Microbes In Sewage Treatment

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Abstract- *The aim of treating sewage is to produce an effluent that will do as little harm as possible when discharged to the surrounding environment, thereby preventing water pollution.[7] Improving sewage treatment across the globe is crucial for reducing pollution to the environment and achieve water quality improvements.[7] Sewage treatment removes the contaminants from sewage to produce liquid and solid (sludge) suitable for discharge to the environment or for reuse. It is a form of waste management. Sewage treatment results in sewage sludge which requires sewage sludge treatment before safe disposal or reuse. Under certain circumstances, the treated sewage sludge might be termed "biosolids" and can be used as a fertilizer.*

With regards to biological treatment of sewage, the objectives are more specific: transform dissolved and particulate biodegradable components into acceptable end products, incorporate colloidal solids into a biological floc or biofilm, transform and remove nutrients (nitrogen and phosphorus), and in some cases remove specific trace organic constituents (micropollutants).[6]:548

In this study the key criteria is the how does microorganisms play a key role in sewage treatment

I. STUDY INTRODUCTION

Microbes are environmentally, economically, and socially important. These are being exploited for a wide range of products, e.g., enzymes, probiotics, biofuels like bioethanol, hydrogen gas, etc. from centuries. Currently, on an industrial scale, these microbes are playing important roles to clean up toxic waste. Microorganisms and their enzymes are chiefly involved in the breakdown of organic materials in wastewater. They perform a key role and act as main engineers in governing all ecological processes. They act as a universal catalyst and provide ecological transformations. Bioremediation is a system that utilizes microorganisms to degrade the pollutants present in wastewater and in soil environments with technological innovations. It is a technique that removes biodegradable complex toxic substances into harmless and acceptable end products, e.g., CO_2 and H_2O through cellular metabolisms. The suspended and nonsettling colloid are captured and incorporated as biological floc and biofilm. Valuable metals, specific organic constituents, and important nutrients can be removed and recovered. It is a cheaper technology with no waste generation as a byproduct.

Bioremediation, besides being a cost effective and eco-friendly method, also provides best alternative to conventional methods of treatment.

II. STEPS OF TREATMENTS

Step 1: Screening and Pumping

The incoming wastewater passes through screening equipment where objects such as rags, wood fragments, plastics, and grease are removed. The material removed is washed and pressed and disposed of in a landfill. The screened wastewater is then pumped to the next step: grit removal.

Step 2: Grit Removal

In this step, heavy but fine material such as sand and gravel is removed from the wastewater. This material is also disposed of in a landfill.

Step 3: Primary Settling

The material, which will settle, but at a slower rate than step two, is taken out using large circular tanks called clarifiers. The settled material, called primary sludge, is pumped off the bottom and the wastewater exits the tank from the top. Floating debris such as grease is skimmed off the top and sent with the settled material to digesters. In this step, chemicals are also added to remove phosphorus.

Step 4: Aeration / Activated Sludge

In this step, the wastewater receives most of its treatment. Through biological degradation, the pollutants are consumed by microorganisms and transformed into cell tissue, water, and nitrogen. The biological activity occurring in this step is very similar to what occurs at the bottom of lakes and rivers, but in these areas the degradation takes years to accomplish.

Step 5: Secondary Settling

Large circular tanks called secondary clarifiers allow the treated wastewater to separate from the biology from the aeration tanks at this step, yielding an effluent, which is now over 90% treated. The biology (activated sludge) is continuously pumped from the bottom of the clarifiers and returned to the aeration tanks in step four.

Step 6: Filtration

The clarified effluent is polished in this step by filtering through 10 micron polyester media. The material captured on the surface of the disc filters is periodically backwashed and returned to the head of the plant for treatment.

Step 7: Disinfection

To assure the treated wastewater is virtually free of bacteria, ultraviolet disinfection is used after the filtration step. The ultraviolet treatment process kills remaining bacteria to levels within our discharge permit.

Step 8: Oxygen Uptake

The treated water, now in a very stabilized high quality state, is aerated if necessary to bring the dissolved oxygen up to permit level. After this step, the treated water passes through the effluent outfall where it joins the Oconomowoc River. The water discharged to the river must meet stringent requirements set by the DNR. Pollutant removal is maintained at 98% or greater.

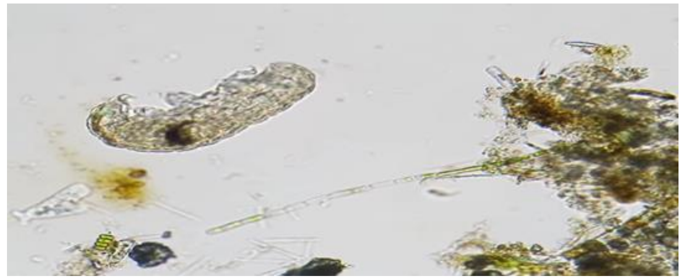
Sludge Treatment

The primary sludge pumped from the bottom of the primary clarifiers in step three, along with the continuous flow of waste activated sludge from the aeration / activated sludge process in step four, must be treated to reduce volume and produce a usable end product. The sludge treatment process involves four steps as described here.

