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Studies On The Soil Microflora And Macroflora In The Treatment Of Waste Water

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Abstract

Waste water treatment methods such as soil biotechnology, submerged aerated fixed film and rotating biological contactors were studied during the research in three different industrial sectors. Various types of microflora and macroflora that helped in cleaning contaminated sites were found. These methods are ecofriendly and cost-effective too. Green plants are not only the lungs of nature with unique ability of purifying air by photosynthesis, but it has also been demonstrated that they could be very useful in cleaning up hazardous waste sites. Vegetation can filter contaminated run off and can be used in the treatment of industrial and other waste water sites. Macroflora are hence being tested for their ability to remove contaminants from waste water.

Objectives

- To identify the microflora and macroflora that have the potential to degrade environmental pollutants present in waste water.
- To understand various waste water treatment processes and prove that microflora and macroflorahelp in treatment of waste water.
- To study the importance of microflora and macroflora in restoring the original natural surroundings and preventing further pollution

Various Biological waste-water treatment technologies that were using different kinds of microflora and macroflora were studied during the research :

1. Soil biotechnology (SBT) process, at vazirsultan tobacco industries ltd, Hyderabad.
2. Submerged aerated fixed film (saff) process at grand kakatiyasheraton hotel and towers, Hyderabad.
3. Rotating biodisk contactor (RBCbc) process, at convention centre , Cyberabad.

Introduction

"Soil Bio Technology" (SBT) is an efficient process of synthesis to completely utilize solid and liquid in wastewater from industries and household activities. It is economical in capital and

recurring costs. The system is robust and hence easy to implement, operate and maintain. SBT is a synthesis process, which harnesses the Energy, Carbon and other elements of the waste and converts them to precious "bioenergy" products like Vegetation, energy rich Soil, complete Bio-fertilizer and Water. SBT offers a bacterial removal of appx.99.99% thus ensuring a healthier environment in a sustained manner without any side effects.

It functions at ambient temperatures, energy efficient and economical. SBT has total and sizeflexibility and can be used in both urban and rural areas. SBT and designs can be made input and site specific.

Submerged aerated fixed film attached growth system works on the principle of extended aeration process:

a. The process can absorb shock load situation due to attached growth process.

b. The process produces a well-oxidized sludge in small quantities only.

The main components of the process include the following:

1. Collection of raw wastewater by gravity into the collection cum equalization sump of STP sump and its transfer to Primary tube settler through Flow regulating box.
2. Primary clarification of suspended impurities in primary tube settler consisting of PVC tubular media to enhance the settling rate and efficiency.
3. Aerobic Treatment in Submerged aerated attached growth process using PVC fill media and diffused membrane aeration system.
4. Secondary clarification of aerated mixed liquor in Secondary tube settler consisting of PVC tubular media to enhance the settling rate and efficiency.
5. Chlorination for disinfection using hypo-chlorite solution.
6. Filtration and de-chlorination of excess chlorine using activated carbon.
7. Recycle of treated water for end use. ie. Irrigation.
8. Sludge thickening, digestion and disposal in external irrigation area as wet manure.

A Rotating Biological Contactor is a biological treatment process used in the treatment of waste water following the primary treatment. The primary treatment process removes the grit and other solids through a screening process followed by a period of settlement.

The RBC process involves allowing the waste water to come in contact with a biological medium in order to remove pollutants in the waste water before discharge of the treated waste water to the environment A rotating biological contactor is a type of secondary treatment process. It consists of a series of closely packed, parallel disks mounted on a rotating shaft which

is supported just above the surface of the waste water. Microorganisms grow on the surface of the discs where biological degradation of water pollutants take place.

The rotating packs of disks known as media are contained in a tank or trough, Commonly used plastics for the media are polythene, PVC and expanded polystyrene. The shaft is aligned with flow of waste water so that the discs rotate at right angles to the flow with several packs usually combined to make up a treatment train. About 40% of the disc area is immersed in the waste water.

Biofilms which are biological growths that become attached to the discs, assimilate the organic materials from the waste water. Aeration is provided by the rotating action, which exposes the media to the air after contacting them with the wastewater facilitating the degradation of the Pollutants being removed. The degree of waste water treatments is related to the amount of media surface area and the quality and volume of the inflowing waste water.

Materials And Methods

Microbes - algae, fungi and bacteria as well as higher plants were found to have capabilities of uptaking pollutants from waste water. Microorganisms are nature's original recyclers.Their capability to transform natural and synthetic chemicals into sources of energy and raw materials for their owngrowth, was the reason for the replacement of expensive physical and chemical waste water treatment methods with biological processes that were lower in cost and more environmentally friendly.

Indigenous microflora that were already existing at the waste water treatment site were used. The microflora identified in the soil were: *Staphylococcus, Pseudomonas putida, Bacillus, Salmonella, Rhizopusarrhizus, Nostoc, Anabaena* etc.

Roots and rhizomes of some plants provide an ideal habitat for the growth of different microflora. These microbes remain active even in extreme conditions like hot summer, as well as highly extreme pH conditions. The actual composition of the microbial community depends on the root type of the plant species, plant age and soil type. Young plants with soft roots were grown at the SBT sites. These green plants grown were found to tolerate, uptake and accumulate pollutants in their cells. Besides this, they were able to take organic matter from waste water as their energy soil.

