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Portable Treatment Plant for Institutional Canteen Waste Water Management

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Abstract:- The Municipal waste water treatment plants to be built in developing countries are expensive and their maintenance cost is high. The cost of treatment has to be low to refine the waste water. The waste water treatment plants require huge area and also the advanced equipment including human labor in handling of the same. In both advanced and developing nations, at least centralized waste water treatment plant will not always fulfil to meet the requirement for the continuous future demands that has to be sustainable. The domestic demand for water could be reduced by building Decentralized system that treat sullage for the reuse of the water to gardening purpose as the minimum usage. These smaller unit's help in reducing the Biochemical Oxygen Demand of water and chemical Demand of water hence the load on the main treatment plant can be decreased. Individual treatment plants will not have the difficulty in disposing of the sludge which pose a challenge when the waste water is chemically treated. The waste water treatment plants producing higher amount of sludge is challenge to disposing of environment, transportation, finances and space for storing.

The methods available for the treatment of waste water are mechanical, physical and chemical methods. The treatment of wastewater, sludge reduction and stabilization also includes ultrasonic, thermal and ozone pre-treatment. The capital requirement and the operational cost and some drawback suffer. However, the technical challenges to operate with skilled and unskilled labour also suffers in effective functioning. Bio engineering technologies based on these raw materials are promoting, regulating, improving and enhancing their self by including the technologies that does not require energy and waste will not be produced. Such units are built easily, maintained and operated with less difficulties. Low or no-energy requiring zero-waste technologies, easy to construct, operate and maintain. The organics are utilized by these technologies with increased activity in conversion to energy, also helps in the exceling conversion of complex organics to simple matter. The organics that otherwise will create problems of foul smell, insect breeding and will not be utilized for other purposes. The reduction of the bio solids could be achieved well in this technology rather than others.

I. INTRODUCTION

Aerobic bio digester is a treatment system comprising of passive biological reaction that numerous organic matter and pathogens and oxygen demand from waste water. The fresh water quality varies the treatment conventionally given in India is by the process of aeration, sedimentation, coagulation with flocculation, filtration, and finally disinfection. The traditions systems are modified to suit the present water quality for treatment,as in the conventional water treatment system, the Aerobic bio-digester system has been designed incorporating following process.

- The sedimentation and coagulation process is carried out using powder of Moringa seeds. The fresh water from natural resources and polluted water from the other sources can be treated by these seeds powdered and considered as biological coagulant.
- The filtration process is carried out by incorporating vermifiltration technique and a secondary filtration unit comprising of different filter media. Earthworms promises to provide cheaper solutions to several social, economic and environmental problems plaguing the human society. Earthworms can safely manage all municipal and industrial organic wastes including sewage sludge and divert them from ending up in the landfills. Their body work as a "bio-filter" and they can "purify" and also disinfect and detoxifies municipal and several industrial wastewater. They reduce the BOD &COD loads and the TDSS of wastewater significantly.
- The disinfection process adopted here is using activated charcoal, crushed quartz candle and chlorination.

II. OBJECTIVES

- To collect the waste water discharged from number of canteens in the institution.
- To determine the various characteristics of the waste water.
- To design the aerobic bio-digester for treating the waste water in order to achieve the drinking water standard.
- To recycle the treated water for garden in the campus and also for washing utensils in the canteen.

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III. METHODOLOGY

A. Sedimentation Aided With Coagulation

The process of coagulation coverts charged particles of water to destabilize through the addition of coagulant. Sedimentation is a helps in removing the floating and suspended particle to come to the bottom of the tank due to gravity. This process being controlled by the velocity, detention time and temperature mainly in this process powder of Moringa seed is used as coagulant and allowed for sedimentation of suspended particles.

B. Filtration

The process of filtering is passing the liquid to trickle through filter media in order to remove the fine solid particles. Filtration is carried out under two stages such as

- Primary filtration is carried out using vermifiltration technique where earthworms are used as bio-digester.
- Secondary filtration unit is carried out by passing the sample series of bed such as Activated charcoal, sand and crushed quartz candle. Activated charcoal and Crushed quartz candle is used for filtration process as it is good adsorbent.

