) Put this sample in incubation bottle and put the bottle in air incubator.
3) Adjust the temperature of incubator at 20ºC. The sample is placed for 5 days.
4) Take out the sample after 5 days and find out the final D.O. of the sample.

Calculation

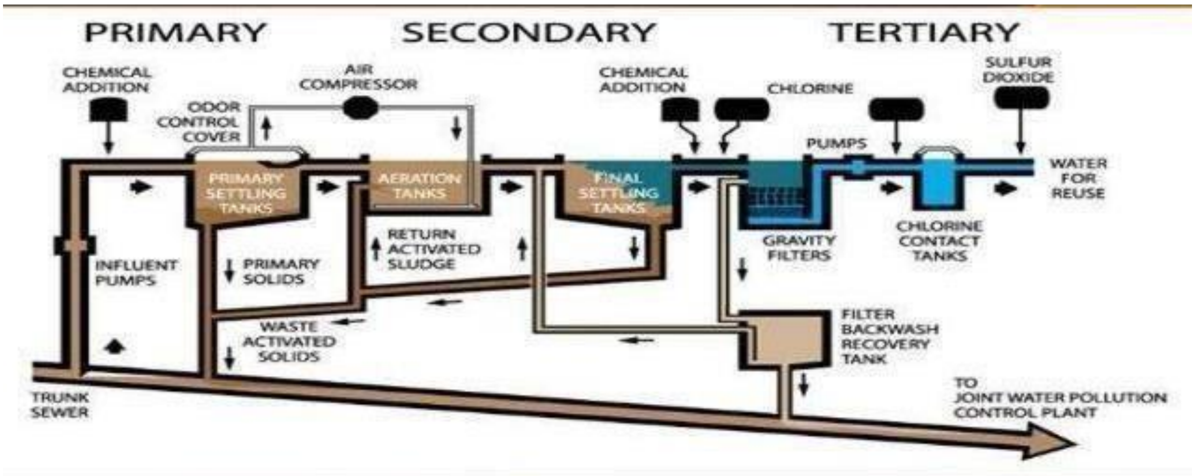
BOD Incubator

1) Dissolve oxygen(D.O)= $\frac{\text{Titrant used x normality x Equivalent wt. of } O_2 \text{ x1000}}{\text{Volume of sample in ml}}$
2) B.O.D.=(Initial D.O-Final D.O) XD.F

a. Waste Water Technology

Relatively simple waste water treatment technologies can be designed to provide low cost sanitation and environmental protection while providing additional benefits from the reuse of water. These technologies use natural aquatic and terrestrial systems. They are in use in a number of locations throughout Latin America and the Caribbean.
These systems may be classified into three principal types, as shown in Figure
28. Mechanical treatment systems, which use natural processes within a constructed environment, tend to be used when suitable lands are unavailable for the implementation of natural system technologies. Aquatic systems are represented by lagoons; facultative,
Aerated, and hydrograph-controlled release (HCR) lagoons are variations of this technology. Further, the lagoon-based treatment systems can be supplemented by additional pre- or post-treatments using constructed wetlands, aqua cultural production systems, and/or sand filtration. Terrestrial systems make use of the nutrients contained in waste waters; plant growth and soil adsorption convert biologically available nutrients into less-available forms of biomass, which is then harvested for a variety of uses,
Including methane gas production, alcohol production, or cattle feed supplements.

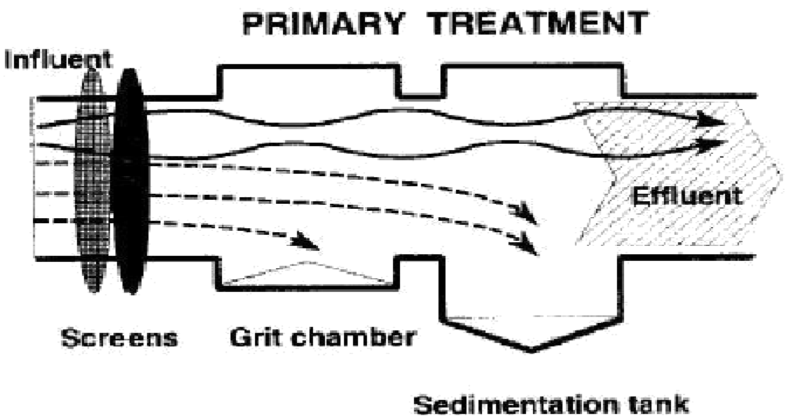
A. Primary Treatment
B. Secondary Treatment
C. Tertiary Treatment



,Secondaryand Tertiary Treatment Process

i. Primary Treatment

In this, sedimentation of solid wastes is done by passing the waste water through the tanks. The sludge is then fed to a sludge digester in which further processing is carried out. Alternatively biological treatment is used. The efficiency is higher in terms of unit removal of pollution for the sedimentation process. The primary sludge formed contains almost fifty percent of the suspended solids.



:Primary Treatment

a) **Screening**

Screening is the first unit operation used at waste water treatment plants

(WWTPs). Screening removes objects such as rags, paper, plastics, and metals to prevent damage and clogging of downstream equipment, piping, and appurtenances. Some modern wastewater treatment plants use both coarse screens and fine screens.

I. Coarse Screens: Coarse screens remove large solids, rags, and debris from waste water, and typically have openings of 6 mm (0.25 in) or larger. Types of coarse screens include mechanically and manually cleaned bar screens, including trash racks

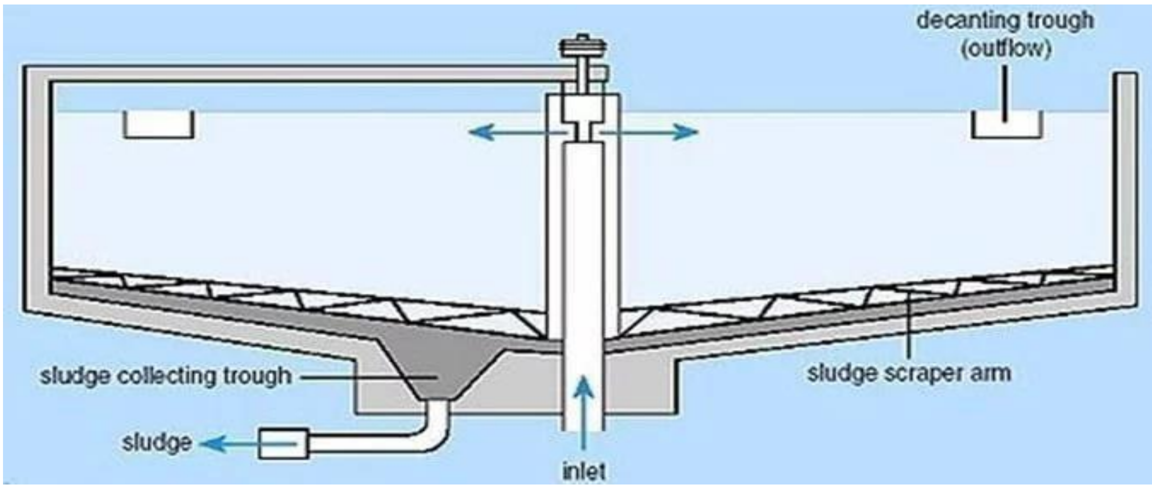
II. Fine Screens: Fine screens are typically used to remove material that may create operation and maintenance problems in downstream processes, particularly in systems that lack primary treatment. Typical opening sizes for fine screens are 1.5 to 6 mm (0.06 to 0.25 in).Very fine screens with openings of 0.2 to 1.5 mm (0.01 to 0.06 in) placed after coarse or fine screens can reduce suspended solids to levels near those achieved by primary clarification

