International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1190-1203 www.ijaem.net ISSN: 2395-5252

"Development of soft computing model for design and analysis of wastewater treatment system"

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Submitted: 25-06-2021 Revised: 04-07-2021 Accepted: 07-07-2021

ABSTRACT: Soft computing has been extensively studied and applied in the last three decades for scientific research and engineering computing. In environmental engineering, researchers and engineers have successfully employed different methods of soft computing for modeling of various real-life environmental problems. In this study, applications of core soft computing techniques, such as artificial neural networks (ANN), fuzzy logic (FL), adaptive neuro fuzzy inference systems (ANFIS), and support vector machines (SVM), are investigated and important mathematical aspects of these methods are highlighted. The correct control and prediction of Wastewater Treatment Plants poses an important goal: toavoid breaking the environmental balance by always keeping the system in stable operating conditions.By soft computing methods, it is easy to design sewage treatment plant rather than traditional methods of design. We can get details very easily by. Soft computing methods to design sewage treatment plant. Soft computing methodis very easy to use and less time consuming. We are using Sequencing batch reactors (SBRs), due to its operational flexibility and excellent process control possibilities,are being extensively used for the treatment of wastewater. which nowadays is fast becoming contaminated with newerand more complex pollutants. It is also possible to includedifferent expanding array of configurations and various operational modifications to meet the effluent limits which are alsocontinuously getting upgraded.

Index Terms – Wastewater treatment plants, excel tool, soft computing, sewage treatment plant, sequential batch reactor,Retention time.

I. INTRODUCTION

Currently 93 percent of sewage finds its way to ponds, lakes and rivers without treatment India's largest cities have centralized sewage systems complete with underground pipes, pumping stations and treatment plants.India generates a staggring 1.7 million tons of waste a day. Official figures show that 78% of the sewage generated remains untreated and it disposes of in rivers or lakes. This wastewater can be treated. Through the treatment of wastewater the amount of waste that is usually released into the environment is reduced thus improving environment's health. We can achieve this by wastewater treatment plants.Water scarcity in India is on ongoing water crisis in India that affects nearly one million people each year. Agriculture alone is responsible for 80% of country's water usage several large cities of India have experienced water shortages in recent years with Chennai being the most prominent in 2019.Treated and recycled wastewater provides a cost efficient supply that decreases that demand and stress on freshwater sources such as groundwater, rivers and reservoirs. This is particularly important in areas that have been affected by water scarcity and also can use treated water for agriculture and many other uses.

RESEARCH METHODOLOGY

The target of Sewage treatment plant proposition is to treat sewage and reuse the treated water for Non-basic purposes, along these lines limiting the ground water contamination.

The system is designed dependent on SEQUENCING BATCH REACTOR, (SBR) innovation. A SBR works in a genuine batch reactor with sludge settlement and aeration each happening in a similar tank. A significant contrasts among SBR and traditional activated sludge system with a continuous flow, is that the SBR tank does the elements of aeration, Equalization and sedimentation in a period arrangement except in a conventional space sequence of continuous-flow systems. Subsequently, there is a level of adaptability related to work in a period instead of space succession. Likewise the SBR system gives acceptable outcome even at inflow amount

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variance. Thus SBR system is proposed for the above venture.

