International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Development of Energy Sustainability in the Waste Water Treatment Plant at Chennai

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A B S T R A C T

Anaerobic absorption (AD) is a demonstrated innovation for sewage slop treatment and which permits age of sustainable power source from a similar procedure. Amid AD, microorganisms separate the natural issue contained in the ooze and convert it into biogas, a blend of fundamentally methane and carbon dioxide, which can be utilized for power, heat and biofuel generation. Biogas is delivered by anaerobic assimilation of biomass because of the breakdown of fats, proteins and sugars, which comprise the main part of natural issue. Biogas, a wellspring of non-customary vitality is created by aging of sewage ooze. The sewage have gathered through sewage siphoning stations and treated in the essential and auxiliary treatment ventures in sewage treatment plant at Nesapakkam, Chennai. The Sewage Treatment Plant gets about40 MLD sewage from various siphoning stations. Crude sewage comprises of natural and inorganic solids in broke down and suspended structure with 90-99.9% of water. After treatment, gigantic measure of sludge stays as strong waste. Around 220cum/day fluid sludge is being gathered every day. The thickened sludge siphoned to the anaerobic digester. The muck experiences biodegradation within the sight of methanogenic microbes and created biogas comprises of methane. After anaerobic absorption the processed sludge dried in the sludge drying bed and it tends to be utilized as soil conditioner or treating the soil. The present investigation was centered around biogas generation from the sludge siphoned to the Digester day by day for Digestion. The present investigation expects to energize economical and proficient generation, transformation and usage of biogas in city WWTPs. The greatest biogas creation was seen in volume 70 m3/ML amid summer and least volume of gas creation was seen amid winter as 40 m3/ML. The biogas is utilized to create vitality source and to work the treatment plant and others as lighting, lab works and so on. The Plant produces power from the biogas delivered in the Sewage Treatment Plant. "The Plant will likewise help in decreasing air contamination by catching and consuming Methane created at Sewage Treatment Plant for power generation".

Keywords: Total solids, volatile solids, Biomethanation, Biocomposting, Biogas, Sewage, Sludge, Anaerobic digestion

1. Introduction

Energy has a major economical and political role as an important resource traded worldwide. Energy consumption in the developed countries has been more or less stabilized whereas in developing countries like India it is increasing at a high rate. The Government is looking forward to Biomethanation Technology (BT) as a secondary source of energy by utilizing industrial, agricultural and municipal wastes. A large amount of money is being invested in this direction with various projects under implementation and many to follow them. Hence the long-term sustainability of the technology needs to be judged to improve bio-degradability or bioactivity of the treated sludge.

Anaerobic digestion

Anaerobic digestion (AD) has become an increasingly important industrial process. AD is a green technology involving the generation of methane-rich biogas via the biological degradation of regionally available biomass like agricultural and municipal solid wastes and wastewaters. AD processes have for many years been used to treat and sanitize sewage sludge waste from aerobic wastewater and animal manure, reduce its odor and volume, and produce

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useful biogas. Biogas in turn is a first generation, renewable biofuel that offers the prospect of replacing fossil fuels in the transportation sector and limiting the net greenhouse gas emissions implicated in climate change.

At the same time, the sludge is stabilized and its dry matter content is reduced. The benefits of AD of sewage sludge are widely recognized and the technology is well established in many countries. Today, a high proportion of biogas produced in AD plants is from those on municipal wastewater treatment sites and there is still an enormous potential to exploit worldwide. Sewage sludge is produced in wastewater treatment plants (WWTPs) as part of the water cleaning process (shown in Figure).

The sludge contains the particles removed from the wastewater, which are rich in nutrients and organic matter, leaving the water clean for its release into nature. Growing population centre's and expanding industry, which are increasingly well served by wastewater treatment facilities, result in rapid growth of sewage sludge production. As important consumers and generators of energy, WWTPs are one of the numerous players influencing developments towards energy sustainability.