C. Disinfection

The process of removal or destroying or eliminating the pathogens from the sample is known as disinfection. Chlorination process is followed in order to prevent the growth of microorganisms. This process is carried out by using bleaching powder as disinfectant. The raw water was passing through all this unit was treated effectively, with effluent confirming to established standards.

The effluent samples were analyzed for various parameters such as, Total solids, Chloride content, Acidity, Alkalinity, pH BOD, COD.

IV. RESULTS

The laboratory model was studied for the presence of earth worms so that it will not be not be causing any foul smell, effective filtration thoroughly through the filter materials placed in the tank. The tank consists of the various filter bed media for water purification. Problems were not encountered during the process in Aerobic bio-digester system throughout the experimental study.

- The filter beds were effective in the vermi-filter to filter through the beds of vermi filter unit as well as secondary filtration unit throughout the experimental study.
- The study period showed consistently the active earth worms growing steadily throughout the process in the filtration unit. Earthworms grew in large numbers during the study period of four weeks.
- The contributions of earthworms in the percentage removal of all analyzed parameters were improved 100%, 100%, 57.63%, 13.50%, 13.835%, 70.76%, 71.29% of COD, BOD, TS, pH, Acidity, Alkalinity and Chloride contents respectively.to degrade the organics effectively was possible form the earthworms in the aerobic filtration unit.

Table 1: Results of influent and effluent sample analyzed for various parameters over a span of 1 week.

Sl No	Odour		Total solids			Alkalinity			Acidity			pH			BOD			COD			Chloride		
	I	E	I	E	% R	I	E	% R	I	E	% R	I	E	% R	I	E	% R	I	E	% R	I	E	% R
1	unpleasant	odourless	1400	659	53	745	210	72	272	250	8.1	8.6	7.2	16	200	0	100	275	0	100	839	220	74
2	unpleasant	odourless	1640	694	58	800	222	72	254	220	17	8.2	7	15	210	0	100	253	0	100	850	250	71
3	unpleasant	odourless	1714	703	59	850	234	73	305	260	15	8.7	7.2	18	205	0	100	260	0	100	825	280	66
4	unpleasant	odourless	1593	615	61	770	216	72	258	240	7	8.4	7.6	9.5	213	0	100	238	0	100	863	240	72
5	unpleasant	odourless	1647	718	56	830	265	68	310	260	16	8.6	7.9	7.6	220	0	100	267	0	100	880	260	72
6	unpleasant	odourless	1625	672	59	780	248	68	289	230	20	8.7	7.3	16	190	0	100	250	0	100	875	235	73