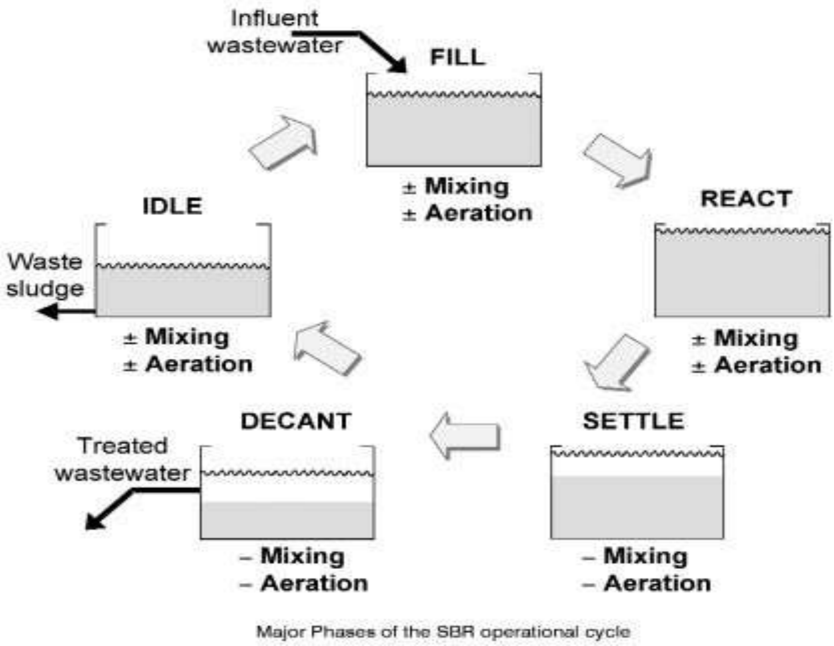

Fig: SBR operational cycle with its major phases.

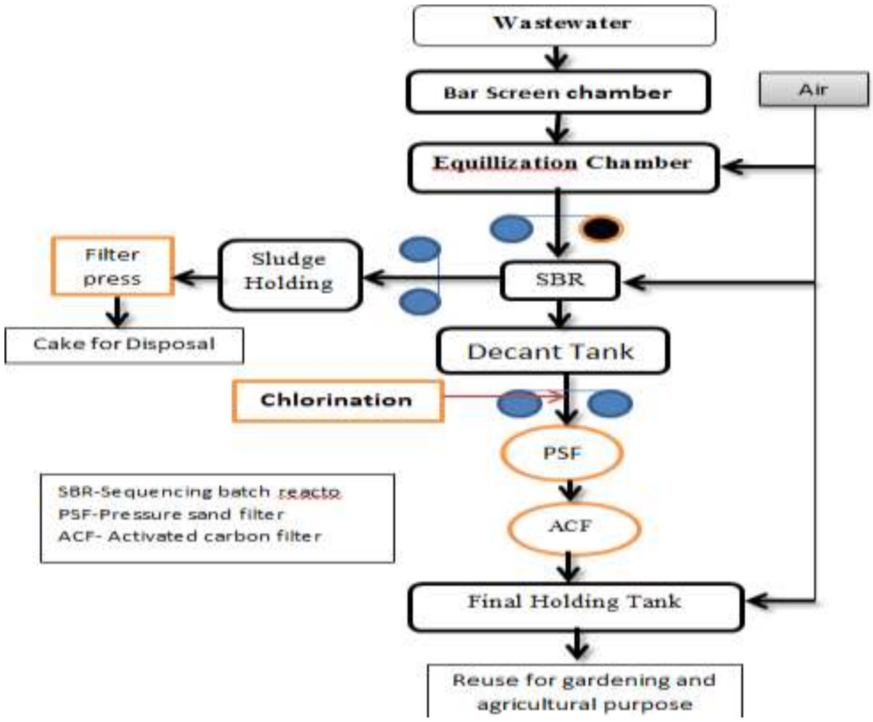

Fig: Flow Diagram

POINTS TO BE CONSIDERED FOR DESIGN:

a) The maximum of generated shall not exceed 120 KLD.
b) The proposed design shall provide sewage treatment plant of 120 KLD capacity which will be consisting of bar screen chamber, equalization tank, SBR tank, treated water holding chamber, tertiary treatment filters and filter press.
c) The wastewater which is shall be utilized for agricultural, flushing, gardening purposes.
d) STP units shall be impervious to prevent underground pollution. It should be constructed in closer kids to avoid odournuisance.
e) Treated effluent shall be in permissibility limits with inland surface water discharge standards.
f) The treatment unit design should be economical and maintenance easy.

Water consumption details:

Water demand is determined dependent on the rules of NBC. All out quantity of water prerequisite for the proposed project is assessed to be about 106 KLD during the activity stage.
By considering 85 % of the water provided will be changed over in to sewage for example 90 KLD. Wastewater produced from the proposed project will be treated in an STP of 120 KLD.
Amount of water required: 790 X 135 lpcd [3]= 106000 LPD say
= 300 KLD
Amount of wastewater generated: 0.85 X 106 KLD
= 90 KLD

Design wastewater quantity & quality:

The primary & Secondary Treatment units are designed for
120 KLD flow.
The raw effluent & treated effluent quality as per norms.

