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REVIEW ON WASTEWATER TREATMENT TECHNIQUES

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ABSTRACT - In the world of pollution it is necessary and important to increase the efficiency of water cleaning processes i.e. removing the residuals from domestic waste water. The current study focusses on the methods of treatment of the residual wastewaters, with respect to finding the optimum condition and parameters for water treatment process. The contents of human and animal bio-waste are constant and unmanaged wastewater directly contributes to the contamination of available fresh water supplies. Domestic wastewater treatment is done to reduce the numbers of excreted pathogens to low levels and therefore the risks of further environmental transmission of emerging diseases are considerably reduced. Review study explains how treated wastewaters can be effectively and safely used in agriculture, industries and aquaculture, etc. also suggestions on how innovative and appropriate technologies can contribute to wastewater treatment and reusing the same water is highlighted which are currently accepted in order to protect the environment, humans and the animal health..

Key words: Wastewater, Water treatment, pathogens.

I. INTRODUCTION

Water resources are enhancing increasingly limited around the world due to the growing imbalance between freshwater availability and consumption, therefore the entry to clean and safe water has become one of the major challenges of our modern society[4].
Water demand increasing due to the following reasons:

a) Increasing of population and migration to drought regions.
b) Rapid industrial development and expanding water use per capita.
c) Climate change leading to changing weather patterns in populated areas.

The function of a wastewater treatment plant is to accelerate this natural cleansing process. The form of wastewater collection and treatment has been developed and, using some of the most technically biological, physical, chemical and mechanical techniques available. As a result, public health and quality of water are protected better today than ever before.

Waste Water Sources:
Wastewater can be defined as the flow of water which is discharged from homes, businesses, industries, commercial activities and institutions which is passed to treatment plants by a carefully designed and engineered network of pipes. This wastewater is further classified and defined according to its sources of origin. The term "domestic wastewater" refers to flows discharged basically from residential sources generated by such activities as food preparation, laundry, cleaning and personal hygiene, sanitary. Industrial and commercial wastewater is flow generated and discharged from manufacturing and commercial activities such as printing, food and beverage processing and production. Institutional wastewater defines wastewater generated by large institutions such as hospitals and educational facilities. Typically 200 to 500 liters of wastewater are generated for every person each day. The amount of water discharged in a treatment plant

varies with the time of day and with the season of the year[5].

II. TYPICAL WASTE WATER TREATMENT TECHNIQUES.

a. Biofilm Technology.

Biofilm is simply defined as communities or bond of micro-organisms that are attached to a surface. Formation of biofilm could be achieved by a single or multispecies of microorganisms that have the ability to form at biotic and a- biotic surface. As a general, there are few steps that are important for development of biofilm, which starts with the initial attachment and establishment to the surface, followed by maturation and finally the partition of cells from surface. The principle of this method is to assess the workability of a Sequential Batch Biofilm Reactor (SBBR) to perform carbon and nitrogen removal from support design to reactor operation. This method usually has two phases. The first phase, deals with testing and selecting the most suitable SBBR operation. The second phase, deals with the most appropriate support used in a SBBR to perform the carbon and nitrogen removal. The results established in this methods indicate that the support with the highest internal surface area presents a higher biomass aggregation. Time profiles of nitrogen ions and acetate concentration leads to typical behavior of a SBBR performing carbon and nitrogen removal.

This method possesses advantages like; Biofilm offers a proficient and harmless option to bioremediation with plank tonic microorganisms since the cells in biofilm have a highly chance of adaptation and survival, particularly in unfavorable conditions. This acts as a barrier and protects the cells within it from environmental distress.

Limitations of using this method include; Biofilm formation on carriers poses problems leading to long start-up times. Overgrowth of biofilms leads to elutriation of particles. Controlling of biofilm thickness is difficult and Liquid distributors for fluidized systems are costly for large-scale reactors and pose problems with respect to clogging and uniform fluidization.

b. Aerobic Granulation Technology.

The biological treatment of wastewater in the sewage treatment plant is often accomplished using conventional active sludge systems. These systems require large surface areas for treatment and biomass separation units due to the generally poor settling properties of the sludge[6]. Aerobic granules are a type of sludge that can self-immobilize flocs and microorganisms into rounded and strong compact structures. The advantages of aerobic granular sludge are impurities settling ability, high biomass retention, nutrient removal and tolerance to toxicity. The studies indicate that aerobic granular sludge treatment could be a likely good method to treat high strength wastewaters with nutrients, toxic substances. The aerobic granular sludge usually is cultivated in SBR (sequencing batch reactor) and applied strongly as a wastewater treatment for high strength wastewater, toxic wastewater and domestic wastewater.

c. Microbial Fuel Cell (MFC) Technology.