The weight has been expanded on the regular wellspring of vitality because of proceed with prerequisite of vitality that expanded the significance of inexhaustible and non-ordinary wellspring of vitality. Then again because of consuming of petroleum product odds of Global warming is likewise expanded by which a large portion of the nations pull in towards the significance of non - ordinary wellspring of vitality. Bio-vitality creation dependent on disintegration of ooze material certainly is useful in taking care of the issue of vitality emergency in the house hold of staff/research facility at site and to expel some weight from the regular wellsprings of vitality (Mukharje,2007).

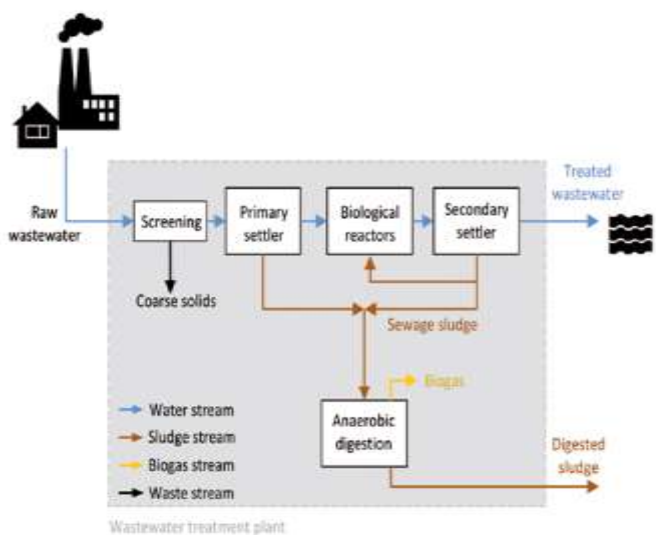

Fig 1.Waste Water Treatment Plant

The sewage treatment plant at Nesapakkam, got 40 MLD sewage from thirteen siphoning station all through the south Chennai. In this treatment plant sewage is being dealt with and remaining buildup (ooze) being utilized as slurry, which have high volume of TS and VS. The slime is being thickened in thickener and siphoned to anaerobic digester. In the anaerobic slop digester, microbial movement happens and delivers 55-65% methane with alternate gases, (CO_2, H_2S). This is called as Biomethanation process. Biogas is an ecological neighborly, clean and shoddy fuel. It is delivered by the maturation procedure in the vault type slop digester. The gear (compartment) in which created gas is being put away, called as Gas Holder. In changing over biogas to electrical vitality utilizing gas-motor generators, the evaluation depended on the biogas utilization of 0.50 m3 (kWh)- 1. Then again, 1 kWh of power would be produced by 0.34 L diesel (Salam, 1985).

2. Materials and Methods

The Sewage Treatment Plant has capacity to treat 40 MLD sewage from main pumping station. After primary and secondary treatment, sludge is remain left that is being collected in thickener and around 73 cum/day sludge is being drained from thickener to digester tank at each 8 hrs. The sludge was taken from thickener and digester and Temperature, pH, Total solids %, Volatile solids %, and Alkalinity parameters were analyzed with the help of the procedure described by APHA (1998). Nutrients, as NPK were also analyzed by Trivedy and Goel, (1988).

3. Results and Discussion

The biogas is an ecological cordial wellspring of vitality. It is a result of anaerobic disintegration of natural issue, comprises essentially of methane, carbon dioxide and follow measures of smelling salts, hydrogen sulfide and different gases. The present investigation was done in the long stretches of winter and summer and the examining were done occasionally from the sewage treatment plant. Crude sewage comprises of natural and inorganic solids in broke up and Suspended structure with 90-99.9% of water. Physical attributes of digester slime were recorded at sewage treatment plant, as pH was watched most astounding 7.06 amid summer and least 6.89 amid winter, complete solids % was watched most noteworthy in summer 4.20% and least in winter 3.94%, Volatile solids% was watched most elevated 60% amid summer and most reduced 57.9% amid winter in the all out solids, Alkalinity was most elevated 2070 mg/l amid summer and most reduced 2050 mg/l amid winter appeared in the table . Methanogenic microbes are commit anaerobes whose development rate is by and large slower than the microscopic organisms. The methanogenic microscopic organisms utilize acidic corrosive, methanol, or carbon dioxide and hydrogen gas to deliver methane. Methanobacterium, Methanoccus and Methanosarcino barkeri were methane-delivering microorganisms, which decayed the slop and shaped biogas (Prescott and Klein, 2007).

