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Design of Sewage Treatment Plant for Wardha City

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ABSTRACT

A detailed study on domestic waste water characterization has been performed followed by the design of sewage treatment for wardha city. The present study involves the analysis of p^H value, total solids, total suspended solids, hardness, chloride, chlorine, BOD, DO.

A Sewage treatment plant is quite necessary to receive the domestic and commercial wastes and removes the materials which pose harm for general public. Its objective is to produce an environmental safe fluid waste stream and solid waste suitable for disposal or reuse.
A sewage treatment plant is quite necessary to receive the domestic and commercial waste and removes the materials which pose harm for general public. Its objective is to produce an environmentally-safe fluid waste stream (or treated effluent) and a solid waste (or treated sludge) suitable for disposal or reuse (usually as farm fertilizer).

The samplings of the domestic waste from Wardha city have been collected in different times of the day to have an average data of the measured parameters.

KEYWORDS :- Sewage Treatment, STP, Wardha.

INTROUCTION:

The growing environmental pollution needs for decontaminating waste water result in the study of characterization of waste water, Especially domestic sewage. Recently, increasing pollution in the waste water leads to developing and implementing new treatment Techniques to control nitrogen and other priority pollutants.

Degradation of water quality is the unfavourable alteration in chemical, physical and biological characteristics of water that prevents domestic, commercial, industry, agricultural, and other beneficial uses of water. Sewage treatment plant is facility designed to receive the waste from domestic, industrial and commercial sources and to remove materials that damage water quality and compromise public health. Sewage is mainly composed of human fecal material, domestic wastes including wash-water and industrial wastes.

Objective:

The principal objective of the waste water treatment is generally to allow human and industrial effluents to be disposed of without danger to human health or unacceptable damage to the natural environment an environmentally safe fluid waste stream is produced.

1. Physical, chemical and biological characterization of the domestic waste water collecting from various areas of Wardha city.

2. Comparison with the prescribed standard.

3. Design of the sewage treatment plant.

Literature Review:

Physical characteristic of waste water:

Odour: It depends on the substance which arouses human receptor cells on coming with them. Pure water doesn t produce odour or taste sensation .Thus waste which contains toxic

substances has pungent smell which makes it easy to distinguish. Odour is recognized as a

quality factor affecting acceptability of drinking water.

The organic and inorganic substance contributes to taste or odour. The ultimate odour tasting device is the human nose. The odour intensity is done by threshold odour test.

Taste: The sense of taste mainly from chemical stimulation of sensory nerve endings in tongue .Fundamental sensation of taste are, by convention more than by research evidence, salt, bitter, and sour.

Colour: Colour in water result from the presence of natural metalic ions such as or Mg humus and peat materials, planktons and weeds.

Total solids: It refers to matter suspended or dissolved in water and waste water.

Floatables: One of the important criterion for evaluating the possible effect of waste disposal into surface water is the amount of floatable material in the waste.

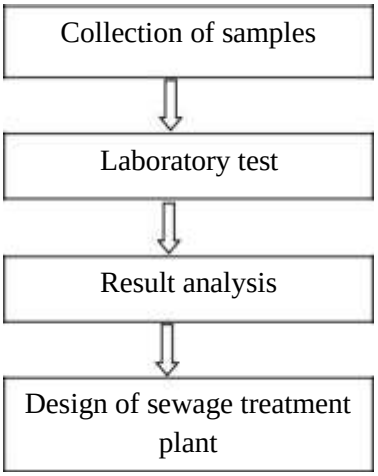
Turbidity: Clarity of water is important in producing products destined for human consumption and in many manufacturing uses.

Chemical characteristic of waste water: presence of metals their treatment the determination of inorganic constituents and the determination of organic constituents .here goes a brief description of all the experiments we have performed .Chemical characteristics of water state the

Biological characteristic of waste water: Water quality has a key role in deciding the abundance, species composition, stability, productivity and physiological condition of indigenous populations of the water

Most microorganisms known to microbiologists can be found in domestic waste water like Bacteria, Protozoa, Viruses, and Algae

METHODOLOGY



Sampling

Waste water samples have been collected in the contamination free sampling bottles from Wardha.

The collected samples were being analysed for major physical and chemical parameters like pH, Electrical conductivity, Cl^- ,Na^{2+},Ca, Mg, Total hardness .