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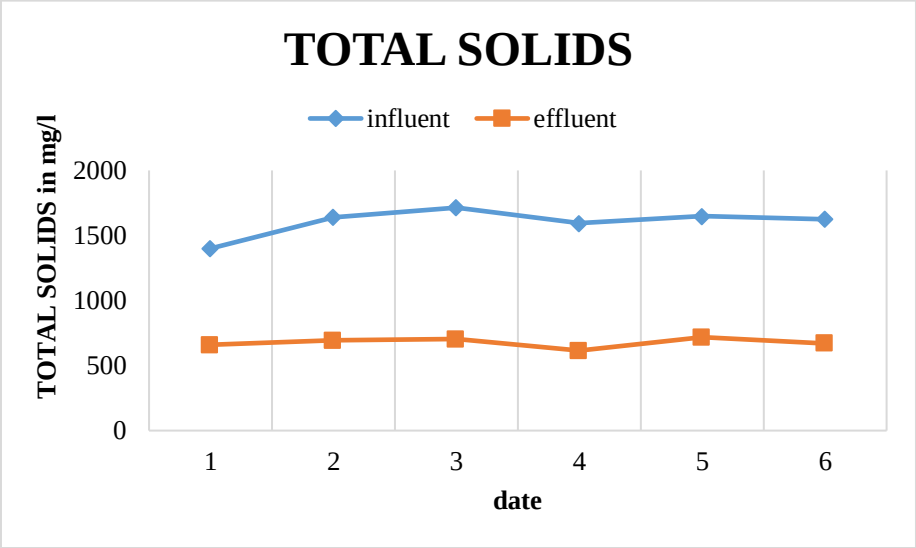
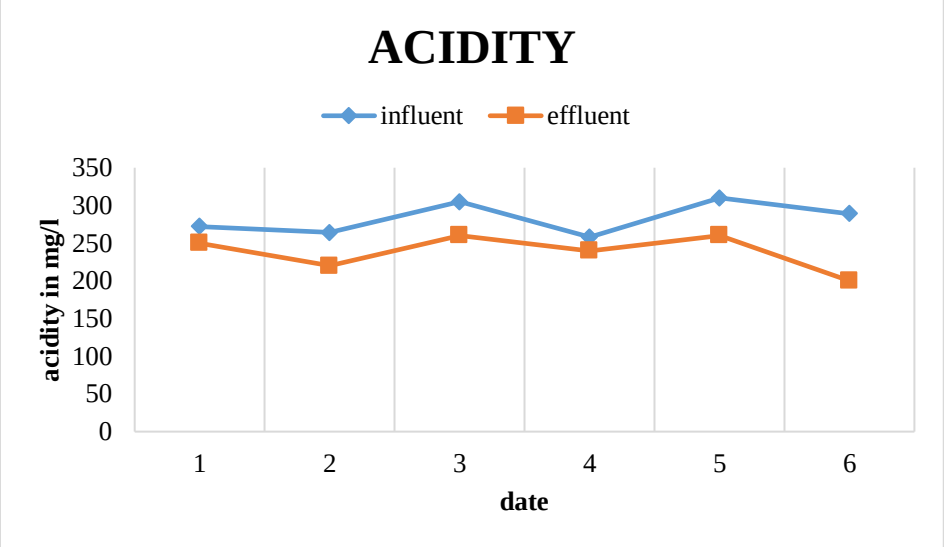
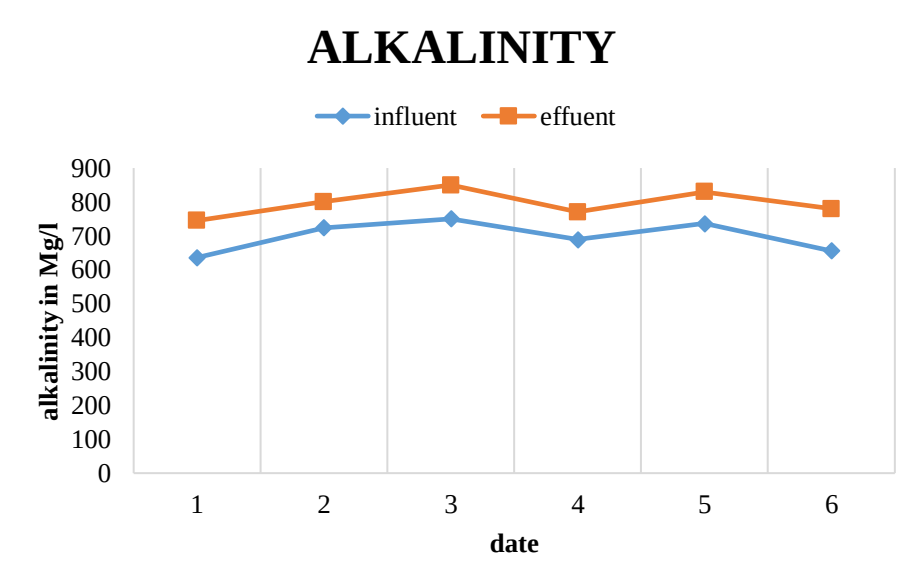