The gas generation was seen in volume 70 m3/ML amid summer under thermophilic condition and amid the winter volume of gas creation was seen under mesophilic condition as 40 m3/ML. In this investigation the grouping of NPK (Total nitrogen 0.88 percent miniaturized scale, absolute Potassium 4.98 percent and all out Phosphorous 2.62 percent) were recorded as supplement estimations of dry ooze (Table-1).

Table 1: Nutrient Concentration in Dry Sludge (composting) at sewage treatment plant.

Total nitrogen	0.88 percent
Total Potassium	4.98 percent
Total Phosphorous	2.62 percent

Table 2: Seasonally Biogas production (m^3)

Production of biogas seasonally	**Amount of biogas production (m^3)**	**Quantity of sludge**	**Temperature range (°C)**
Winter	40 cum/MLD	140cum/ day	25-35 °C
Summer	70 cum/MLD	220cum/ day	25-45 °C

Table 3: Chemical characteristics of Digester sludge at sewage treatment plant.

	Parameters	**Winter**					**Summer**			
1	pH	6.98	6.97	6.98	6.89	7	6.98	7	7.06	7.02
2	Total solids (%)	3.94	3.88	3.62	3.84	3.58	4.20	4.12	4.06	4.06
3	Volatile solids (%) in Total Solids	57.9	58	58.5	57.9	58.6	59.5	59.7	59.6	60.0
4	Alkalinity (mg/l)	2000	2050	2015	2020	1560	2050	2010	2030	2070

As indicated by Lee et al., (1970) additionally made an examination on ranch scale Biogas plants which have been intended to process pig slurry of 10 m3 day – 1 under mesophilic conditions. In this framework, the biogas age rate was 138-m3 day – 1, with 230 kg of unstable solids expansion. To deliver the power, the measure of biogas expended was 1.8 m3 per kwh at 5-9 kw power loads. This outcome demonstrated that sustainable power source generation with 2000 pig was 216000 kwh yr-1 - enough to satisfy the power needs of 100 provincial family units in Korea. Chanakya et al. (1992) used significant piece of SW for biogas generation. The anaerobic digester utilized in present examination is having appropriate blending. The income to be gotten from side-effect usage in the anaerobic treatment framework is related with vitality recuperation from the biogas methane produced and supplement recuperation from the digester profluent. Biogas containing 73.4 percent methane with calorific esteem 6052 k cal/kg.

Hamzawi et al. (1998) assessed the specialized possibility of the anaerobic co-absorption of sewage slime with the natural portion metropolitan strong waste. Utilizing natural movement tests, an ideal blend was related to 25% natural portion of metropolitan strong waste and 75% sewage muck dependent on biogas creation. The city junk is a high potential bio vitality source and it very well may be successfully used for biomethanation process.

Results demonstrated that biogas yield of 70 cum/ML, showing the high biodegradability of the feed sludge. An examination of biogas yields per ton of feedstock material between dairy animals compost and kitchen squander uncovered that civil sewage squander possibly produces a few times more biogas than cow fertilizer. The biogas created in the 40 MLD sewage treatment plant is utilized for power generation. The power delivered at site is utilized for working the STP and for lighting, and so forth, consequently appropriate upkeep of the plant is normally be done and remembering the view to build up the non-ordinary wellsprings of vitality.

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