Operations of Sewage Waste to Zero Waste

(Environmental Friendly Treatment)

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***Abstract*— In our world wastes are generated in huge amount. Especially in our country, wastes are generated in huge and they are not treated regularly. If it is treated regularly we can get more money by its byproducts and these Sewage wastes are collected and it is to be treated to satisfy the needs of human beings. Like reusable water, bio-manures, bio-gas, electricity, pure oxygen, fly ash. Thus our project is eco -friendly to our environment and also benefits people through their wastes and makes India as a hygienic domain.**

I. INTRODUCTION

The proposed project which comes under the three following topics are:

1. Water resources
2. Environment
3. Irrigation.

Through this project we can attain three products which are electricity, bio –manures, re usable water, biogas. The electricity is the main source of energy which is under crisis for the past few years and also water scarcity which is the main problem that that we are facing now a days. Water is the main source of the material for the human life .so in order to achieve the human needs .the project of "ZERO WASTE MANAGEMENT OF SEWAGE WASTE "are recommended. the project enclose these needs and supports human life.

Methodology:

1. The sewage waste is collected from different areas and taken through sewer pipes which are collected in large tank.
2. The water from different areas is allowed for screening process, in which solid and waste water are separated and the process of aeration takes place to support the process.
3. Then waste water is taken for the treatment and solid waste is kept aside.
4. The waste water is allowed to settle for 10-12 hours which undergoes sedimentation process.
5. Then process of coagulation and flocculation takes place in order to separate the sludge particles after sedimentation process.
6. In case of chemical waste the process of adsorption, absorption techniques are used to decrease the COD contents.
7. In case of oil content in water, polymers are recommended to clear over the oil.
8. Then process of biological treatment takes place now, trickling filter and anaerobic sludge process techniques are implemented in order to attain 99% of pure water.
9. Then the final product of water is taken for solar evaporation process, the water is heated, during heating the vapor water is very pure which is used for drinking purpose.
10. After solar boiling, the process of chlorination/ozonalisation takes place.
11. Then it is allotted for distribution with cent percent assurance for domestic purpose.
12. When reverse osmosis technique is used, the water outlet product can be consumed.
13. Now, the water is treated, the sludge from the above process and solid waste is taken for treatment to provide zero waste.
14. The sludge is now taken for the conditioning process like coagulation in which smaller particles can be precipitated below.
15. Then the process of dewatering takes place for drying.
16. Then process of thickening takes place by using roller type machineries.
17. If it is not a domestic waste, the process of stabilization takes place in order to reduce the acid and alkali contents by techniques like solidification.
18. Then process of sludge digestion takes place, during sludge digestion bi-product of bio-gas is obtained and small amount of electricity is also obtained.
19. After domestic waste it can be powdered and given as bio manure for agricultural domain.
20. Remaining waste products after bio manures extracted along with stabilization waste is taken for incineration and thermal energy is converted into electrical energy in a closed chamber.
21. The water which is treated is allowed to circulate around the chamber where heat energy is adsorbed and the process of boiling takes place for high quality of water purity.

22. The carbon dioxide forms during incineration process along with high pressure by water circulation around the chamber is allowed to turbine through narrow pipe lines in order to generate electrical power.

23. After this process, carbon dioxide is passed to turbine, it is allowed to another chamber for co2 extraction process and pure form of oxygen is formed which is taken as an aeration product for our water treatment and remaining ashes formed is taken as fly ash and given to several useful domains.

24. After incineration, the ash products which settle down in the chamber is given as a composite material for construction in Civil domain.

25. The final products which are obtained through our project is re useable water, biogas, bio manure, electricity, fly ash, pure