b) **Grit Removal**

Grit includes sand, gravel, cinder, or other heavy solid materials that are “heavier” (higher specific gravity) than the organic biodegradable solids in the wastewater. Grit also includes eggshells, bone chips, seeds, coffee grounds, and large organic particles, such as food waste. Removal of grit prevents unnecessary abrasion and wear of mechanical equipment, grit deposition in pipelines and channels, and accumulation of grit in anaerobic digesters and aeration basins. Grit removal facilities typically precede primary clarification, and follow screening and combination. This prevents large solids from interfering with grit handling equipment. In secondary treatment plants without primary clarification, grit removal should precede aeration

c) **Primary Settling Tank (PST)**

The Primary Settlement or sedimentation tanks are designed to reduce the velocity of the wastewater flow, allowing heavier organic solids (called raw sludge) to settle. They are the first stage of treatment after the removal of rags and grit in the inlet works. Scrapers present in the tank move continuously along the floor of the tank to deposit the raw sludge in hoppers for removal. The scum which floats to the surface is directed by water jets or scum boards to the sludge sump. The raw, settled sludge is removed by pump or gravity feed to a sludge treatment process, either on site or via tanker to a larger processing centre. Approximately 60%of suspended solids and 35% of BOD removal efficiency can be achieved at this stage.



: Primary settling Tank

ii. Secondary Treatment

It involves removal of dissolved and colloidal compounds by the process of oxidation. It is usually done through microorganisms for removal of organic compounds. There are three methods employed depending on the nature of effluent obtained after primary treatment.

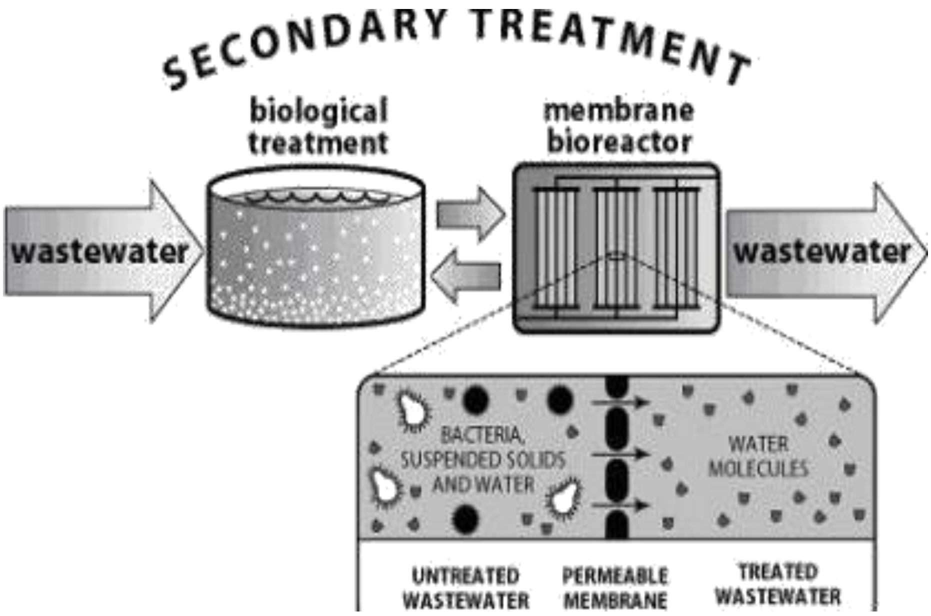


Fig.No3.6: SecondaryTreatment

a) Attached Growth System :

Waste water treatment processes in which the microorganisms and bacteria treating the wastes are attached to the media in the reactor. The wastes being treated flow over the media. Trickling filters and rotating biological contactors are attached growth reactors. These reactors can be used for BOD removal, nitrification, and de-nitrification.

b) Suspended Growth System:

Wastewater treatment processes in which the microorganisms and bacteria treating the wastes are suspended in the wastewater being treated. The wastes flow around and through the suspended growths. The various modes of the activated sludge process make use of suspended growth reactors. These reactors can be used for BOD (biochemical oxygen demand) removal, nitrification, and gentrification.

c) Aeration/Activated Sludge Process:

These systems treat the waste water by mixing it with a flocculent suspension of microorganisms and aeration of the mixture for long hours some time seven up to 30 hours depending on the nature of primary effluent. The suspended solids and colloidal matter gets adsorbed on the microbial aggregates. The microbes metabolize these flocs and dissolved nutrients into smaller compounds in a process known as stabilization. There are three types of activated sludge processes such as conventional, stepped aerations and contact sterilization systems. The activated sludge is essentially an aquatic system in which the higher links of food webs are absent. The microbial mass has to be maintained by periodic withdrawal of excess sludge from the system. Filter beds are more efficient in oxidizing nitrogen than activated sludge plants. The microbial community in the sludge is established at two stages one with the untreated waste and another with the purified effluent. Filter beds harbor a succession of communities at different depths. Activated sludge has higher species diversity. They contain more gram negative bacteria and about 200 species of protozoans. The basic process has undergone more revisions and technological improvisations and now it is the most widely used biological waste water treatment process to treat organic and industrial effluents.

