An integrated approach of wastewater treatment and management system

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Abstract:

India being highly populated country and also the most polluted too there is a huge need for availability of natural resources. The world is surrounded by water all around but the availability of the fresh water is very less about 4-5% and to overcome this issues there are several researches are being made to recycle the waste water and store the rain water and increase the ground water level. As many industries uses huge amount of water and release them directly into the running water the quality of the entire water bodies is being polluted and the aquatic ecosystem is completely disturbed. And such industries are one of the major sources of water pollution. Next comes the agricultural practices where the farmers use high amounts of nitrogen, potassium and phosphorous based fertilizers and these travel into the underground and nearby running water bodies leads to eutrophication. The treatment of sewage or the municipal water is one of the necessary needs to be done because it can be recycled and reused to household things. In present in India an average of 80% of fresh water is utilized for the agricultural and industrial purpose and the remaining water is used for the household purposes. The integrated waste water treatment is one of the new and easy method to treat the waste water. It can be done using microbes and through STP (sewage treatment plan) method. And the microbial biomass is recovered at the end and that biomass can be used as feed for fishes and other aquatic organisms. The integrated method was effective to remove the physical, chemical and most effective against microbial removal. This article deals with the use of integrated system to treat the waste water and the application of algae and microarray.

Keywords: waste water, remediation, treatment process, aquatic, ecosystem, algae, feed, sewage, agriculture, eutrophication.

Introduction:

The natural treatment system of the water treatment which includes sewage fed aquaculture, duckweed ponds system, constructed wetlands uses natural systems and microorganism to clean up the water. Industries are the main source of water contamination and then leaving it untreated or partially treated which in turn disturbs the ecosystem. There is a rapid depletion in the ground water level now there is no other source of fresh water available and the need to treat the waste water is becoming very critical. The industrial waste water contains carcinogenic compounds such as dyes in textile and chemicals in the pharmaceutical companies and if they leave it untreated it may cause many problems and when the outlet is mixed up with the running water the quality of water is completely destroyed and when we intake the water which is contaminated we may face severe health problems or even lead to death. Not only the carcinogenic compounds but also harmful microorganism which can cause death can be present in the polluted water. To treat such contaminated water we must choose natural and cost effective ways and modern technologies include the use of algae and certain bacterial cultures to degrade the toxins and then the algal or the bacterial cultures are collected back after the treatment process to use as by products in fisheries. Waste materials in the water may also possesses some compounds which may be used for the energy generation and it is also one of the ways to reduce the energy conservation cost. The integrated waste water treatment helps for the synthesis of bioenergy. The usage of water by the humans is increasing day by day at a faster rate due to over population rate and modern life style such that the production of a litre of oil uses 4 litres of water and to cultivate rice it uses tons of water and absorbed by the soil and remaining water is evaporated back to the life cycle. The contamination of water leads to the pressure to increase the treatment of waste water. Since water is a natural resource we humans cannot generate or produce water and there is no other substance which can replace the water so we must be careful while using water. Since the technology is also increasing the less treated water can be used up for the agricultural purposes and also for some industries back and then recycled again. It is also the responsibility of each individual and also the government to create awareness among people about the use of water and how to recycle the waste water for gardening and then building rain water harvesting setup to collect the rain water and increasing the level of ground water and use it for household things and also for gardening.

Waste water as a water source:

Waste water is the only source which can be recycled and can be used for agricultural practices and urban uses which require large water requirements. An average person needs about 50 litres of water per day and for household things we use about 50 litres and can be reused for gardening. And the industrial waste water has a potential for the energy production and also to synthesise the biogas.