Graph 1: Representig total solids of influent and effluent after treatment



Graph 2: Representig total solids of influent and effluent after treatment



Graph 3: Representig total solids of influent and effluent after treatment

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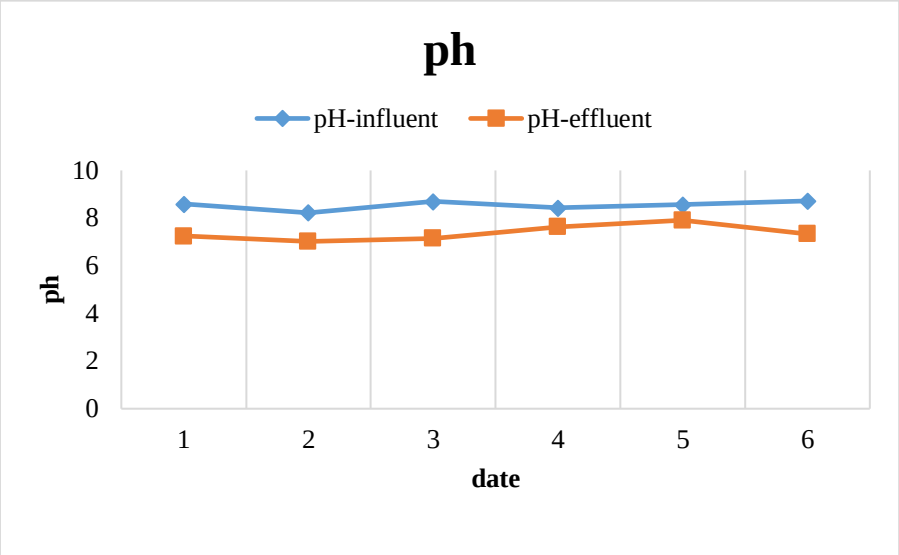
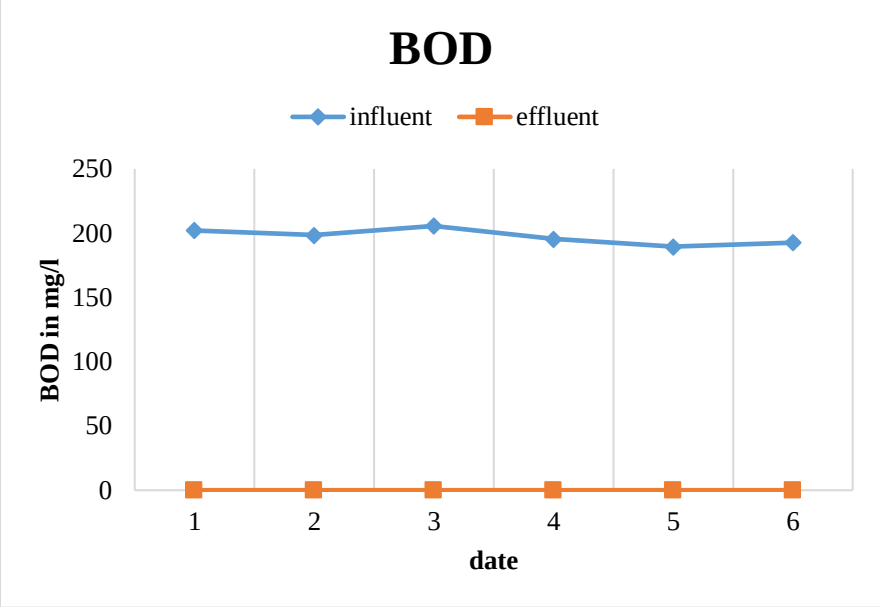
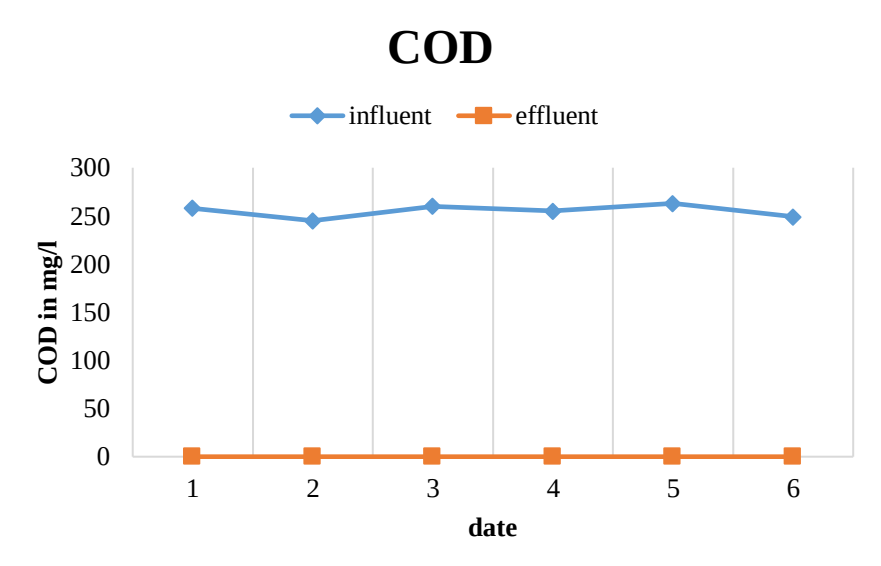