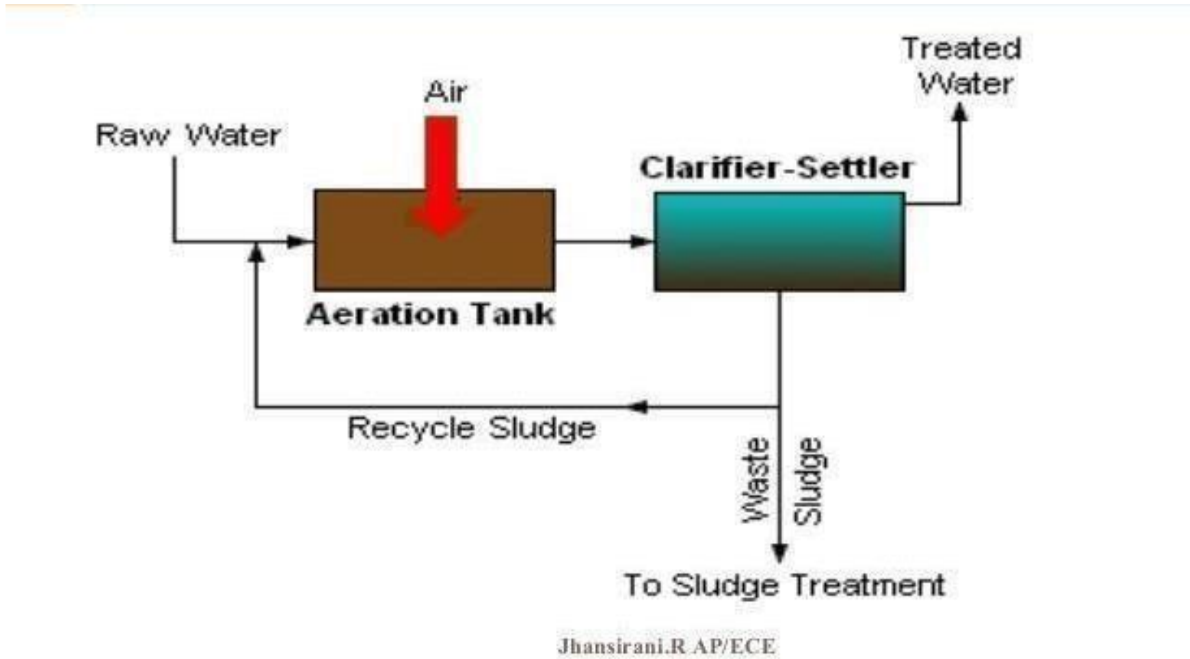


Fig.No3.7: Activated sludge process

4. Oxidation Ponds:

These are used in warmer climates and makes use of natural water bodies such as lagoons. The waste water is allowed to pass through the lagoon and retained for about 2 to 3weeks. The organic contaminants undergo bacterial decomposition and carbon dioxide, ammonia and nitrate are released for use by the algal community. Organic sludge settles at the bottom of the pond and methane is finally released. These ponds are prone to harbour pathogens and insects.

Fig.No.3.8: OxidationPond

iii. Tertiary Treatment:

This is applied to the secondary effluent for maintaining the water quality. The processes essentially remove phosphates and nitrates from the system. Rapid sand filters,

Micro straining and fluidized bed systems are commonly used in tertiary treatment. Activated carbon and sand are typically used. Beds of aquatic macrophytes and reed bed systems are also used in tertiary treatment. The biomass should be harvested frequently to maintain the productivity of the system for efficient functioning.

1. Constructed Wetland

Constructed wetlands (CWs) are, engineered systems, designed and constructed to utilize the natural functions of wetland vegetation, soils and their microbial populations to treat contaminants in surface water, groundwater or waste streams". Constructed and planted filter beds provide the space for biological treatment of effluent. The main performance is the bio-chemical treatment in the bio film of the filter bed. Filter beds usually contain one of two different types of filtering material, usually sand or gravel.

Constructed wetlands were first used in Germany over 40 years ago for the treatment of domestic wastewater treatment mostly in rural areas. In addition, constructed wetlands have now been adapted to also treat waste waters from agriculture, industry and landfills.

Constructed wetlands can be used for the following waste water streams:

1) Domestic waste water
2) Grey water
3) Urban waste water from combined or separated sewerage
4) Industrial waste water treatment such as effluent from paper mills etc. Sludge dewatering and mineralization of fecal sludge or sewage sludge

2. Filtration:

Sand filtration removes much of the residual suspended matter. Filtration over activate carbon, also called adsorption, removes residual toxins.

3. Nitrogen Removal:

Waste water containing nutrients includes sewage, agriculture runoff and many of the industrial effluents. The nutrients of most concerned are N and P. The principal nitrogen compounds in domestic sewage are proteins, amines, amino acids, and urea. Ammonia nitrogen in sewage results from the bacterial decomposition of these organic constituents. The nitrogen compounds results from the biological decomposition of proteins and from urea (NH_3) or to the ammonium ion (NH_4^+) by one of several different metabolic path ways. These two exists in equilibrium as $NH_4^+ NH_3 + H^+$

Ammonia nitrogen is the most reduced nitrogen compound found in wastewater, which can be biologically oxidized to nitrate if molecular oxygen is present (under aerobic condition). In wastewater, the predominant forms of nitrogen are organic nitrogen and ammonia. The nitrification may takes place in biological treatment units provided the treatment periods are long enough. Generally, for the HRT used in secondary treatment conversion of organic nitrogen discharged in body waste. This nitrogen is in complex organic molecules and is referred simply as organic nitrogen. Organic nitrogen may be biologically converted to free ammonia to ammonia is significant and nitrification may not be significant. Because of oxygen demand exerted by ammonia (about 4.6mg of O_2 per mg of NH^+-N oxidized) and due to other environmental factors, removal of ammonia may be required. The most common processes for removal of ammonia from waste water are i) Air stripping, ii) Biological nitrification and denitrification.

4. 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.

5. 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.

Waste water may contain high levels of the nutrients nitrogen and phosphorus.

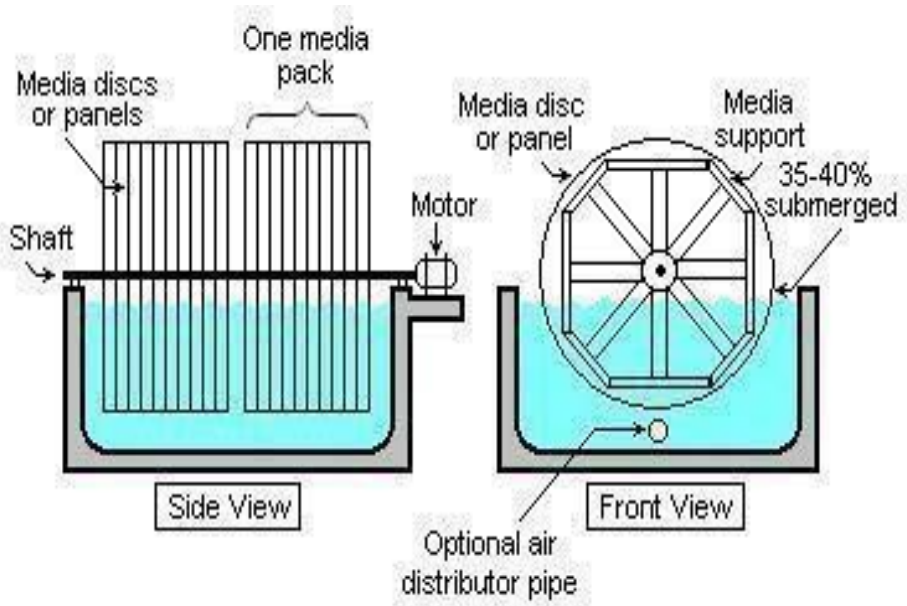
Excessive release to the environment can lead to a buildup of nutrients, called eutrophication ,which can in turn encourage the over growth of weeds, algae, and cyanobacteria (blue-green algae). This may cause an algal bloom, a rapid growth in the population of algae. The algae numbers are unsustainable 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.