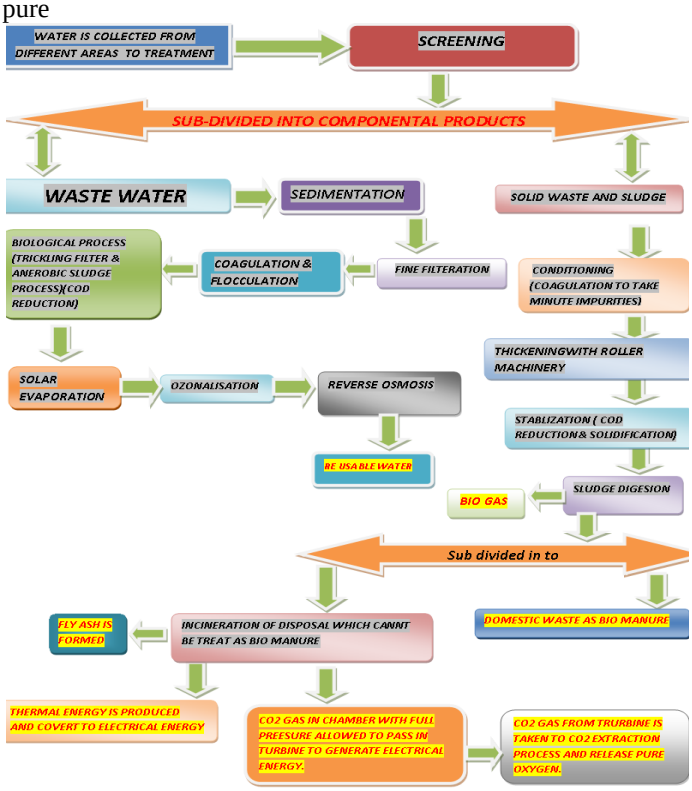

Fig : Sludge digestion process

II. STUDY AREA

We refer Theni district as our study area that does not have proper drainage system. So in order to control this menace .By constructing sewage treatment plant can product our environment and also can earn money. More over now Chennai is using underground drainage system. At last these sewage wastes are treated by sewage treatment plants and reuse beneficial to our people.

III. PROCESS DESCRIPTION

A. Sewage waste

Sewage is a water-carried waste, in solution or suspension that is intended to be removed from a community. Also known as wastewater, it is more than 99% water and is characterized by volume or rate of flow, physical condition, chemical and toxic constituents, and the bacteriological organisms that it contains. It consists mostly of greywater and the human waste that the toilets flush away; soaps and detergents; and toilet paper.

B. Screening

It is the first treatment station, both for surface and wastewater. Protect the structure downstream against large objects which could create obstructions in some of the facility's units. Easily separate and remove large matter carried along by the raw water, which might negatively affect the efficiency of later treatment procedures or make their implementation more difficult.

C. Sedimentation

Sedimentation is the tendency for particles in suspension to settle out of the fluid in which they are entrained, and come to rest against a barrier. This is due to their motion through the fluid in response to the forces acting on them: these forces can be due to gravity, centrifugal acceleration or electromagnetism.

D. Coagulation and Flocculation

In theory and at the chemical level, coagulation and flocculation is a three step process, consisting of flash mixing, coagulation, and flocculation. However, in practice in the treatment plant, there are only two steps in the coagulation/flocculation process - the water first flows into the flash mix chamber, and then enters the flocculation basin.

E. Biological treatment

Biological treatment is an important and integral part of any wastewater treatment plant that treats wastewater from either municipality or industry having soluble organic impurities or a mix of the two types of wastewater sources. There are multitudes of aerobic biological treatment process and technologies are:

IV. CONVENTIONAL ACTIVATED SLUDGE PROCESS SYSTEM

This is the most common and oldest bio treatment process used to treat municipal and industrial wastewater. Typically wastewater after primary treatment i.e. suspended impurities removal is treated in an activated sludge process based biological treatment system comprising aeration tank followed by secondary clarifier. The aeration tank is a completely mixed or a plug flow bioreactor where specific concentration of bio mass is maintained along with sufficient dissolved oxygen (DO) concentration to effect biodegradation of soluble organic impurities measured as biochemical oxygen demand (BOD5) or chemical oxygen demand (COD).

A. Cyclic activated sludge system

It is as the name, one of the most sequencing batch reactors it is employed to treat municipal waste water and industrial waste water.

B. Integrated fixed film activated sludge system

Several industries have two type of biological treatment comprising with stone or plastic media. Trickling filter followed by activated sludge process based on aeration tank, followed by secondary clarifier in the operation.

C. Trickling filter process

A trickling filter is a type of water pollution treatment system. It consists of a fixed bed of rocks, lava, coke, gravel, slag, polyurethane foam, sphagnum peat moss, ceramic, or plastic media over which sewage or other wastewater flows downward and causes a layer of microbial slime (bio film) to grow, covering the bed of media. Aerobic conditions are maintained by splashing, diffusion, and either by forced air flowing through the bed or natural convection of air if the filter medium is porous. The terms trickle filter, trickling bio filter, biological filter and biological trickling filter are often used to refer to a trickling filter. These systems have also been described as roughing filters, intermittent filters, packed media bed filters, alternative septic systems, percolating filters, attached growth processes, and fixed film processes.

D. Solar evaporation

The evaporation of water by using UV radiation it under go vaporization in the tank. Those it is fit to drink and makes our water to boiling in it.

E. Ozonalisation/chlorination

Ozone is an unstable molecule which readily gives up one atom of oxygen providing a powerful oxidizing agent which is toxic to most waterborne organisms. It is an effective method to inactivate harmful protozoa that form cysts. It also works well against almost all other pathogens. Ozone is made by passing oxygen through ultraviolet light or a "cold" electrical discharge. To use ozone as a disinfectant, it must be created on-site and added to the water by bubble contact.