DESIGN OF SEWAGE TREATMENT PLANT

Expected Parameter	Influent	Treated water
Average BOD	250 to 300 mg/lit	<10 mg/lit
Average COD	400-650 mg/lit	<250 mg/lit
Total suspended solids	250 to 300 mg/lit	<20 mg/lit

Design of Receiving Bar screen chamber

Design flow = 0.0015 m3/sec Assume the detention time = 6 min
Volume of receiving chamber V = 0.0015 (6 x 60)= 0.54 m3

Chamber size = 1m x 0.6m x 1m

Design of coarse screen:
Velocity through the screen at maximum flow = 0.54 m/s Bar spacing (clear)= 2.5 cm [6]
Average discharge of wastewater = 0.0015 m/s
Peak discharge of sewage = Qaverage x peak factor
= 0.0015 x3
= 0.0045 m/s
The velocity at average flow not allowed to exceed 0.54 m/s Vertical projected area of screen, A = Q/V
= 0.0045/0.54
= 0.008 m3
Gross area of screen
Thickness=10mm width= 25mm Clear spacing= 25 mm [6] Therefore, A= 0.008((25+10)/25) = 0.0112 m2
The screen is inclined @60O
Horizontal gross sectional area of the screen = area/ sin (600)
= 0.0112/ sin (60) = 0.0182

Width of screen = 0.6
Width of screen = (no. of bars x thickness) + (no. of openings x spacing)
0.6 = (n x 0.01) + ((n+1) x 0.025)
n = no. of bars = 16.42 = 17, no. of openings = 18
Assuming depth as 0.9m including free board
Coarse screen is designed for the size of 0.6m x 0.9m The bar receiving chamber along with screen additionally serves to catch grit and other inorganic materials attributable to its reducedspeed which can be cleaned/rejected physically once in a month.

Equalization tank design.

Equalization tank volume calculation.
Hydraulic retention time(HRT) is general taken as 6 to 8 hours. [4]
Providing Equalization tank of 6 hours of hydraulic retention time
Q maximum = 100 m3/day
flow rate per hr =4.167 m3/hr Required chamber volume=4.167 x 6 = 25 m3 effective depth to be provided of 2.5 m
Size of the chamber = 3.5m x 3m x2.5 m SWD+0.5m FB

Equalization chamber air required = 0.5 m3of air/ m3of chamber volume when more than 2 hrs of retention time is to be provided. [5]
= 0.5 x 25 = 12.5 Cu.m /Hr

Design of SBR Reactor.
1. Organic Load : 100 Cu.m x (300 – 10) x 10-3 = 29.0 Kg/Day
2. Calculation of Aeration time F/M ratio range: 0.1 – 0.18 [4] Adopt F/M = 0.125
For a SBR F/M ratio shifts from as high as 0.3 to as low as
0.10. Anyway we think about an estimation of 0.20 for design calculations)
Assuming the Total oxygen requirement as 29.0 Kg of O2/kg of BOD extracted : 29 x 2 = 58 Kg/day
MLSS in the reactor = 4000 mg/L
Hydraulic retention time = BOD (mg/l)/ (MLSS x F/M)
= 58 / (0.2 x 4000) (Assuming 50% decantation)
= 1.74 Hours (Say 2 Hours)
So the cycle time = 1.74(Aeration) + 0.5(Decantation) + 0.5 (Settling) = 2.74 Hours (Say 3 Hours)
Hence designed for 4 batches a day
3. Design of tank [5][7]
- Design Flow = 100 m3/ day
- BOD = 300 mg / lit
- Volume SBR tank = Q x BOD

MLSS x F/M
= (100 x 300) / (0.2 x 4000)
= 37.5 m3
- Sludge accumulation provided is 30%
- Total volume of SBR tank provided = 48.75 m3 (say 50 m3)
- SWD assumed is 3 m
- plan area = 50/3 = 16.67 m2

So, provide a Reactor of 50 m3effective volume + Free board
Size of Tank: 4.2 x 4.0 x 3.0(SWD) + 0.3m F.B.
4. Oxygen Requirement for SBR Reactor
Oxygen requirement = 1.5 x BOD Load = 1.5 x 29/4 = 10.875 Kg/Batch = 11/ 3 = **3.660 Kg/Hr**
So, Oxygen to be supplied = 3.66 Kg/Hour
Assuming Oxygen transfer efficiency of 3.5 % per meter depth of water column [12]
Total SWD of the reactor = 3.0 m Overall Efficiency = 3.0 x 3.5 = 10.50 %
Oxygen to be supplied = 3.66 / 0.105 = 34.85 Kg /Hour
Air to be supplied = Oxy. Required /(Density of air x W/W % of Oxy in air)
= 34.85 / (0.23 x 1.4) = 108.22 Cu.m / Hr
5. Total Air required = Air for equalization tank + Air for SBR reactor = 12.5+ 108 = 120.5 Cu.m / Hr