Graph 4: Representig total solids of influent and effluent after treatment



Graph 5: Representig total solids of influent and effluent after treatment



Graph 6: Representig total solids of influent and effluent after treatment

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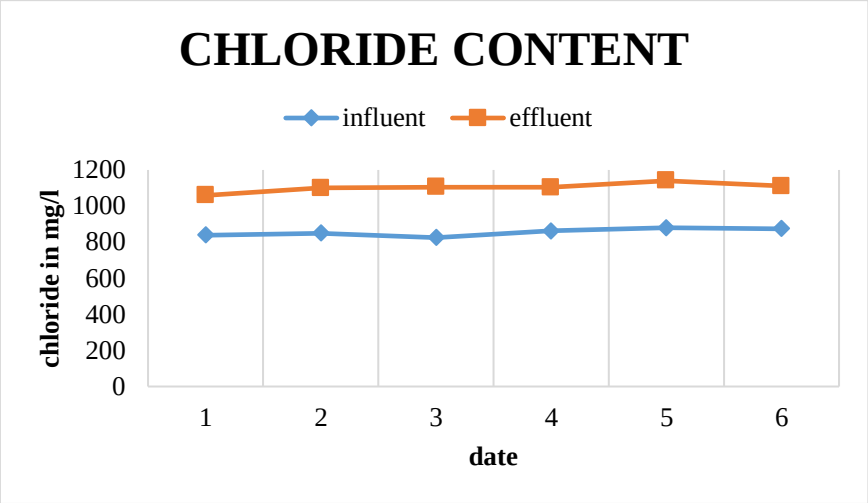
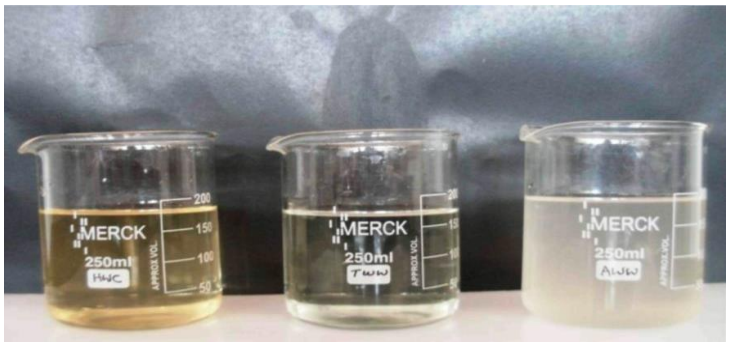