III.OUR ARENA

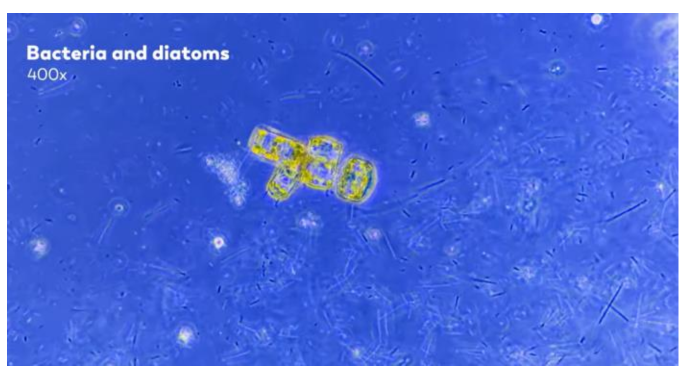
In this our area is 4th process that is aeration/activation sludge

3.1 Importance of Microalgae in Waste Water Treatment Microalgae have the photosynthetic capability which can convert solar energy to biomass and have established the efficiency to absorb some nutrient such as nitrogen and phosphorus in short span time. Some types of genera algae found in stabilization pond are Ankistrodesmus, Golenkinia, Euglena and Micractinium. These microalgae can be used to treat wide range of sewage system and it is counted as tertiary treatment process which removed organic ion. Removal organic ion achieved by chemically or biologically and biologically treatment seems to be more promising [19].



3.2 Stabilization of Ponds Waste stabilisation ponds are a non-conventional system to treat wastewater. This wastewater stabilization known as biological treatment system which is accessible to operate and limited equipment maintenance promotes better sludge thickening [20]. The perfect architecture will help to cultivate bacteria and algae which will efficiently and completely dispose organic waste in water thus this will decrease problem during treatment and disposal of wastewater [21].

3.3 Bacteria and Structural Units Heterotrophic bacteria play an important role in removing organic matters in waste water treatment system. These bacteria work during the waste water treatment in the clusters forms as floc, biofilm or granule.



3.3.1 Extracellular Polymeric Substances (EPS) The clusters or group of microorganisms produce EPS. EPS is created upon cells lysis, cell secretion and absorption of substances from waste water environment. Colloid of EPS is made of proteins and polysaccharides and is important in determining the biomass structure and properties. One of the parameters in treatment can trigger the EPS production in order to sustain and protect the biomass structure against toxic [22]. EPS also constructs a diffusion barrier that scales down the toxicity of compounds around the cells [23].

3.3.2 Flocs Floc is an activated sludge which forms bacteria colony by the attachment of the cells and pollutant from waste water by physiochemical reaction. Flocs consist of bacteria and EPS [24]. Flocs stability is mediated by the content of the microorganism and factor as environmental stress will cause floc to be fragmented [25]

.3.3.3 Biofilm Biofilm formational is formed when microorganism structure is immobilized on a solid platform which is supported through electrostatic interaction, hydrophobic interaction and covalent bonds. It is facilitated by microorganism itself, its component such as cilia, fimbriae, cell wall and EPS. Mass transport in the biofilm depends on diffusion meanwhile thickness of the biofilm depends on the ability of substances and oxygen penetration. Genetic transfers happen when channel and pores crossed into biofilm. These changes can cause resistance to the toxic compounds [26].

3.3.4 Aerobic Granules Microbial self-immobilization is one of the examples of aerobic granules. The EPP setting ability of granules and high concentration of microorganism in its structure. The presence of slow growing bacteria and denitrification promotes aggregation and formation of granules [27].

3.4 Protozoa Protozoa play roles in removing of the organic matter in sewage but as the main role as predatory activity they conduct on bacteria in liquid medium. Protozoa is also related in activation sludge in wastewater treatment besides bacteria. Protozoa also maintain good balance in the biological ecosystem by eliminating the excess bacteria, promote their growth and promote floc [28]. Protozoa can mineralize carbon in activated sludge and can eliminate mineral nutrient when the carbon source is expedited by bacteria. Meanwhile, protozoa can secrete growth stimulating substances that can promote bacterial activity [29].

IV. CONCLUSION

Treatments adopted are geared toward acheiving common goal of water quality standards to ensure environmental protection. Wastewater are being generated from different sources ranging from industrial productions to domestic activities, and various treatment techniques are put in place, which includes biological methods. For effectual treatment, considerations are paid to charcterisation of wastewater, requirement of treated wastewater standard, alternative ways of treatment as well as associated sampling methods with analysis. In order to have better understanding and control measures of wastewater treatment processes, it is requisite and paramount to understand the role played by microbial community structure of the organisms taking part in the treatment processes. Generally, microorganism enzymes taking part in degradation of environment contaminants are very specific in catalysis for each substrate. However, when microorganisms are subjected to new growth conditions or substrates, they are capable of synthesizing new enzymes to produce energy and nutrients from different substrates or under new growth conditions after an acclimation period. Controlling the microorganism activities is essential, so as to utilize its potentials for bioremediation purpose. Several methods exist for the control of this activity like the designed pathways for precluding any biodegradation limitation, and the utilization of available genomic resources to construct the new pathways, and the explosion of entire-genome sequence information. Adoption of biological approach ahead of others is being canvassed because of its greener nature as well as its relatively lower cost. Yet, the time taken when utilizing biological approach of wastewater treatment is a recurring factor that is a disadvantage, and the wide range of pathogens in wastewater often rise concerns on the utilization of microbes in treatments.

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