Laboratory testing

Test	Method
pH	pH meter
Chlorides	Titration
Total hardness	Titration
Total solids	Oven
Turbidity	Turbidity meter
Acidity	Titration
Alkalinity	Titration

Result analysis

Determination of acidity

SOURCE	CONCENTRATIONIN PPM
Bath room waste water	3.2
Kitchen waste water	4.1
Tap water	1.9
Distilled water	1

Determination of chloride content

SOURCE	CONCENTRATION IN PPM	STANDARD
Bath room waste water	56.7	30-100
Kitchen waste water	112	
Tap water	3.1	

Determination of pH of the sample

SOURCE	PH	STANDARD
Kitchen waste	7.82	7.8
Bath room waste	7.32	
Tap water	7.96	

Determination of residual chlorine

SL NO	SOURCE	CONC.IN PPM	STANDARD
1	Kitchen waste	3	1-2 ppm
2	Bath room waste	3	
3	Tap waste	1	

Determination of turbidity of sample

SL NO	SOURCE	VALUE IN NTU
1	Bath room waste	13
2	Kitchen waste	115
3	Tap waste	10

Determination of alkalinity

SOURCE	CONC.IN PPM	STANDARD CONC.
Kitchen waste	74	50-200
Bathroom waste	81	
Tap waste	14	

DESIGN OF SEWAGE TREATMENT PLANT

Plant capacity:

Average water supply per day =60000lit

=0.06 mld

Average sewage Generated per day = 85% of supplied water

=0.85x0.06

=0.051mld

Average sewage generated per hour =51/24

=2.125cum/hr

Peak factor =3

Design flow capacity (max) =2.125x3

=6.375 cum/hr

Sizing calculation for collection pit:

Retention time required =4h

Average design flow $=6.375 m^3/h$

Capacity of collection sump =4x6.375

$=25.5 m^3$

Assume liquid depth =5m

Area required for collection pits =25.5

$=5.1 m^2$

Let it is a circular tank

$5.1 = \pi r^2$

r = 1.27m

Volume of the pit provided = π/4x4x4x5

= 62.8 m^3

Sizing calculation of bar screen:

Peak discharge = 6.375m^3/h

Average discharge = 2.125m^3/h

Average spacing between bar 20mm

The velocity =0.3x25.5

=7.65m/h/m^2

Cross sectional area required = flow / Velocity

= 6.375 / 7.65

=0.833m^2

Liquid depth required = 1m

Velocity through screen at the peak flow =1.6/sec

Clear area = 2.5 / 1.6 =1.3

No. of clear spacing = 1.3/0.02 =65

Width of channel = (65x20)+(67x6)

=1702mm

Width of screen =1700mm

Sizing calculation of aeration tank:

Bod in the feed sewage =100 ppm

No. of aeration tank =2

Average flow = 51/2 =25.5kld

Total bod load to aeration tank =2.125x24x100

=5.1kg

Let mlss =2000mg/1,f/m =0.15

Volume of tank required = (Q x bod load) / (fmxmlss)

= (25.5x100) / 0.15x2000

=8.5m^3

Assume liquid depth =3.5m

Area = 8.5 / 3.5m

=2.42m^2

Tank size provided =4.5x4.5x3.7

So,volume of tank =75m^3

Check for aeration period/hydraulic retention tim:

Hydraulic retention time t =75x24 / 25.5

=70h

So the tank retention time is more than the required time.

Sizing calculation for sludge drying beds

Maximum design flow rate =6.375m^3/h,51 kld

Total feed suspended solid =250ppm

Total outlet suspended solid =50ppm

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Load to the clarifier =250-50
=200ppm