Graph 7: Representig total solids of influent and effluent after treatment



K J I

Fig. 1: K – Waste water to be treated,J –Treated water from the filter beds, I – wastewater for end use

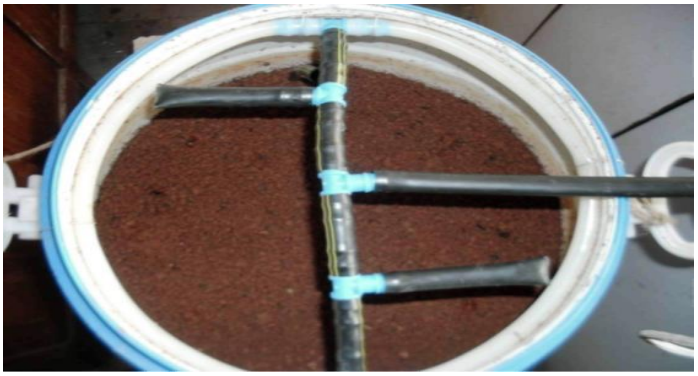


Fig. 2: Set up of the vermi filtration unit developed.

Fig. 3: Schematic Sketch of the Units of the Plant

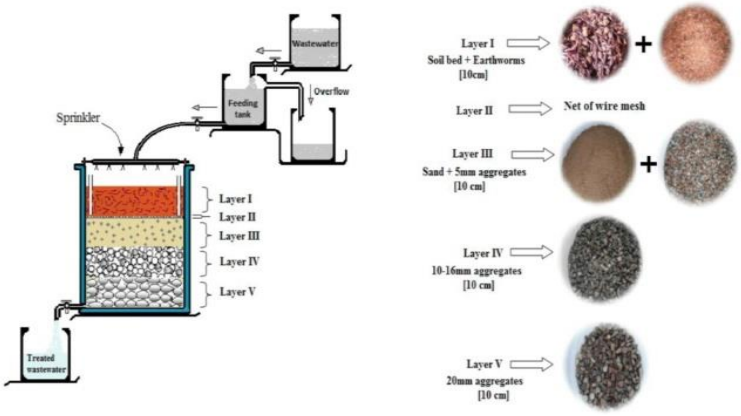


Fig. 4: Schematic Sketch of the Units of the Plant

V. CONCLUSION

According to the experiment the conclusion were outlined below:

- From the study on the filtration technique the removal of Biochemical oxygen demand, Chemical oxygen demand and total solids are effectively carried out by the aerobic digester.
- The test shows that aerobic bio digester can be cost effective and odor free process for waste water treatment with the efficiency, economy and potential for decentralization.
- The Biochemical oxygen demand, Chemical oxygen demand was removed and the majority was degraded with the decomposition process carried out by the action of earthworms, removal of total solids was achieved by the filter media and coagulant used and pathogens were removed by the disinfectant used.
- Because the Aerobic bio-digester was able to significantly reduce the Biochemical oxygen demand, Chemical oxygen demand and total solids from wash water or the sullage of canteen, This digester can serve to treat the domestic waste water very effectively.
- From the experimental data it can be concluded that, reduction of wastewater characteristics was greatly facilitated by the addition of sawdust to the soil, which could enhance the porosity of soil.
- This laboratory-scale study may allow extension of methodology to applications like controlling water pollution in rural areas that cannot be served by conventional waste water treatment systems.

VI. RECOMMENDATIONS

- The present study has shown the removal potential of bio-digester for the characteristics of waste water like BOD, COD and solids.
- The present work can be further extended to treat the food processing industry wastewater which contain mainfraction of organic waste i.e. the industries such as food processing, dairy industries, sugar industries, paper and pulp industries etc.
- Further studies may be carried out adopting robo-sand instead of using normal sand bed layer and incorporating resins in filtration unit as a filter media to reduce hardness.
- For better results present work can be further carried out by implementing sequential vermifiltration units.
- Further investigations can be studied under different hydraulic loading rate by altering the flow to study the effectiveness of bio-digester's efficiency.

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