b. Attached Growth System:

Attached Growth is a biological treatment process in which microorganisms responsible for conversion of organic matter or other constituents in wastewater are attached to some inert material such as: rocks, sand or specially ceramic or plastic materials. This process is also called fixed film process.

i. Rotating Biological Contractor

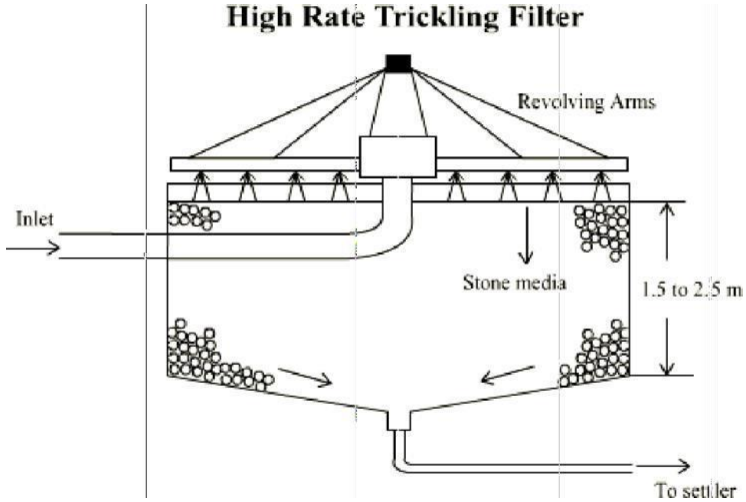
The rotating biological contactor (RBC) developed in Germany in the 1960s. RBCs are an attached growth, aerobic, biological wastewater treatment system. A growing market has been reported for both domestic and industrial effluents ranging from small units serving residential dwellings to large ones treating large flows of up to several million liters. The principal reasons are easy construction, simplicity of operation and maintenance, stability under shock loads, and low energy consumption. Modifications made to augment performance characteristics of RBCs have made these units more popular in the past two decades. Physically, they consist of a plurality of parallel, deformed discs mounted perpendicularly on as haft that is slowly rotated in a tank through which the waste water to be treated is passed. The shaft is mounted just above the water level in the tank, submerging approximately 40% of the media. The shafts are rotated through the water using one of two methods of propulsion. The first, most common, is the use of an electrical motor, operating through a drive system. The rotating biological contactor is a fixed biomass system comprising rotating discs. The constant rotation of the disc causes mixing of the liquid. During the treatment process, microbes that remove the organic material in the wastewater (by using the organic material as a food source) attach themselves to the discsurfaces. Biofilm gradually forms on the discsurface, whose thickness is controlled by the shearing force of the discs being rotated through the water. Also, the rotating discsurface alternately comes into contact between air and waste water and thus acts as an aeration device for waste water treatment. The surplus microorganisms that are sheared off the discs are carried with the waste water to clarifiers wheretheyare separated from the treated wastewater



:Rotating Biological contractor

ii. Trickling Filters

Trickling filter is an attached growth process i.e. process in which microorganisms responsible for treatment are attached to an inert packing material. Packing material used in attached growth processes include rock, gravel, slag, sand, redwood, and a wide range of plastic and other synthetic materials.



:Trickling Filter

9. Process Description:

A. The waste water in trickling filter is distributed over the top area of a vessel containing non-submerged packing material.
B. Air circulation in the void space, by either natural draft or blowers, provides oxygen for the microorganisms growing as an attached biofilm.
C. During operation, the organic material present in the waste water is metabolized by the biomass attached to the medium. The biological slime grows in thickness as the organic matter abstracted from the flowing waste water is synthesized into new cellular material.
D. The thickness of the aerobic layer is limited by the depth of penetration of oxygen into the microbial layer.
E. The micro-organisms near the medium face enter the endogenous phase as the substrate is metabolized before it can reach the micro-organisms near the medium face as a result of increased thickness of the slime layer and lose their ability to cling to the media surface.
F. The liquid then washes the slime off the medium and a new slime layer starts to grow. This phenomenon of losing the slime layer is called sloughing.

a. Suspended Growth System

Suspended growth treatment systems freely suspend microorganisms in water. They use biological treatment processes in which microorganisms are maintained in suspension within the liquid. In suspended growth treatment systems, microorganisms convert the organic matter or other constituents in the wastewater into gases and cell tissue. The most common type of aerobic system is the suspended growth treatment system. Suspended growth technologies are conventional activated sludge treatment systems that use various process modes ranging from:

- Conventional;
- Extended Aeration;
- Contact Stabilization;
- Sequencing Batch; and
- Single Sludge.

The various process modes are available for polishing an aerobically treated effluents.

i. Applications

A water treatment system used with suspended growth treatment systems can apply to:

- Industrial Plants;
- Heating and Cooling Systems;
- Cooling Tower Systems;
- Steam Systems; and
- Domestic Water Supplies and Swimming Pools.

A waste water treatment system is an essential component of effluent distribution systems. These suspended growth treatment systems deliver wastewater to soil infiltrative surfaces either by gravity or by pressure distribution. Residuals are the by- products of a wastewater treatment process, including sludge and septage. Polymers are used for industrial water treatment as scale inhibitors in stressed cooling water. They do not contain phosphorous, inhibit the deposition of calcium carbonate and other low soluble salts, and provide good activity over a wide pH range.

ii. Features

Suspended growth treatment systems, such as biological treatment of water, involve the use of naturally occurring microorganisms in the surface water to improve water quality. Under optimum conditions, the organisms break down material in the water and improve the water quality. Natural suspended growth treatment systems, such as wastewater biological treatment, can be used for organic wastewaters such as municipal sewage and tend to be lower in cost for operation and maintenance. Although such processes tend to be land-intensive when compared to conventional biological processes, they are often more effective in removing pathogens and do so reliably and continuously when properly designed. Wastewater treatment equipment can be categorized as screening and conveying equipment, clarification and suspended solids removal equipment, aeration and biological treatment equipment, and tertiary treatment and disinfection equipment.

b. EXPERIMENTAL MODEL:

The laboratory model contains two tanks of size, 1st tank is **(1.21mx0.5mx0.3m)**, 2nd tank is**(0.75m*0.5m*0.5m)** having inlet and outlet arrangement fabricated using a thick GI sheet of thickness **0.7mm**. It is proper to provide the treatment of domestic wane water by using the experimental lab scale model having five reactors. The overall capacity of the model is 308 lit. The inlet and outlet arrangement were provided at all three reactors. A concept of constructed wetland is used to obtain better results regarding BOD.