Water chlorination is the process of adding chlorine (Cl 2) or hypochlorite to water. This method is used to kill certain bacteria and other microbes in tap water as chlorine is highly toxic. In particular, chlorination is used to prevent the spread of waterborne diseases such as cholera, dysentery, jaundice, typhoid etc.

F. Reverse osmosis

Reverse osmosis (RO) is a water purification technology that uses a semi permeable membrane to remove larger particles from drinking water. This membrane technology is not considered a proper filtration method. In reverse osmosis, an applied pressure is used to overcome osmotic pressure, a colligative property, which is driven by chemical potential, a thermodynamic parameter. Reverse osmosis can remove many types of molecules and ions from solutions, including bacteria, and is used in both industrial processes and the production of potable water.

G. Sludge

It is semi-solid slurry and can be produced as sewage sludge from wastewater treatment processes or as a settled suspension obtained from conventional drinking water treatment and numerous other industrial processes. The term is also sometimes used as a generic term for solids separated from suspension in a liquid; this 'soupy' material usually contains significant quantities of 'interstitial' water (between the solid particles).Industrial wastewater solids are also referred to as sludge, whether generated from biological or physical-chemical processes. Surface water plants also generate sludge made up of solids removed from the raw water.

V. CONDITIONING PROCESS

Sludge conditioning is a process whereby sludge solids are treated with chemicals or various other means to prepare the sludge for dewatering processes.

A. Chemical conditioning

The addition of the chemical to the sludge lowers or raises its pH value to a point where small particles coagulate into larger ones and the water in the sludge solids is given up most readily. There is no one pH value best for all sludge's. Different sludge's such as primary, various secondary and digested sludge and different sludge's of the same type have different optimum pH values which must be determined for each sludge by trial and error. Tanks for dissolving acid salts, such as ferric chloride, are lined with rubber or other acid-proof material. Intimate mixing of sludge and coagulant is essential for proper conditioning. Feeders are also necessary for applying the chemicals needed for proper chemical conditioning.

B. Thermal conditioning

There are two basic processes for thermal treatment of sludge's. One, wet air oxidation, is the flameless oxidation of sludge's at temperatures of 450 to 550°F and pressures of about 1200 psig. The other type, heat treatment, is similar but carried out at temperatures of 350 to 400°F and pressures of 150 to 300 psig. Wet air oxidation reduces the sludge to an ash and heat treatment improves the dewater ability of the sludge. The lower temperature and pressure heat treatment is more widely used than the oxidation process.

C. Blending

Blending is a process where two or more types of sludge's are "blended" together to facilitate a higher sludge solids concentration and a more homogenous mixture of sludge prior to dewatering. Blending operations tends to decrease the chemical demand for conditioning and dewatering sludge's. The blending operation usually takes place in sludge holding tanks normally where primary sludge is mixed with waste activated sludge. The amounts of the sludge's to be blended can only be found by experimentation, with the final results being seen at the dewatering operations.

D. *Dewatering*

Sludge dewatering is, as the name clearly implies, removing water from sludge. Sludge dewatering is typically the final step for industrial wastewater treatment processes and plants. After wastewater treatment the sludge remaining is very high in water content that can be reclaimed through sludge dewatering.

E. *Thickening*

Wastewater treatment objectives are accomplished by concentrating impurities into solid form and then separating these solids from the bulk liquid. This concentration of solids, referred to as sludge, contains many objectionable materials and must be disposed of properly. The sludge resulting from wastewater treatment operations and process is usually in the form of a liquid or semisolid liquid that typically contains from 0.25 to 12 % solids by weight, depending on the operations and processes used. Of the constituents removed by treatment, sludge is by far the largest in volume, and it's processing and disposal is perhaps the most complex problem facing the engineer in the field of wastewater treatment. Sludge disposal facilities usually represent 40 to 60 % of the construction cost of wastewater treatment plants, account for as much as 50 % of the operating cost, and are the cause of a disproportionate share of operating difficulties.

VI. STABILIZATION

1. Aerobic Digestion:

Aerobic digestion is an extension of the activated sludge aeration process whereby waste primary and secondary sludge's are continually aerated for long periods of time. In aerobic digestion the microorganisms extend into the endogenous respiration phase, which is a phase where materials previously stored by the cell are oxidized, with a reduction in the biologically degradable organic matter. This organic matter, from the sludge cells is oxidized to carbon dioxide, water and ammonia. The ammonia is further converted to nitrates as the digestion process proceeds.

2. Anaerobic digestion

The purpose of digestion is to attain both of the objectives of sludge treatment -- a reduction in volume and the decomposition of highly putrescible organic matter to relatively stable or inert organic and inorganic compounds. Additionally, anaerobic sludge digestion produces a valuable by-product in the form of methane gas.