Assuming 80 % efficiency for blower = 120.5 / 0.8 =150.625 Cu.m .Hr
Assuming compression factor of 1.4,
required volume is 150.625 / 1.4 = 107.58 Cu.m / Hr Provide Blower with a capacity of 150 Cu.m /Hr considering air to be provided in sludge tank.
Considering the requirement for Sludge digestion and efficiency factor provide 200 Cu.m /Hr capacity blower.

Decant Tank Design.

- Average flow = 4.167 m3/hr
- Providing holding capacity of 4 hours
- Tank required Volume = 16.67 m3
- SWD provided is 2.5 m
- **Final collection size of tank is 2.5m x 3m x 2.5m SWD+0.3 m FB**

Tertiary Treatment

A. Chlorination

There is no filter before chlorination. The supernatant from the SBR Reactor is emptied by gravity and is straightforwardly taken care of into the chlorine contact tank. The tapped treated water will have under 20 mg/L of TSS and this will be taken consideration by the sand filter. Thus we don't give any filter before chlorination.

We don't suggest sand filtration before any disinfection procedure as this permits development of microscopic organisms, parasites and green growth (diverted from Reactor) in the sand filter. Besides giving on the web chlorination after sand filter and before carbon filter doesn't give satisfactory contact time to disinfection.

Dosage required for 3 log reduction for Secondary treated effluent = 3 – 6 mg/L [5]

Adopt 4 mg/L of chlorine

Required Dosage = 4 x 100 = 400 gm / Day

Sodium hypo chlorite to be used as a source of chlorine @ 6.5

% available chlorine.

= 400 / 0.065 = 6.2 Kg of Sod. Hypo chlorite solution / Day Say 6.516 Lit of Sod hypo chlorite / Batch

B. Pressure Sand Filter

Assuming 20 Hours of operation in a day average flow rate = 5 Cu.m / H

Considering one PSF with the period of filtration of 20 hrs / day

Flow rate = 100/20 = 5 m3/hour Filter type = Vertical type sand filter Rate of Filtrations = 120 lit/m2.min[5]

=0.120 x 60 m3/m2.hr =7.2 m3/m2.hour

Cross section area of Filter = 5/7.2 = 0.694 m2 Filter dia. = 0.9 m

Provide Filter size= 0.9 m dia. x 1.5 m ht – 1 nos

C. Activated Sand Filter

Considering one ACF with the period of filteration of 20 hrs / day

Flow rate = 100/20 = 5 m3/hr Filter type = Vertical type

Rate of Filtrations = 120 lit/m2.min [5]

=0.120 x 60 m3/m2.hr =7.2 m3/m2.hr

Cross section area of Filter = 5/7.2 = 0.694 m2 Filter dia. = 0.9 m

Provide Filter size= 0.9 m dia. x 1.5 m ht – 1 nos

Sludge Calculation for design of filter press.

Reduction of BOD in aeration tank = 300 – 10= 290 mg/L Net yield considering average age of sludge of 20 days 25% Therefore, sludge production = 0.280 kg/Cum x1000 cu.m/Day x 0.25 =7 Kg/day of secondary sludge Contribution of Sludge by TSS = 0.5 x 350 g/Cu.m x 100 Cu.m/Day = 17.5 Kg / day on dry basis

Total Produced sludge = 7+17.5 = 24.5 Kg , Say 25 Kg. Sludge is drawn from the SBR reactor at the end of settling at 1% concentration. So the volume of produced sludge

= 25/0.01 = 2500 Lit or 2.5 Cum. / Day

The excess sludge generated is dried from the above treatment; filter press is used for sludge de-watering. The filtrate will be connected with the screen chamber.