:Reactor Tank A

:Reactor Tank B

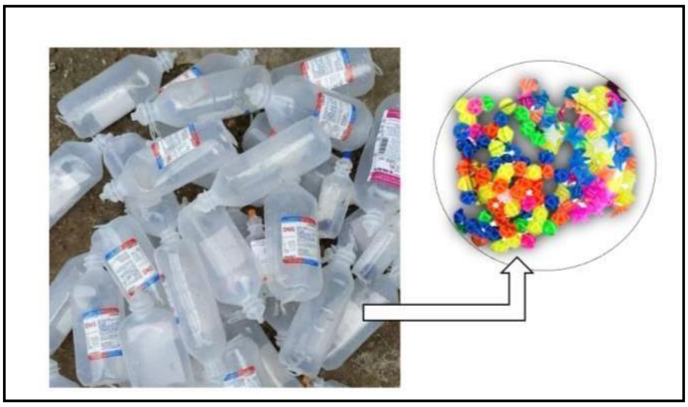
The suspended growth process is carried out in first reactor and constructed wetland is made in third reactor. The performance of the reactor was observed for various operating conditions for PH, BOD, Colour, Turbidity, Odour and Total Solid parameter.

i. Reactor A

<u>Media used</u>:- Scrubber, Coir Rope, Plastic Bottle with Plastic Bits

The first reactor with a dimension (**1.21mx0.5mx0.3m**) is provided with a four partitions of Scrubber, Coir Rope, and Plastic Bottle with Plastic Bits. They are arranged in a proper in this size and ratios. The water is collected up to height 175mm with proper outlet water from the reactor is collected and allowed to flow in the fourth reactor of RBC.

: Scrubber **:CoirRope**



Plastic Bottle with Plastic Bits

ii. **Reactor B**

<u>Media Used</u>: Used RBC with Scrubber

The Second rector with a dimension (**0.75m*0.3m*0.5m**). In this reactor, we used rotating biological contractor with scrubber. There actor is provided with proper inlet and outlet arrangements. A reactor is provided for aeration process as oxygen is needed by microorganism to carry out the aerobic process. The waste water is collected up to the height of the rotating bodies is half of the water is submerged. The water is allowed to flow in constructed wetlands.

iii. **Reactor C**

<u>Media used</u>-Constructed wetland

The fifth reactor with a dimension of (**0.75m*0.5m*0.5m**). Reactor with constructed wetland model consist of gravel or rock beds, sand sealed by an impermeable layer and planted with wetland vegetation. The waste water from the second reactor flows to the third reactor, through the porous medium (sand gravel bed) under the surface of the bed in a more or less horizontal path until it reaches the outlet zone, where it is collected and discharged. In the filtration beds, pollution is removed by microbial degradation and chemical and physical processes in a network of aerobic, anaerobic zones with aerobic zones being restricted to the areas adjacent to roots where oxygen leaks to the substrate. Constructed wetland vegetation like“ Calcusia Esculenta” is used for our laboratory model. it is the most common and easily available vegetation.

Fig.No3.16: CalcusiaEsculenta

c. **WORKINGOFMODEL:**

The whole filtration unit is feed with domestic waste water at designed in up flow. The working of model starts by filling the feeding tank by the sample which wants to treat and remove the BOD of that sample i.e. the main and basic purpose.

By opening the tap of inlet tank, the further process takes place. First the water comes in the first chamber and reactor is with suspended growth system. In suspended growth system also, media is playing an important role. Film or layer of microorganism or bacteria is formed on that media. To fulfill that requirement used one media in suspended growth system. In that firstly scrubber is provided to remaining particle of waste do not flow into water and then will formed Coir Rope arrangement used for removing oil & stick particle are formed.

In Second chamber, second reactor is an oxidation process takes place because RBC (Rotating Biological Contractor) rotating of blade with their scrubber water is contact with air mixed oxygen because of that oxidation process is activated. In this reactor is provided for aeration process as oxygen is needed by microorganism to carry out the aerobic process. With proper inlet and outlet arrangements. The shaft is mounted just above the water level in the tank, submerging approximately 40% of the media. The shafts are rotated through the water using one of two methods of propulsion. The first, most common, is the use of an electrical motor, operating through a drive system. The rotating biological contactor is a fixed bio mass system comprising rotating discs. The constant rotation of the disc causes mixing of the liquid. During the treatment process, microbes that remove the organic material in the wastewater (by using the organic material as a food source) attach themselves to the disc surfaces. Biofilm gradually forms on the disc surface, whose thickness is controlled by the shearing force of the discs being rotated through the water. Also, the rotating disc surface alternately comes into contact between air and wastewater and thus acts as an aeration device for wastewater treatment. The surplus microorganisms that are sheared off the discs are carried with the wastewater to clarifiers where they are separated from the treated wastewater.

After treating water in RBC oxidation process takes placed then water flows and comes in mixed reactor. Constructed wetland is Last Reactor. Constructed wetlands significantly remove pathogenic indicators by 1–3 log orders, similar to

Technical activated sludge systems. Grey water which has been treated in subsurface flow CWs usually meets the standards for pathogen indicators for safe discharge to surface water without further treatment. The wetland vegetation "Calcusia Esculenta" used in model. This is placed in a bed made of fine sand coarse sand gravel and pebbles. In this filtration bed, pollution is removed by microbial degradation and chemical and physical processes in a network of aerobic, anoxic, anaerobic zones with aerobic zones being restricted to the areas adjacent to roots where oxygen leaks to the substrate. The roots act as filter, absorbing nitrates in water. This action reduces then it rate content and releasing some oxides, ultimately reducing the BOD of water. Water from this filtration bed is then collected as final sample of our test. The outlet taps given to the model is open to collect the final sample. The test for ph, total solid and BOD is carried out to test the effluent parameters and efficiency of model.

10. PERFORMANCE ANALYSIS

a. Experimental Analysis

To study the performance of Hybrid System a laboratory model was developed. The models consist of 3 reactors of a tank made of GI sheets having 180 liters capacity. The model was provided with separate inlet and outlet arrangement of each reactor for feeding influent and withdrawal of effluent. The waste water collected from kitchen was fed as an influent in the model for different iteration. The performance of units was analyzed based on various parameters such as pH, Total Solids, BOD, etc. To study the efficiency of proposed unit, the performance of various reactors is highlighted below.

The test was conducted for a period of 3 weeks. In first week, the inlet and outlet water samples were collected for each day i.e. for day1, day2, day3, day4, day5, and day6 and the test for pH, BOD Turbidity, Odour, and TS were performed for them and the results were noted.

In the second week the inlet and outlet samples were collected for day2, day4 and day6 and the test were performed for Ph, TS and BOD and the results were noted.