Use of algae in sewage treatment:

The idea of waste water treatment was started years ago and the main aim of the sewage or the waste water treatment is to remove nitrogen, potassium, phosphorous and chemical oxygen demand and the biological oxygen demand. Eutrophication is the major problem reported recent days and it is caused due to the excess nutrients released from the industries. Due to eutrophication the flora and fauna of the aquatic ecosystem is completely disturbed and lower portion of the water is experiencing low light penetration and large growth of phytoplankton and indirectly affect the life of larger aquatic organisms. The growth of phytoplankton reduces the BOD (biological oxygen demand) of the ecosystem and there

won't be any organisms living in those water bodies. The use of algae and microalgae in the treatment of waste water is becoming an interesting approach in the upcoming days as there is a huge benefit in this technology. Few algal species can be macro sized which is visible to naked eye and few are microscopic. Microalgae are unicellular organisms present in the water body. They can be present both on the freshwater and the waste or sewage water and grow abundantly. Major reason for the development of algae is the presence of the nutrients in the water and the rapid growth of harmful algae leads to eutrophication. Moreover certain beneficial algal species are used for many purposes such as processing food for fishes and treating waste and sewage effluents. Improving the quality of water by reducing the nitrogen, potassium and phosphorous present in the waste water after the required pre-treatment is achieved by the microalgae. Since the nitrogen, phosphorous and potassium are the major cause for the pollution and cause serious health issues it is our aim to reduce these nutrients biologically without the use of any chemicals. The growth of algae is also being disused as it also important. And the factors which influence the growth including both the biotic and abiotic things. The main process in the sewage treatment is the biological treatment since there may be millions of microbes living in it and then comes the physical and chemical treatment.

Waste water treatment methods:

The treatment of waste water is carried out by physical, chemical and biological treatment. The physical treatment primarily removes all the physical substances such as plastics or metallic wares through screening. Chemical treatment involves the treatment of water using chemicals such as chlorination. And the main thing is the biological treatment where the microbes are used to degrade the toxins or other harmful pollutants present in the water and also achieved through bioremediation. The biological treatment helps to convert the nutrients of solid state into gages and they escape to the atmosphere. And it is used to degrade the organic substances. The aerobic and anaerobic treatments are also types of biological treatment. The main aim is to reduce the organic and carbonaceous matter present in the water.

1. Anaerobic ponds:

These are the large tanks used for the treatment of large waste water in the absence of oxygen. The scum at the end settles on the surface of the tanks.

2. Stabilization ponds:

Stabilization ponds are suitable for the natural treatment of water in the presence of sunlight where the waste water is continuously flowed in the ponds. These ponds are cost efficient and easy to maintain and gives high effluent waste. These tanks can be used to produce electricity through production of energy. But these acquire large space.

3. Aerobic ponds:

These aerobic ponds are large ponds which uses algae and bacteria for natural treatment of the waste water. The treatment process is done in the presence of the oxygen and photosynthesis by algae. The algae present in the pond uses up the nutrients and avoid eutrophication.

4. Facultative ponds:

These ponds works both in the presence and absence of oxygen. It uses facultative bacterial strains to treat the organic waste matter present in water. The sludge which is settled at the bottom is digested by anaerobic bacteria because the lower surface lacks oxygen.

5. Maturation ponds:

These ponds work in the use of oxygen and used to clean up the harmful bacteria and viruses. The water can be retained within six days and more number of ponds can be used for faster results.

6. Oxidation ditches:

These are also called the aerated lagoons and used for the fast conversion of organic waste into gases by algae. These ponds use oxygen and in case they lack oxygen an additional oxygen supply has to be provided by us. This method can also be called as mechanical aeration.

7. Solar detoxification:

As we have discussed earlier the facultative ponds work on the presence of sunlight, the solar energy can be used to treat the waste in water. And the UV light is also used. It is used to disinfect the water and used earlier days also.

The Integrated Approach:

The integrated waste water treatment involves certain technology which involves less cost, new technology, less place usage and does not cause any cause to environment by treating the water with biological aspects. There are some principles composed based on the integrated waste water treatment.

1. There should be a potential approach towards the socio-economy of the country to invest for the setup to start the treatment process of the waste water.
2. One must create awareness to the public of how to protect water and how to treat and reuse the household water.
3. The government should take initiative to search for the water source and protect it from the pollution and people and safeguard it for the future use since the fresh water availability is nearly getting declined.
4. Once the waste water from the sewage is treated one must know how to use it or implement it for the daily use.
5. The integrated system may contain wetlands, aerobic bio-digesters and the sand filter for the biological treatment of the water.