3. Thermal stabilization

Thermal stabilization is a heat process by which the bound water (water associated with sludge) of the sludge solids is released by heating the sludge for short periods of time. Exposing the sludge to heat and pressure coagulates the solids, breaks down the cell structure, and reduces the hydration and hydrophilic nature of the solids. The liquid portion of the sludge can then be separated from the solid by decanting and pressing.

4. Chemical stabilization

Chemical stabilization is a process whereby the sludge matrix is treated with chemicals in different ways to stabilize the sludge solids.

VII. SLUDGE DIGESTION

Sewage sludge treatment describes the processes used to manage and dispose of sewage sludge produced during sewage treatment. Sludge is mostly water with lesser amounts of solid material removed from liquid sewage. Primary sludge includes settle able solids removed during primary treatment in primary clarifiers. Secondary sludge separated in secondary clarifiers includes bio solids grown in secondary treatment bioreactors.

VIII. INCINERATION PROCESS

Incineration of sludge is less common because of air emissions concerns and the supplemental fuel required burning the low calorific value sludge and vaporizing residual water. Co-firing in municipal waste-to-energy plants is occasionally done, this option being less expensive assuming the facilities already exist for solid waste and there is no need for auxiliary fuel. Incineration tends to maximize heavy metal concentrations in the remaining solid ash requiring disposal; but the option of returning wet scrubber effluent to the sewage treatment process may reduce air emissions by increasing concentrations of dissolved salts in sewage treatment plant effluent.

IX. TURBINE POWER GENERATION

It turbines are driven by a fluid acting as an intermediate energy carrier. Many of the heat engines just mentioned are turbines. Other types of turbines can be driven by wind or falling water. Sources include: These plants offer efficiency of up to 60%.

A. Bi-products

1. *Reusable water*

Reclaimed water or recycled water, is former wastewater that is treated to remove solids and impurities, and used in sustainable landscaping irrigation, to recharge groundwater aquifers, to meet commercial and industrial water needs, and for drinking. The purpose of these processes is sustainability and water conservation, rather than discharging the treated water to surface waters such as rivers and oceans.

2. *Bio gas*

Biogas typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. It is a renewable energy source and in many cases exerts a very small carbon footprint .Biogas can be produced by anaerobic digestion

with anaerobic bacteria, which digest material inside a closed system, or fermentation of biodegradable materials.

3. *Bio manures*

Manure is organic matter, mostly derived from animal feces except in the case of green manure, which can be used as organic fertilizer in agriculture. Manures contribute to the fertility of the soil by adding organic matter and nutrients, such as nitrogen, that are trapped by bacteria in the soil. Higher organisms then feed on the fungi and bacteria in a chain of life that comprises the soil food web. It is also a product obtained after decomposition of organic matter like cow dung which replenishes the soil with essential elements and adds humus to the soil.

4. *Electricity*

Electricity is the set of physical phenomena associated with the presence and flow of electric charge. Electricity gives a wide variety of well-known effects, such as lightning, static electricity, electromagnetic induction and electrical current.

5. *Fly ash*

Fly ash, also known as flue-ash, is one of the residues generated in combustion, and comprises the fine particles that rise with the flue gases. Ash that does not rise is called bottom ash. In an industrial context, fly ash usually refers to ash produced during combustion of coal.

ADVANTAGES OF OUR PROCESS

1. More labor efficient in treatment plant.
2. Clear of drainage system and septic tank.
3. Reduce and control water scarcity.
4. Avoid wastage of water.
5. To provide more employment.
6. To produce by useful products to serve people.

PROJECT ASPECT VIEWS

Financial aspect (small scale it varies depends on consumer rate).

For small scale treatment plant for 5000 users estimation. Total sq. Feet land required: 4792sq.feet land required (11 cent). Construction cost of tank and building :(125+4.5lakhs rupees).

Task capacity covered by treatment plant for above estimation:

Area covered: 100% NO. Of dwellings with sewer connections: 598249, length of the sewer mains: 2677, NO. Of pumping stations: 196, treatment plants: 5 no’s, treatment capacity: 486mld.

CONCLUSION

In order to solve caveri river and Ganges river problem. This project is useful. If its maintained as district wise. In future we will construct a treatment plant and serve people through entrepreneurship business aspect we earn more knowledge on environmental manner.

REFERENCES

[1] Adhoum, N.; Monser, L.; Bellakhal, N.’Belgaid E.J. Treatment of electroplating waste water containing Cu2+, Zn2+ and Cr (VI) by electro coagulation. J. Hazard. Mater. 2004. B112, 207.

[2]Fox, M.; Noike, T. Wet oxidation pretreatment for the increase in anaerobic biodegradability of newspaper was te. Bioresour. Teclmol. 2004. 91, 273.

[3]Ganjidoust, H.; Tatsumi, K.; Yamagishi, T.; Gholial, R.N. Effect of synthetic and natural coagulant on lignin removal from pulp and paper mill wastewater. Water Sci. Technol. 1997, 35, 291.