Similarly, for third week the inlet and outlet samples were collected for day3 and day6.The test were performed and the results were noted down.

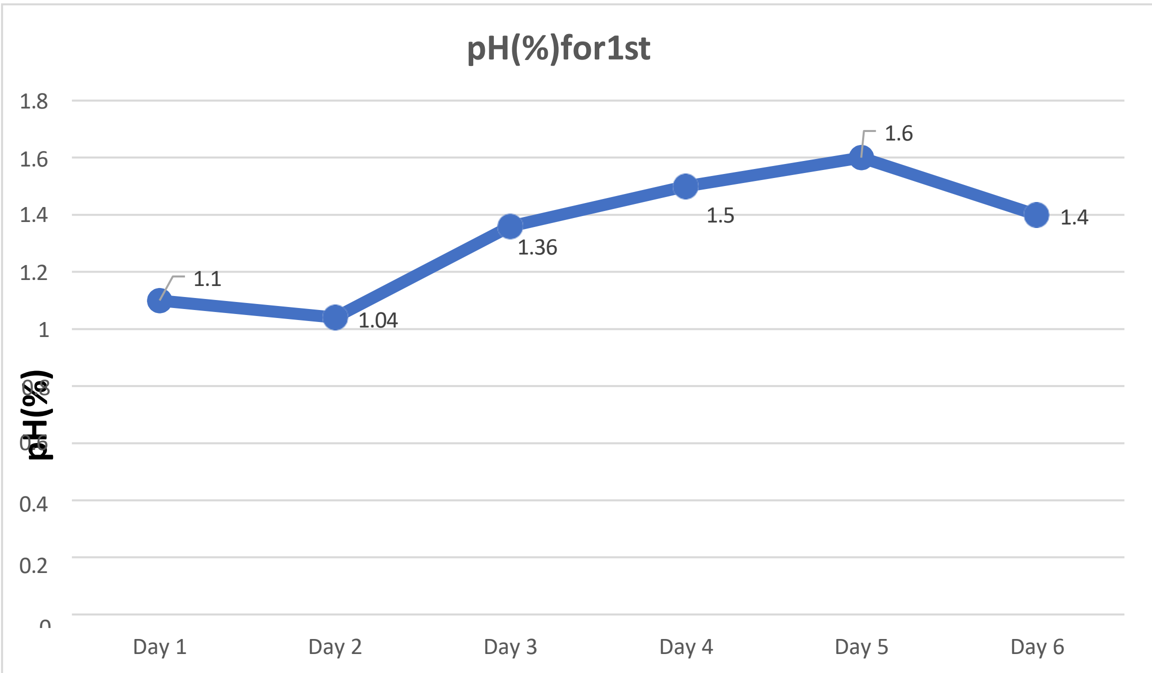
The obtained results are tabulated below along with graphs for better understanding.

Table .Characteristic of Influent of Domestic Sewage

Sr no	**Characteristic**	**Value**
1	PH	5.9
2	Odour	Moderate
3	Turbidity	800JTU
4	BOD	95 mg/l
5	TS	--

pH Value for Sample of 1st Week

Days	pH		Percent Increase
	Initial	Final	
Day 1	8.14	8.23	1.10
Day 2	7.68	7.76	1.04
Day 3	7.32	7.42	1.36
Day 4	6.42	6.52	1.5
Day 5	7.77	7.90	1.6
Day 6	6.34	6.43	1.4



Days

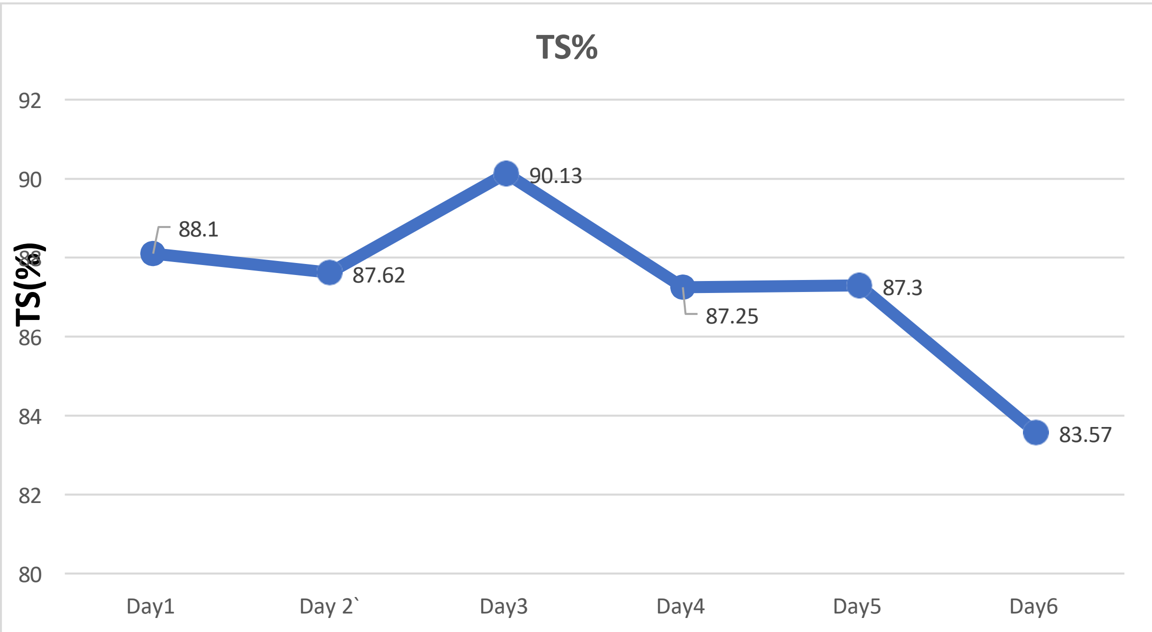
Graph. pH Value of 1st Week

From the above table and graph an average incremental increase of 1.33% is observed in the pH value for sample of 1st week.