The treatment involves the septic tank or bioreactor where the waste water from the industries or any other source such as sewage water is stored initially and then the preliminary treatment where the screening of the water in which the plastics and metallic waste is being able to remove. Then it moves into the stabilization tanks which are larger in size and require the presence of sunlight. Then this waste water is added with urea and sodium hydroxide and it is flowed to up flow sludge using a feeder pump.

Then through scrubbing the gasses are collected and stored to convert to the energy form in constructed wetlands. On beforehand the algae is being cultivated which is suitable for the

degradation of toxins. One the treatment process is finished the water can be used for the cultivation and agricultural purpose and the algae is recovered back and used up for the energy production and as feed or any other useful purpose.

Outputs of the integrated waste water treatment:

When we use the integrated treatment plans it does not only provide pollution free but also eco-friendly, used for the generation of bioenergy and the production of the biogas and it is very cost efficient. Thus the technology improves the production of biogas where it also reduced waste water and prevents pollution. It also helps to recover the nutrients required for some of the agricultural purposes. These help in the reduction of greenhouse gasses and then prevent the eutrophication in the water bodies. To reduce the biological and the chemical oxygen demand and helps to convert organic carbon to methane for the production of biogas. There is a lot of use of liquid fertilizer which is produced from the treated agro water and used by the farmers for the crop growth instead of chemical fertilizers. The treated waste water can be used for the irrigation process and the algae cultivation.

Types of wastewater treatment plan:

There are many treatment plans for the waste water which also includes:

1. Industrial wastewater treatment plans.
2. Agricultural wastewater treatment plans.
3. Sewage wastewater treatment plans.
4. Leachate waste water treatment plans.
5. Integrated waste water treatment plans.

These are the types based on the type of source from where the waste water is produced.
Industrial wastewater treatment plan: The unwanted products are removed and the toxins are removed by the biological treatment. Many of the petrochemical and fuel based industries have their own treatment plans because they contain toxins. In some of the granite industries the water is reused again for the washing purpose in the same industry. The brine treatment removes all the solids, toxins, chemicals and the organic compounds present in the waste water.

Agricultural wastewater treatment plans:
The water which comes out from the animal and the plant based industries is treated in this treatment process. The recycled waste water is then reused for the agricultural purpose. The waste water from the agro based industries is used to produce the liquid fertilizers. The excess water from the agricultural field contains high nutrients which lead to eutrophication, hence it is more essential to treat such water and recover the nutrients for the bioenergy production.

Leachate treatment plan:
The water from the landfills is treated in this treatment plant. It may include biological, reverse osmosis, electrocoagulation and the mechanical treatment. Since the main pollution is caused by the landfill and the leachate water it is very important to treat such water to prevent the environmental pollution.

Sewage treatment plan:

It is one of the major sources of water pollution. The sewage water from the domestic and pre-treated industries is collected and stored in the septic tank. Then it is allowed for screening where all the solid particles are removed followed by the grid chamber where the tiny particles like sand are removed off. Then it is stored in the wetlands where aerobic and anaerobic digestion through open space is done. Then the biological treatment is done using some of the trickling filters which contains microorganism to degrade the toxins in the waste water. Also it is a type of integrated waste water treatment. It is cost effective and also uses some of the algal species for the degradation of the toxins. Later the algal biomass is recovered back and used for the bioenergy production and also for any other beneficial purpose. In some of the countries the micro pollutants are also removed. The sludge which is settled down can be treated and used as fertilizers for plants.

Conclusion:

Many health hazards can be caused to the humans, animals, birds and aquatic organisms by drinking the polluted water. Not only the health problems but it also cause environmental degradation if untreated. By treating such waste water the water can be recycled back for agricultural and household purposes. Since the waste water contains many coliforms which is very harmful it is very important to remove all the coliforms using biological treatment. The integrated treatment produces biogas and bioenergy using the algal biomass and it is cost efficient than the other treatment plans.

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