ISSN 2277 – 5528
Impact Factor- 4.015

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & MANAGEMENT

DECENTRALIZED WASTEWATER TREATMENT FACILITY

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ABSTRACT

Providing reliable and affordable wastewater treatment in rural areas is a challenge in many parts of the world, particularly in developing countries. The problems and limitations of the centralized approaches for wastewater treatment are progressively surfacing. Centralized wastewater collection and treatment systems are costly to build and operate, especially in areas with low population densities and dispersed households. Developing countries lack both the funding to construct centralized facilities and the technical expertise to manage and operate them. Alternatively, the decentralized approach for wastewater treatment which employs a combination of onsite and/or cluster systems is gaining more attention. Such an approach allows for flexibility in management, and simple as well as complex technologies are available. The decentralized system is not only a long term solution for small communities but is more reliable and cost effective .this paper presents a review of various decentralized approaches to wastewater treatment and management. a discussion as to their applicability in developing countries primarily in rural areas and challenges faced is emphasized all through this paper .while there are many impediments and challenges towards waste-water management in developing countries these can be overcome by suitable planning and policy implementation .

***Keywords**:* Decentralization, biomedia rotating filter, microfiltration, planted gravel filter, activated carbon filter, ozonation

I. INTRODUCTION

Environment is repeatedly experiencing highly stressing phenomena related to deficient or non-existent wastewater and waste treatment plants, compromising the accessibility to water and sanitation with the resulting health troubles. To cope with this problem, decentralization, in association with local governance, is increasingly recognized as a potentially suitable way to contribute towards reducing the world's population with no access to a clean water supply or lacking proper sanitation, as well as increasing the efficiency of wastewater treatment and treated wastewater recovery and reuse. The goal of environmental sustainability should be pursued to reduce all discharge dilution phenomena, maximize treated wastewater reuse and by-products recovery.This paper tries to highlight the main aspects of decentralization, pointing out the fact that it is not at all in contrast with centralization, but is a way to integrate and increase the general performance of wastewater treatment.Wastewater is nowadays considered as a renewable resource from which potable/non-potable water and energy (e.g. from anaerobic digestion processes) as well as fertilizers could be derived.

II. LITERATURE REVIEW

Decentralized treatment is principally defined by the fact that raw wastewater is treated next to the source. Decentralization in wastewater treatment can consist of from one to several decentralized systems: from individual on-site systems, to a series of larger clusters or semi-centralized plants, going to a range of various potential alternative options.(Giovanni Livralato), 2011 [4],et al summarizes that Decentralization seems top increase the possibility of Achieving some of the united nations millennium development goals that is mainly to halve by 2015 the proportion of population without sustainable access to save drinking water and basic sanitization. Ensuring environmental resources increasing the accessibility to water and sanitation does not imply overexploitation of existing resources by improving the management by reducing,recycling and reusing as well as identifying new water sources such a storm water and reclaimed water.Conventional or centralized waste water treatment plant usually is government or company owned they are located at a particular location in the city/town, because of all this the cost of conveying the sewage, pumping the sewage, etc adds to the cost of treatment more over than the cost of the land, machinery and disposal problem .

Conventional process includes primary secondary and tertiary treatment processes which include conventional screening followed by coagulant aided sedimentation, aeration, activated sludge processes, clarifiers, disinfection,

etc. This system proves costly and cannot completely treat the waste water some waste water is directly drained into local water bodies and also disposal of sludge is a major issue .The analysis of more recent trends in wastewater management inevitably led to identifying the major advantages and disadvantages of both centralized and decentralized treatment approaches.

This section summarizes some statements reporting their pros and cons mainly referring to the essential information that, according to Brown et al. (2010), should be provided: life span of system elements, estimated capital and operating costs, periodic maintenance and operation costs, energy use, residuals, water and nutrient budgets and water reuse potential. Due to their importance, economic and social issues are discussed in the following relative sections .On centralization, some general statements may be provided from a series of authors such as that Treatment procedures

Preliminary Treatment
The objective of preliminary treatment is the removal of coarse solids and other large materials often found in raw wastewater.

Primary treatment
The objective of primary treatment is the removal of settle able organic and inorganic solids by sedimentation, and the removal of materials that will float (scum) by skimming.

Secondary treatment
The objective of secondary treatment is the further treatment of the effluent from primary treatment to remove the residual organics and suspended solids. In most cases, secondary treatment follows primary treatment and involves the removal of biodegradable dissolved and colloidal organic matter using aerobic biological treatment processes

Tertiary and/or advanced treatment
Tertiary and/or advanced wastewater treatment is employed when specific wastewater constituents which cannot be removed by secondary treatment must be removed

III. ANALYSIS

A. Quantity of Sewage Generated:

The project work is based on design of treatment plant for a community of 2000 persons which is roughly calculated considering a medium sized residential colony or a medium sized commercial complex As per CPHEEO Norms the sewage quantity generated by an individual is about 150litres per day, hence for a community of 2000 persons, Sewage generated = 2000*150 liters /day =300,000 liters/day = 300 CMD

B. Characteristics of sewage:

sampling of sewage - Grab samples of sewage from public sewer were collected on 5/10/16 at Dadar pumping station for the purpose of analysis of the influent characteristics as per CPHEEO manual

Tab. 1 Iinfluent characteristics

Sr.no	Parameter	value
1	Biological oxygen demand BOD	100-200mg/l
2	Chemical oxygen demand COD	200-400mg/l
3	Total suspended solids TSS	100-200 mg/l
4	Free ammonia	10-14 mg/l
5	Dissolved oxygen	Below detection limit
6	Temperature	29℃
7	Chlorides	70-150 mg/l
8	pH	6.9
9	Oil and grease	Below detection limit