Table. Total Solids (Mg/Lit) For Sample of 1st Week

Days	TS		Percent Decrease
	Initial	Final	
Day1	353	42	88.10
Day2	307	38	87.62
Day3	304	30	90.13
Day4	259	33	87.25
Day5	244	31	87.30
Day6	207	34	83.57

Days

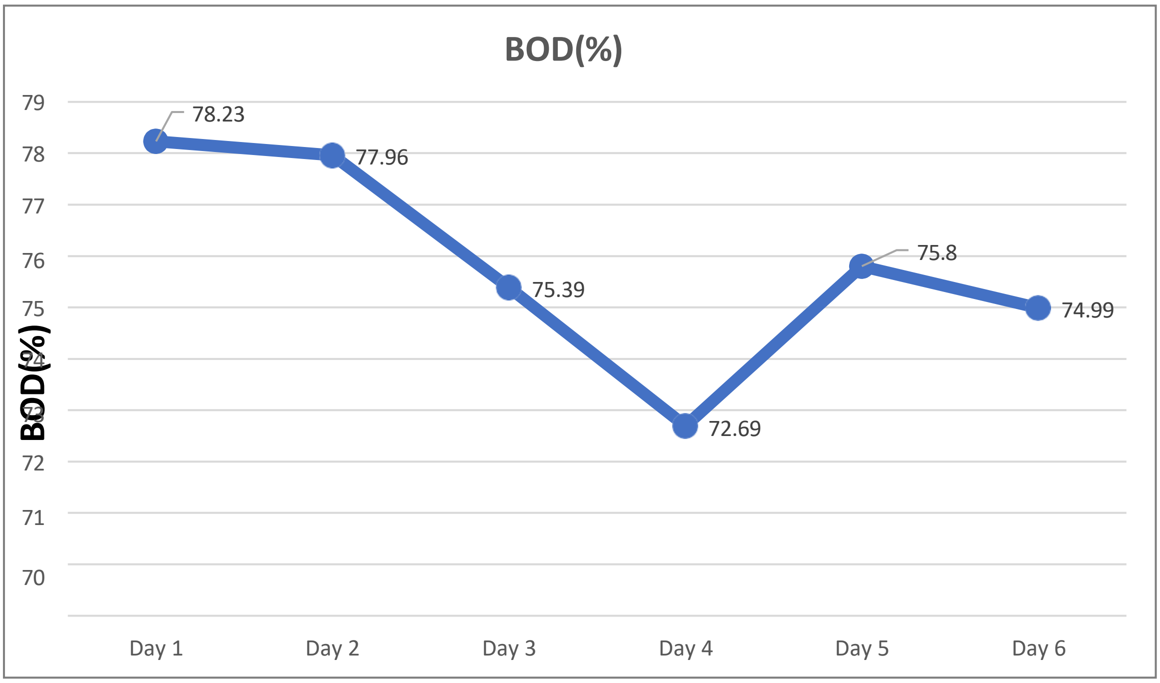


Graph. TS Value of 1st Week

From the above table and graph an average incremental decrease of **87.32%** is observed in the TS value for sample of 1st week.

Table. BOD for Sample of 1st Week

Days	BOD		Percent Decrease
	Initial	Final	
Day 1	78.1	17	78.23
Day 2	75.42	16.62	77.96
Day 3	66.04	16.25	75.39
Day 4	65.19	17.8	72.69
Day 5	62.82	15.2	75.80
Day 6	60	15.01	74.99



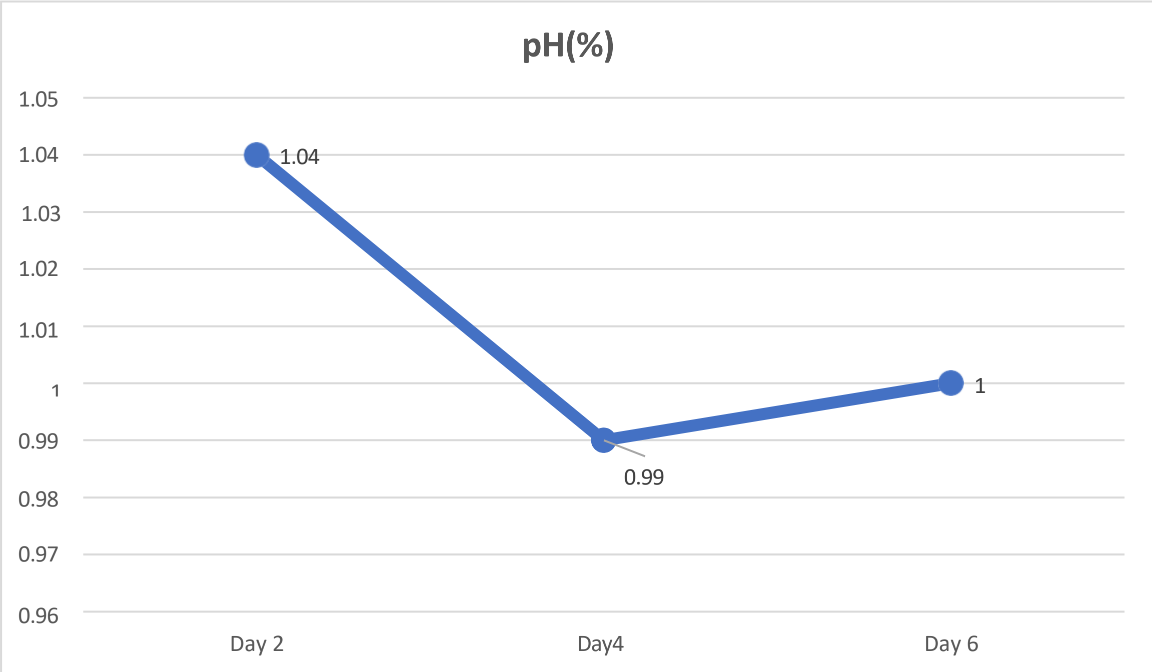
Days
Graph. BODValueof1stWeek

From the above table and graph an average incremental decrease of **75.84%** is observed in the BOD value for sample of 1st week.