Assuming the type of sludge : Organic

Designed sludge flow : 2500 ltrs/day

Solids concentration : 1%

Solids specific gravity : 1.2

Dry solids minimum to be allowed in : 25-30 % the cake of sludge

Sludge solids generated on daily basis Generation rate: 2500 x 1.2 x 0.01 =30 kgs/ day

Quantity of Sludge load on filter: 30 x 3 (three days of operation per week) = 90 kgs/day

Assuming sludge holding capacity as 40 kgs/m2

The size of the filter press required = 90/40 =2.25 m2 Size of each plate taken will be (0.6 x 0.6 m) = 0.36 sq.m. No. of chambers required = 2.25/0.36 = 6.25 nos

However**, provide 8 chambers with 30mm of spacing and filter press of 0.6m x 0.6m.**

Consider 50 kg sludge production per day, and at 30 % solids in sludge cake the volume of sludge cake = 25/0.3 = 83 Lit Henceforth the filter press given is satisfactory.

5.7.FINAL COLLECTION TANK

- Average flow = 4.167 m3/hr
- Provide 6 hour of capacity of holding
- Tank vol. required= 25 m3
- Providing SWD 2.5 m
- **Size of Final collection tank is 3.5m X 3m X 2.5m SWD+0.3 m FB**

Pumps

A. Providing 2 Nos. sewage transfer pumps (one working and one standby)

Capacity: 5.0 KLH @ 15 m head Type: Centrifugal pumps

Solid handling capacity: Up to 10 mm

Purpose: To pump the sewage from the Equalization tank to SBR tank.

B. Provide 1 No. Sludge Transfer pump Capacity : 3 KLH/hr @ 15 m head Type : Centrifugal pumps

Solid handling capacity: Up to 25 mm

Purpose: To pump the sludge from the SBR tank to the Sludge holding tank

C. Provide 2 Nos Filter feed pumps Capacity : 5.0 KLH @ 30 m head Type : Centrifugal pumps,

Solid handling capacity: Up to 5 mm

Purpose: To pump the treated effluent from the Pre-filtration tank through both the tertiary treatment filters.

EXCEL BASED MODEL FOR DESIGN-

1. Sequential Batch Reactor (SBR) :-

File Home Insert Page Layout Formulas Data Review View Help Tell me what you want to do

D9 0.2

Excel Sheets of Sequential Batch Reactor

Design of 120 KLD Effluent Treatment Plant

Design of Screening Unit

Sr.No.	Description	Value	Unit
	Inputs		
1	Sewage Flow Rate	120.00	m3/d
2	Velocity of flow through screen	0.20	m/Sec
3	Clear spacing between the bars	0.005	m
4	Diameter of bar	0.008	m
5	Depth of water	0.25	m
	Outputs		
1	Total Area	0.00694	m2
2	Net width of the screen	0.02778	m
3	Number of opening	6	
4	Number of bars	5	
5	Total No. of bars	7.00	
6	Total Gross Width	0.09	m
7	Length Of Screen	0.36	m

Design of Grit Chamber			
Sr.No.	**Description**	**Value**	**Unit**
Inputs			
1	Sewage Flow Rate	120.00	m3/d
2	Particle Size	0.00015	m
3	Surface over flow rate	1555	m3/m2/d
4	Kinematic Viscosity	0.0000011	m2/sec
5	Depth	0.8	m
6	crest of weir	0.1	m
7	Free Board	0.1	m
8	length to width ratio	3	
Output			
1	settling Velocity	0.01706094	m/s
2	Plan Area of Each Grit Chamber	0.07717042	sq.m
3	Width of Grit Chamber	0.16038539	
4	Lenght of Grit Chamber	0.48115616	m
5	Total Depth Of Grit Chamber	1	m
6	Detention Time	46.8907265	sec

Design of Equalisation Tank			
Sr.No.	**Description**	**Value**	**Unit**
Inputs			
1	Sewage Flow Rate	120	m3/d
2	Hydraulic Retention Time	6.00	hr
3	Water Depth	3.00	m
4	Free Board	0.30	m
5	L/B Ratio	1.50	
6	Assumed BOD reduction in the tank	15%	
7	Influent BOD	500.00	mg/l
8	Oxygen required to remove BOD load	2	kg/kg of BOD
Output			
1	Volume of tank	30.00	m3
2	Area Required	10.00	m2
3	Width of Tank	2.58	m
4	Length of Tank	3.87	m
5	Total Depth of tank	3.30	m
6	BOD Removal in Equalisation Tank	75	mg/l
7	BOD Load	60	kg/d
8	Oxygen Requirement	120	kg/d
9	Actual Air Required	511.12	Cum/hr
Provide the Equalisation tank as 3.87 m x 2.58 m x 3 m SWD + 0.3m Freeboard			