The macroflora grown for the SBT process were: *Canna indica* (canna lily), *Croton* species, *Capsicum annum* (chilly), *Epipremnumaureum* (Pothos/Money plant) *Impatiens balsemina*

(balsam), Ipomoea (morning glory),*Lycopersiconesculentum* (Tomato), *Ricinuscommunis*(Castor).

Variation of bacterial diversity is seen in the biofilm used in submerged aerated fixed film process. The bacteria used were: *Staphylococcus aureus, Pseudomonas putila,Micrococcus lutens, Acinetobactercoleoaceticus,Nocardiacorynebacteroides.*

Bacteria grow rapidly under proper engineered conditions utilising the organic substances present in the waste water as food. As the bacteria grow, viscous polysaccharides are secreted by the cells, which enable them to adhere to the surface of the matrix and form a fixed film. As the bacteria grow on the matrix, the film becomes thicker, the depth of penetration of materials, oxygen or other nutrients is insufficient to reach the base of the bacterial film. At this point, the inner layers of organisms become starved, lose their ability to adhere to the matrix. The shear forces of the water and air bubbles flowing through the matrix will ultimately become great enough to tear this portion of the biological film.This process is called 'sloughing'. The solids which slough from the media will flow out of the system with the treated effluent. The exposed portion of the matrix surface will repeat the process of growth and sloughing.

The rigid plastic matrix provides 150 square metre of surface area per metre cube of volume on which the bacterial film can grow. The high surface area to the volume ratio allows for the accumulation of substancial concentrations of bacteria in a film, using a small treatment unit• Furthermore, the accumulated viable bacteria are fixed in the system and do not need to be recycled.

Microflora seen in the biofilms used in rotating biological contactor process, mainly consisted Of bacterial species and yeast. Bacteria used were: *Acetobacter, Hafnia protea, Lactobacillus brevis, Pediococcus, Staphylococcus epidermidis.* Yeast used were: *Saccharomyces cerevisiae, Candida intermedia, Candida albicans, Pischianiembranifaciens, Hanseniaporauvarum ,Williopissatumus*. The presence of bacteria and yeast in a biofilm is not a new phenomenon. It has been shown that both bacteria and yeast co-flocculate easily' so they are used together. Biofilms which are the biological growths become attached to the discs and assimilate the organic material of waste water. Aeration is provided by the rotating action of the disc' which exposes the media to the air after contacting them with water. The degree of waste water treatment is related to the amount of media surface area and to the quality and volume of the inflowing waste water.

Results

Testing of the samples and recording of the data done for the Biological Wagte-water Treatment processes. This is tnt19t tho treatment plant needs to be operated continuougly at a good efficiency and the water quality has to be maintained, Effluent referq to the impure water containing inorganic salts, organic compound%, n) microbial contamination and turbidity,

1. Normally identified impurities in an effluent are:
2. MINERAL MATI'ER: calcium, magnesium hardnesg, carbonates, bicarbonates, alkalinity, mineral acidity and metal salts.
3. DISSOLVED GASESGASES: carbon-dioxide, oxygen, nitrogen and hydrogen.
4. TUBIDITY: inorganic and organic particles which reduce the clarity of the water, cor,„OUR AND ORGANIC MATTER: colour in water may exist in the form of colloidal suspension or non colloidal matter.
5. MICROORGANISMS: they include small plants or animals, they are the most difficult contaminants to remove from waters.

Discussion

Waste -water treatment is complex, requiring various levels of treatments and combination of separation and conversion technologies. Efficient economically feasible and sustainable measures require process integrated treatment technology. The various biological waste water treatment plants meet individual specific requirements.

Principle

The microflora and macroflora used in the waste water treatment processes, used the organic material present in the waste water. Through their metabolism, the organic materials is transformed into cellular mass, which is no longer in solution but can be precipitated at the bottom of the settling tank or retained as slime on solid surfaces or vegetation in the system. The water exiting the system is then much clearer than that which entered the system.

A key factor in the operation of any biological system is an an adequate supply of oxygen. Without oxygen supply, the biological degradation of waste is slowed down, requiring a longer residency time of water in the system. The SBT, SAFF and RBC processes are tailored according to the requirement of that particular industry. The effluents from SBT, SAFF and RBC were sent to the laboratory for investigation. •Common analyses such as BOD, COD, nutrients and so on were carried out.The results show that the treated water in all the three processes meets the required standards.

Soil Biotechnology process used indigenous microflora like bacteria, fungi and algae that were present in the soil and macroflora for the treatment of waste water. Submerged aerated fixed film process used microflora such as bacteria in the fixed media. Rotating bilogical contactor process used bacteria and fungi as a biofilm to treat waste water. Hence the use of microflora and macroflora in the waste water treatment is an ecologically sound and natural process.

Summary And Conclusions

In view of increasing population and demand for water, it is essential to undertake water reuse as a matter of human survival. Increase in water pollution has rendered our fresh water resources more and more scarce. We can no longer afford to waste water and we must consider every drop precious. Hence various treatment processes like physical, chemical and biological have been designed, but the use of biological processes have been found to be efficient, economical and robust. These biological treatment processes use different types of microflora and macroflora to treat waste water. The immense environmental challenges facing the world now and in the coming years can only be met through the use of innovative and cost-effective solutions offered by the Biological waste watertreatment methods. Hence the use of microflora and macroflora in the biological treatment of water has a promising future with several potential applications in comparison to the physical d chemical treatment methods. We hope to overcome the critical environmental issues of waste water by acquiring new Biological waste water treatment technologies and develop new applications which is of strategic importance to many industries

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