Table. pH Value for Sample of 2nd Week

Days	pH		Percent Increase
	Initial	Final	

Day 2	7.68	7.76	1.04
Day 4	5.40	5.45	0.98
Day 6	4.96	4.92	1



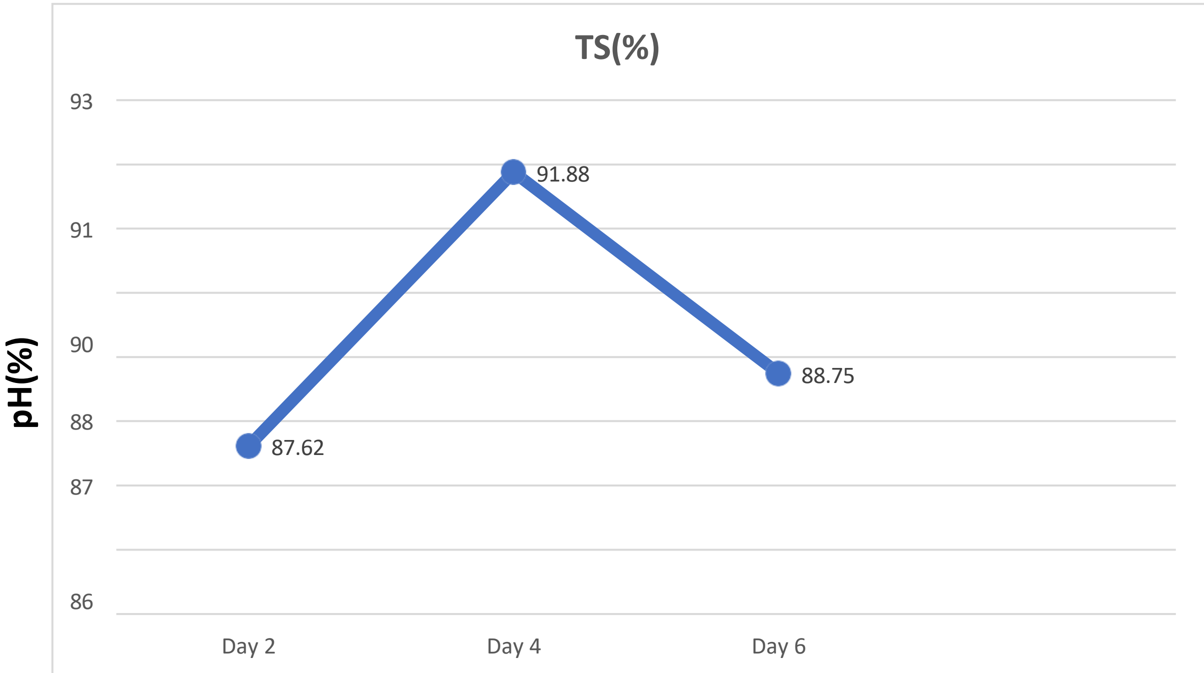
Days

Graph. pH Value of 2nd Week

From the above table and graph an average incremental increase of **1%** is observed in the pH value for sample of 2nd week.

. Total Solids(Mg/Lit)For Sample of 2nd Week

Days	**Ts**		**Percent Decrease**
	Initial	**Final**	
Day 2	307	38	87.62
Day 4	382	31	91.88
Day 6	249	28	88.75

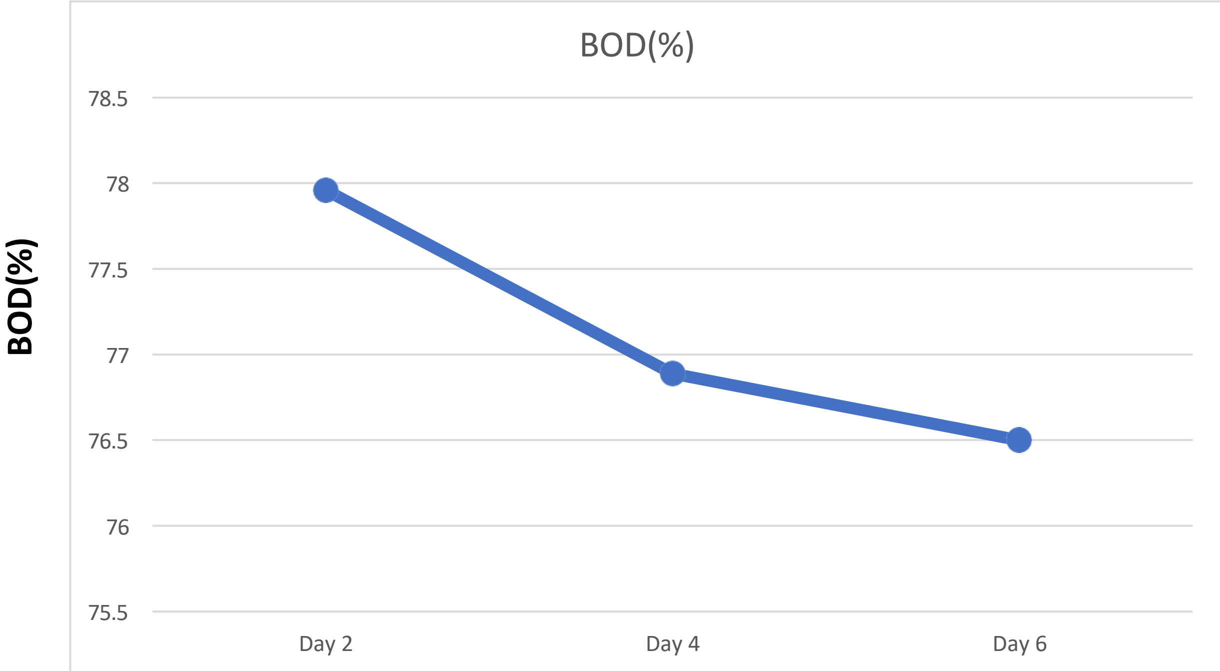


Days

Graph. TS Value of 2nd Week
From the above table and graph an average incremental decrease of **89.47** % is observed in the TS value for sample of 2nd week.

Table. BOD for Sample of 2nd Week

Days	BOD		Percent Decrease
	Initial	Final	
Day2	75.42	16.62	77.96
Day4	68.11	15.74	76.89
Day6	63.02	14.92	76.32



Graph. BOD Value of 2nd Week

From the above table and graph an average incremental decrease of **77.05%** is observed in the BOD value for sample of 2nd week.

b. Results and Discussions

i. This study gives an over view of performance of various design and functional characteristics of the used hybrid system it was observed for the first week analysis a small increase in the pH value was observed with average value of 1.33%. An incremental decrease in total solid within the range of nearly 85 to 90%. A considerable decrease in range of 75 to 80 % was observed in the BOD value for sample.

ii. For 2nd week a decrease of 1% was observed in the pH value for sample. An increase in total solids with the range of 80 to 90% was observed. An average decrease is observed in the BOD of range 70 to80 % value for sample.

11. CONCLUSIONS

Varieties of organic and inorganic substances are found in domestic waste water parameters such as BOD total solids pH .these parameters were analyzed by using standard methods for calculation the raw waste water was collected from various sources and its characteristics were studied this chapter deals with the conclusion obtain from the observation and experimental study of wastewater treatment with attached and suspended growth system. A concept of constructed wetland is used for better result.

1. Waste water treatment by such hybrid process can adopt only to treat small quantity of water and can use for single community like a colony.
2. Plastic scrubber's shows remarkable mark down in BOD, when waste water is allowed to pass through reactor containing scrubber.
3. Innovative arrangement of glucose bottles with plastic bits helps to increase the detention time and contact period of

waste water with bits containing aerobic bacteria. This helps to decrease BOD concentration of waste water.

4. Aerocon blocks absorb solid impurity present in water. So, the suspended impurities get fixed into voids of block. But with passage of time it may get clogged and therefore requires backwashing regularly.
5. Activated charcoal proves the best for removal of colour.
6. Reactor unit with organic plant that is constructed wetland provides natural aeration, filtration, decolouration and odour removal by roots.

FUTURE SCOPE

The unit can be used in a large scale model for any housing colony, society, etc. The domestic waste from these sources can be used and the effluent from this plant can be used for washing gardening etc.

With some further treatment process of water purification the effluent can be treated and could be send again to water treatment unit. From here it can be used in the treatment cycle and then supplied to us from water supply schemes.

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