MFC is a biochemical device that uses the bacteria as a biocatalyst to convert the chemical energy present in organic matter (e.g. glucose) into electricity. MFC comprises an anaerobic anode chamber, a cathode chamber and a proton exchange membrane (PEM) or salt bridge which separates both chambers and only allows the transfer of the proton (H^+) from anode chamber to the cathode chamber[3]. Bacteria gain energy by converting the electrons from its central metabolic system to the anode, which acts as the final electron acceptor in MFC. The electron is then conducted beyond an external circuit to the cathode where they combine with oxygen and H^+ to form water. Recently, both the mixed and pure cultures of bacteria have been utilized in MFC to generate electricity. The transfer of electron from bacteria to the anode, known as the extracellular electron transfer mechanism in MFC can be achieved in three different pathway.

i. Direct outer membrane c-type cytochrome transfer,

ii. Exploitation of electron mediators that are either externally added or produced by the microorganisms themselves.

iii. Through electrically conductive pile.

MFC offers various advantages such as, aeration is not required since the cathode is aerated passively, thus reducing the cost of operation.

As the power output and treatment ability of MFC technology, the system is still undergoing research and so not assured for real application. The major limitation of utilizing MFC is the low power density in MFC that hinders the scaling up of the system. Membrane fouling is a common problem in MFC setup with membrane which keeps repeating especially while treating wastewater that contains high quantity of suspended solid. This membranes may require continues replacement, increasing the cost of operation.

d. Phytorid System for Wastewater Treatment

Phytorid system has unique qualities of treating wastewater. Phytorid system is developed on the basis of waste water treatment by wetland which is artificially developed by engineers. There are various types of plants which are capability of cleaning the streams, rivers, wastewater, by themself. Phytorid system or it is also known as Reed Beeds introduce by NEERI (National Environmental Engineering Resurch Institute) [1].

Various advantages of using this method are:

i. Cost-Efficient Technology.

ii. Needs negligible operation and maintenance expenses.

iii. Minimum Electricity requirement

iv. Facilitates recycle and reuse of water.
v. No foul odor and No mosquito nuisance due to this technology.

III. OUTCOMES & CONCLUSION

In comparison with all the methods mentioned, Phytorid System suits most appropriately for treating waste water in domestic and industrial sector. Phytorid combines physical, biological and chemical processes all combined together which helps in ease in operation and maintenance of the system. Phytorid system is cost effective technology as it is purely based on use of the specific plants, such as elephant grass, cattails, cannas & yellow flag iris which are easily found in natural wetlands. These plants possess natural filtration & treatment capability. Use of this technology can also help in landscaping purposes.

Limitations of using this method include:

i. The wastewater passes through a sand medium on which plants are rooted. A gravel medium can be used as well and is mainly deployed in horizontal flow systems though it does not work as efficiently as sand.

ii. In warm and dry climates the effects of evapo-transpiration and precipitation are significant. In cases of water loss, a vertical flow CW is preferred to a horizontal because of an unsaturated upper layer and a shorter retention time. The effluent can have a yellowish or brownish color if domestic wastewater is treated[2].

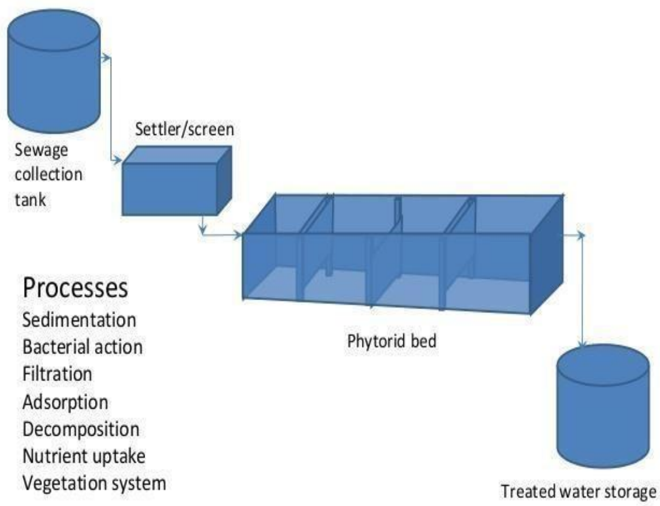

Fig. 1- Phytorid System of Wastewater Treatment

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