Sludge generated per day =51x200
1000

=10.2kg/day

Solid content in feed =3%

Specific gravity of the sludge =1.015

Volume of sludge =((10.2/0.03)
(1000x1.015))
=0.33m^3

For our college condition, the beds get dried out about 7 days

No. of cycles per year =365
7
=52 cycles

Period of each cycles =7 days

Volume of sludge per cycle =0.33x7

=2.31m^3/cycles

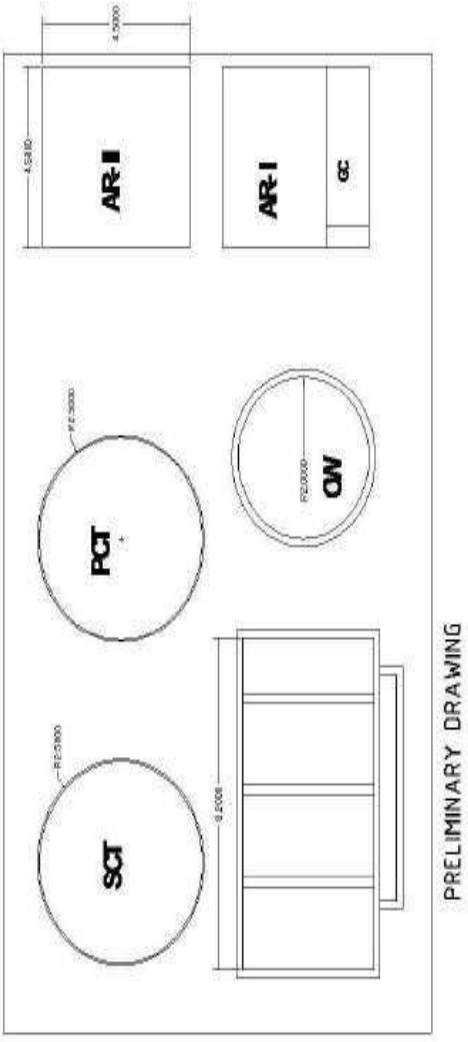
Spreading a layer 1m per cycle,

Area of bed required = 2.31/1

=2.31m^2

So area of 16.55m^2 drying beds is provided for The above system. Hence, Sludge Drying Bed has dimensions of 4.5mx4.5mx1m of two numbers.

Fig 5.1 Top View of Sewage Treatment Plant



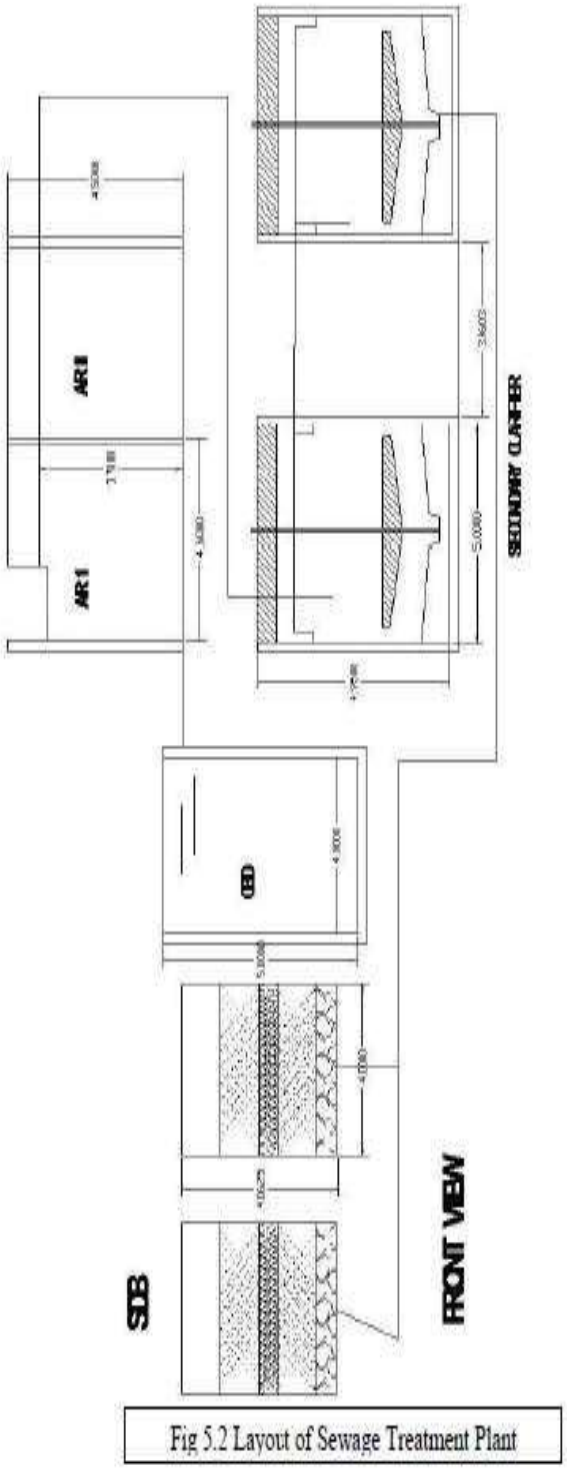


Fig 5.2 Layout of Sewage Treatment Plant

CONCLUSION

The average ranges of physical, chemical and biological characteristics of waste water quality are experimented and found out.

- The Ph range from 7.8 to 8.01. The Turbidity ranged from 10 to 120 NTU.
- The value of Turbidity was found to be within the permissible limit.
- The Chloride and Alkalinity were in the range of 3.5 to 120 mg/l and 15 to 80 mg/l respectively.
- The Total Iron content was in the range of 0 to 3 mg/l.
- The Zinc content was in the limits of 0.1 to 2 mg/l.
- Copper content ranged from 0 to 0.2 mg/l.
- Potassium was present in the limits of 2 to 12 mg/l.
- The parameters studied resemble the waste water quality.
- Total amount of waste water treated =0.051mld.
- Dimension of the collection pit is calculated to be 4m in diameter and 5m depth of the cylindrical tank.
- A bar screen of width 1.7m is provided.
- Dimension of the aeration tank is $4.5x4.5x3.7m^3$
- Dimensions of Sludge Drying Bed are 4.5mx4.5mx1m of two numbers.

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