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Design of Primary Settling Tank (PST)			
Sr.No.	**Description**	**Value**	**Unit**
Inputs			
1	Sewage Flow Rate	120.00	m3/d
2	Detention Time	2.00	hrs
3	Surface overflow rate	30.00	m3/d/m2
4	Free board and sludge depth	1.00	m
Outputs			
1	Volume of PST	10.00	cu.m
2	Plan Area (Surface Area)	4.00	sq.m
3	Diameter of PST	2.26	m
4	Perimeter of PST	7.10	m
5	Depth of PST	2.50	m
6	Overall depth of PST	3.50	m
7	Weir Loading	16.91	m3/m/d
Provide the dimension of PST as 2.26 m diameter, 3.5 m depth			

Design of Sequential Batch Reactor (SBR)			
Sr.No.	**Description**	**Value**	**Unit**
Inputs			
1	Sewage Flow Rate	120.00	m3/d
2	Aeration Time	2.00	hrs
3	Settling Time	0.50	hrs
4	Decant Time	0.50	hrs
5	Number of tank	2.00	
6	MLSS in sewage	3500.00	mg/l
7	Sludge volume index	150.00	ml/gm
8	Ratio of fill volume to total volume	0.30	
9	Liquid depth	6.00	m
Outputs			
1	Fill Time	1.00	hrs
2	Total Cycle Time	6.00	hrs
3	Number of Cycles in 1 day by 1 tank	4.00	
4	Total number of cycles in 1 day	8.00	m
5	Fill Volume per cycle	15.00	m3
6	MLSS in settled sludge	6666.67	g/m3
7	Ratio of volume of settled solids to total volum	0.53	
8	Ratio of volume of settled solids to total volume (Provide 20% extra so that the solids are not removed by the decanting mechanism)	0.63	
9	Ratio of fill volume to total volume	0.37	
As ratio of fill volume to total volum is greater than provided hence as ssumption is correct			
10	Total Volume	50.00	m3
11	Decant Depth	1.80	m
12	Area of SBR Tank	8.33	m2
13	Diameter of SBR Tank	3.26	m
Provide the dimension of SBR as 3.26 m diameter, 6 m depth + 0.5 m Freeboard			

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Sr.No.	Description	Value	Unit
Design of Pressure Sand Filter (PSF)			
Inputs			
1	Sewage Flow Rate	120.00	m3/d
2	Rate of Filtration	12	m3/hr/m2
3	Heigth of the Container	1.5	m
Output			
1	Area of Filter Required	0.42	m2
2	Diameter of PSF	0.54	m
Provide the dimension of PSF as 0.54 m diameter, 1.5 m height			

Sr.No.	Description	Value	Unit
Design of Activated Carbon Filter (ACF)			
Inputs			
1	Sewage Flow Rate	120	m3/d
2	Rate of Filtration	6	m3/hr/m2
3	Contact Time	20	min
Output			
1	Area of Filter Required	0.84	m2
2	Diameter of ACF	1.08	m
3	Volume of Tank	1.67	m3
4	Depth of Tank	1.988095238	m
Provide the dimension of ACF as 1.08 m diameter, 1.98809523809524 m height			

2. Moving Bed Biofilm Reactor (MBBR) :-

Excel Sheets of Moving Bed Biofilm Reactor

Design of 120 KLD Effluent Treatment Plant

Salient Features of Proposed Layout	
Types of project	Public building
Total land area	56657.22 m2
Source of water	Underground water
Number of visitors	600 to 900
Water consumption	106 KLD
Sewage quantity	90 KLD
Design flow for proposed STP in KLD	120.00

Design of Screening Unit

Sr.No.	Description	Value	Unit
Inputs			
1	Sewage Flow Rate	120.00	m3/d
2	Velocity of flow through screen	0.20	m/Sec
3	Clear spacing between the bars	0.005	m
4	Diameter of bar	0.008	m
5	Depth of water	0.25	m
Outputs			
1	Total Area	0.00694	m2
2	Net width of the screen	0.02778	m
3	Number of opening	6	
4	Number of bars	5	
5	Total No. of bars	7.00	
6	Total Gross Width	0.09	m
7	Length Of Screen	0.36	m