ISSN 2277 – 5528
Impact Factor- 4.015

IV. METHODOLOGY

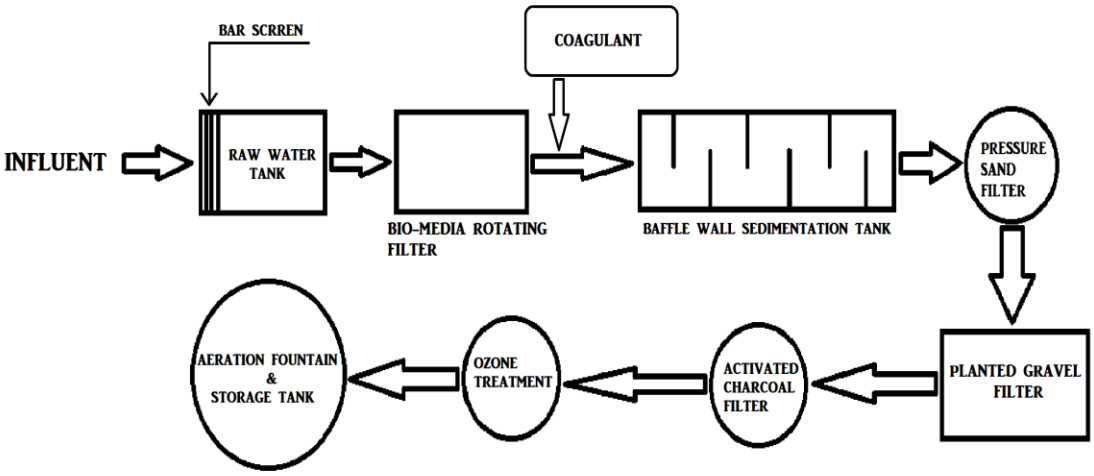

Fig. 1-sequence of treatment.

A. Bar Screen

The primary treatment incorporates unit operations for removal of floating and suspended solids from the wastewater. They are also referred as the physical unit operations.

B. Bio-Media Rotating Filter

In the BMRF process, the bio-solids are separated by means of a polymeric membrane based on microfiltration or ultrafiltration unit, as against the gravity settling process in the secondary clarifier in conventional activated sludge process.

C. Coagulation

In coagulation treatment chemicals are used in effluent water treatment processes for solids removal, water clarification, softening, sludge thickening, and solids dewatering. Coagulants neutralize the negative electrical charge on particles, which destabilizes the forces keeping colloids apart. When an inorganic coagulant such as Ferric Alum is added to water containing a colloidal suspension, the cationic metal ion from the coagulant neutralizes the negatively charged electric double layer of the colloid.

D. Sedimentation tank with Baffle wall

Sedimentation tanks are essential hydraulic structures used to remove most of suspended sediments which enters the intake by flowing water. The bigger the basin, the best the retardation of the sediments, but the expenses and dredging are higher too therefore, improvement of performance and increasing sediment removal efficiency of settling basins by providing baffles.

E. Pressure Sand Filter

In pressure sand filter, pressure drop across a clean sand bed is usually very low. It builds as particulate solids are captured on the bed. Particulate solids are not captured uniformly with depth, more are captured higher up with bed with the concentration gradient decaying exponentially. The build-up of particulate solids causes an increase in the pressure lost across the bed for a given flow rate

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F. Planted Gravel Filter

In this process natural functions of vegetation, soil, and organisms to treat different water streams. Depending on the type of wastewater that has to be treated the system has to be adjusted accordingly which means that pre- or post-treatments might be necessary. These are Constructed wetlands designed to emulate the features of natural wetlands, such as acting as a bio filter or removing sediments and pollutants such as heavy metals from the water. Planted gravel filter emphasizes on removal of Phosphorous and Nitrogen.

G. Activated charcoal filter

Granular activated carbon (GAC) is commonly used for removing organic constituents and residual disinfectants in water supplies. This not only improves taste and minimizes health hazards; it protects other water treatment units such as reverse osmosis membranes and ion exchange resins from possible damage due to oxidation or organic fouling

H. Ozone Treatment

Ozone wastewater treatment is a method that is increasing in popularity. An ozone generator is used to break down pollutants in the water source. The generators convert oxygen into ozone by using ultraviolet radiation or by an electric discharge field.

Ozone is a very reactive gas that can oxidize bacteria, moulds, organic material and other pollutants found in water Using ozone to treat wastewater has many benefits: Kills bacteria effectively.

Oxidizes substances such as iron and sulphur so that they can be filtered out of the solution.

I. Storage of treated sewage water

Storage of the treated water shall be done in an open fountain of circular shape .the fountain shall not only act as storage for water but also will add beautification or aesthetic value

V. CONCLUSION

Effluent characteristics after process:

The effluent obtained after the process which would be stored in an open pond cum fountain shall be used for washing cars, cleaning of streets, gardening & horticulture purposes hence effluent would have the following characteristics

Tab.2-effluent characteristics

Sr No.	Parameter	Value
1	Biological oxygen demand BOD	<5mg/l
2	Total suspended solids	<10mg/l
3	Ph	6.5-9
4	Nitrogen as ammonia	<10 mg/l
5	Fecal coli forms	,200 nos./100ml
6	DO	Not less than 2mg/l
7	Colour	Colourless
8	Odour	Odourless

- Tailor made decentralized sewage treatment plant for residential colony /commercial complex
- Self-reliable sanitation solution
- Decreased load on central sewage treatment units
- Zero discharge norm for colonies
- Recycling and reuse of water for various purposes
- Use of waste water as a resource

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ISSN 2277 – 5528
Impact Factor- 4.015

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