Design of Grit Chamber

Sr.No.	Description	Value	Unit
Inputs			
1	Sewage Flow Rate	120.00	m3/d
2	Particle Size	0.00015	m
3	Surface over flow rate	1555	m3/m2/d
4	Kinematic Viscosity	0.0000011	m2/sec
5	Depth	0.8	m
6	crest of weir	0.1	m
7	Free Board	0.1	m
8	length to width ratio	3	
Output			
1	settling Velocity	0.017060943	m/s
2	Plan Area of Each Grit Chamber	0.077170418	sq.m
3	Width of Grit Chamber	0.160385388	
4	Lenght of Grit Chamber	0.481156164	m
5	Total Depth Of Grit Chamber	1	m
6	Detention Time	46.89072648	sec

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Design of Equalisation Tank			
Sr.No.	**Description**	**Value**	**Unit**
Inputs			
1	Sewage Flow Rate	120	m3/d
2	Hydraulic Retention Time	6.00	hr
3	Water Depth	3.00	m
4	Free Board	0.30	m
5	L/B Ratio	1.50	
6	Assumed BOD reduction in the tank	15%	
7	Influent BOD	500.00	mg/l
8	Oxygen required to remove BOD load	2	kg/kg of BOD
Output			
1	Volume of tank	30.00	m3
2	Area Required	10.00	m2
3	Width of Tank	2.58	m
4	Length of Tank	3.87	m
5	Total Depth of tank	3.30	m
6	BOD Removal in Equalisation Tank	75	mg/l
7	BOD Load	60	kg/d
8	Oxygen Requirement	120	kg/d
9	Actual Air Required	511.12	Cum/hr
Provide the Equalisation tank as 3.87 m x 2.58 m x 3 m SWD + 0.3m Freeboard			

Design of Primary Settling Tank (PST)			
Sr.No.	**Description**	**Value**	**Unit**
Inputs			
1	Sewage Flow Rate	120.00	m3/d
2	Detention Time	2.00	hrs
3	Surface overflow rate	30.00	m3/d/m2
4	Free board and sludge depth	1.00	m
Outputs			
1	Volume of PST	10.00	cu.m
2	Plan Area (Surface Area)	4.00	sq.m
3	Diameter of PST	2.26	m
4	Perimeter of PST	7.10	m
5	Depth of PST	2.50	m
6	Overall depth of PST	3.50	m
7	Weir Loading	16.91	m3/m/d
Provide the dimension of PST as 2.26 m diameter, 3.5 m depth			

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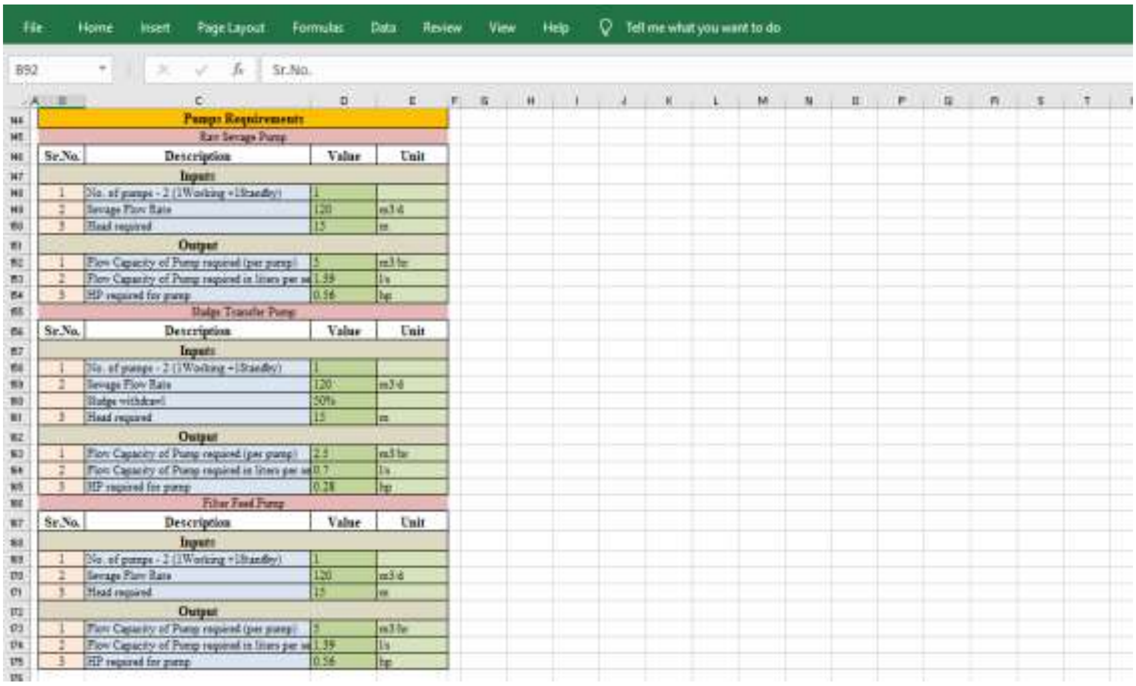
Design of Moving Bed Biofilm Reactor			
Sr.No.	Description	Value	Unit
Inputs			
1	Sewage Flow Rate	120.00	m3/d
2	Aeration Time	2.00	hrs
3	Settling Time	0.50	hrs
4	Decant Time	0.50	hrs
5	Number of tank	2.00	
6	MLSS in sewage	3500.00	mg/l
7	Sludge volume index	150.00	ml/gm
8	Ratio of fill volume to total volume	0.30	
9	Liquid depth	6.00	m
Outputs			
1	Fill Time	3.00	hrs
2	Total Cycle Time	6.00	hrs
3	Number of Cycles in 1 day by 1 tank	4.00	
4	Total number of cycles in 1 day	8.00	m
5	Fill Volume per cycle	15.00	m3
6	MLSS in settled sludge	6666.67	g/m3
7	Ratio of volume of settled solids to total volum	0.53	
8	Ratio of volume of settled solids to total volume (Provide 20% extra so that the solids are not removed by the decanting mechanism)	0.63	
9	Ratio of fill volume to total volume	0.37	
As ratio of fill volume to total volum is greater than provided hence as sumption is correct			
10	Total Volume	50.00	m3
11	Decant Depth	1.80	m
12	Area of SBR Tank	8.33	m2
13	Diameter of SBR Tank	3.26	m
Provide the dimension of SBR as 3.26 m diameter, 6 m depth + 0.3 m Freeboard			

Design of Pressure Sand Filter (PSF)			
Sr.No.	Description	Value	Unit
Inputs			
1	Sewage Flow Rate	120.00	m3/d
2	Rate of Filtration	12	m3/hr/m2
3	Heigth of the Container	1.5	m
Output			
1	Area of Filter Required	0.42	m2
2	Diameter of PSF	0.54	m
Provide the dimension of PSF as 0.54 m diameter, 1.5 m height			

Design of Activated Carbon Filter (ACF)			
Sr.No.	Description	Value	Unit
Inputs			
1	Sewage Flow Rate	120	m3/d
2	Rate of Filtration	6	m3/hr/m2
3	Contact Time	20	min
Output			
1	Area of Filter Required	0.84	m2
2	Diameter of ACF	1.08	m
3	Volume of Tank	1.67	m3
4	Depth of Tank	1.9880952	m
Provide the dimension of ACF as 1.08 m diameter, 1.98809523809524 m height			



Pumps Requirements			
Raw Sewage Pump			
Sr.No.	Description	Value	Unit
Inputs			
1	No. of pumps - 2 (1Working +1Standby)	1	
2	Sewage Flow Rate	120	m3/d
3	Head required	15	m
Output			
1	Flow Capacity of Pump required (per pump)	5	m3/hr
2	Flow Capacity of Pump required in liters per se	1.39	l/s
3	HP required for pump	0.56	hp
Sludge Transfer Pump			
Sr.No.	Description	Value	Unit
Inputs			
1	No. of pumps - 2 (1Working +1Standby)	1	
2	Sewage Flow Rate	120	m3/d
	Sludge withdrawl	50%	
3	Head required	15	m
Output			
1	Flow Capacity of Pump required (per pump)	2.5	m3/hr
2	Flow Capacity of Pump required in liters per se	0.7	l/s
3	HP required for pump	0.28	hp
Filter Feed Pump			
Sr.No.	Description	Value	Unit
Inputs			
1	No. of pumps - 2 (1Working +1Standby)	1	
2	Sewage Flow Rate	120	m3/d
3	Head required	15	m
Output			
1	Flow Capacity of Pump required (per pump)	5	m3/hr
2	Flow Capacity of Pump required in liters per se	1.39	l/s
3	HP required for pump	0.56	hp

II. CONCLUSION:

Soft computing model is the new way to design sewage treatment plant.It is less time consuming method. It gives exact data for designing of treatment plant. We can design sewage treatment plant of smaller and highest scale using soft computing model.

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