International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 08 | Aug 2021 www.irjet.net p-ISSN: 2395-0072

Treatment Over Service Station Wastewater

Mr. Mahesh Lokhande[1], Dr. Girish Kulkarni[2], Mr. Shrikant Bhosale[3]

[1]Assistant professor, Department of Civil Engineering, D Y Patil Technical Campus (faculty of engineering), Maharashtra, India.
[2]Deputy Registrar (Civil)/Director, Department of technology, Shivaji University, Kolhapur, Maharashtra, India.
[3]Assistant Professor, Department of environmental science and technology, Department of technology, Shivaji University, Kolhapur, Maharashtra, India.

Abstract - *At early part of year water pollution is an important contaminant compare to air and noise pollution. Water from different type of industries is directly discharge into river some of industries have the treatment process on contaminated wastewater but in the crucial amount, leading to water contamination; the factories dump waste water in the river day after day and rising to a greater proportion. Car washing effluent is one of the main environmental factors the public generally think that wastewater from car washing is not seriously contaminated in comparison with other heavy waste products from other industries. Kolhapur is situated in a 66.82 sq.km. Area, Maharashtra region in South-West. The river Panchaganga is the principal river that passes through the town. In the Kolhapur city area huge source of water polluting industries are Shivaji udyam nagar, Shiroli MIDC, Gokul shirgaon MIDC and Kagal 5star MIDC. Around 95 registered bike/car washing servicing stations are located in the Kolhapur city area and about 200-300 non registered service stations are in the city area. On the car/bike wash service station no treatment should be carried out except one or two service station.*

Key Words: Environment factor, oil and grease, oxygen content

1.INTRODUCTION

Nearly 119MLD water supply scheme is available in city and 230MLD water supply scheme is approved and is at tendering stage. Following table represent the discharge of wastewater from different sources:

Sources	Wastewater generated
Drainage waste from Kolhapur city	120 MLD
Drainage water from factory	19 MLD
Hotel	15 MLD
Hospital	3 MLD
Crematorium ash	130 MLD

Table -1: Wastewater generated from different sources in Kolhapur city.

About 100 MLD of untreated wastewater is discharged into river the main source of this water pollution is nalha's situated in Kolhapur city. Four sites of nalha in the town. These are as below:

1) Dudhali stream
2) Jayanti stream
3) Line bazaar stream
4) Bapat camp stream

Among this streams/nalha's Jayanti and Dudhali flow as main stream through city. Along with the stream the floatable material like oil and fatty acids float on the surface. Because of the huge number of industries, water is h ighly polluted along the river basin. According to the study, a pproximately 8 percent of wastewater is discharged to the ri ver basin from the auto / bike washing station. Car wash is considered as non-domestic installation for external cleaning. For washing of car approximately 150 to 350 lit of water is required as that of bike requires 100 to 200 lit of water. Oil and grease are major parameter observed in the wastewater also detergent is used for washing that contains various phosphates and heavy metals which affects the storm water quality and damages the eco-system. So, there is need of attention is given to the service station water quality management system. The aim of study and strategy, observations, conditions, diagnosis etc. will be disc ussed below.

1.1 General aspect of service station wastewater

In Kolhapur city area mainly 4 streams are flowing that streams or nalha's are Dudhali, Jayanti, Line bazaar and bapat camp. Jayanti nala is work as major stream circulate in middle of city which is discharged into Panchaganga river basin. In India around 103.8MLD safe water is required per day but the amount of industrial and other discharge is in large amount and the treatment provided to treat this water is less than the discharge, so proper management of wastewater is required car/bike washing is also major polluting parameter considered in water pollution. In Kolhapur STP provided at Kasaba bawada and Dudhali having capacity of 76MLD and 17MLD respectively. Approximately 287MLD of wastewater generated in city and about 100MLD of wastewater is untreated. The stream Jayanti originated in Kalamba Lake and is connected to Dasara chowk's Panchaganga river. This flux is blocked and

is injected into STP in Kasaba bawada. 60 percent of the total waste in Kolhapur is carried by Jayanti nalha. Dudhali stream flows through the Sakoli corner area and merge into the Panchaganga River. It includes Laxatirth, Shivaji peth, Phulewadi, Ravivar peth, etc. areas. Along the basis of these nalha's or streams we locate the service stations for our study area.

1.2 Impact of car washing on environment

We must face the facts: washing cars may cause environmental threats. The biggest issue with a car wash is water runoff. Many soaps contain harmful substances that degrade the consistency of water. Soapy water is only mixed with the grime, dirt and grate removed from a vehicle and the pollution is aggravated. For a single vehicle, most washrooms require a total of 40 gallons of water.

There will always be somewhere to wash down; normally a storm drains nearby. Depending on the situation, this runoff ends either in our water treatment centers or in larger water bodies. This certainly isn't pleasant regardless of who actually causes emissions. On the reverse side, it cannot be washed your car either.

A polluted vehicle can leave a toxic track if the water is released. You must keep your car clean and clean it in an ecological manner. Much soap contains chemical substances that damage fish and damage the quality of water. If you wash your car in the driveway, the soap is drained from the vehicle and spills to local storm drains along with mud, grease and oil.

2. METHODOLOGY

2.1 Literature study

At the primary stage, a literature study will be carried out on the parameters of wastewater quality and also on the quantity of disposal at the service station. Such that parameters of wastewater are pH, BOD, COD, etc. This parameter defines the quality of wastewater.

2.2 Decide study area

There are 5 wards in the Kolhapur city, where Jayanti nala and Dudhali nala flow as a main stream to the Panchaganga River.We will determine the study area/data collection based on nala/stream and with the aid of KMC registered service station list.

2.3 Sample collection

The sample will be collected from service station point sources and combined sources. Then the collected sample will be tested in departmental laboratory.

2.4 Design

Prototype system is design which is discussed in the result and discussion part. The treatment will be designed on the basis of recycle of wastewater at the service station.

3. STUDY AREA

In Kolhapur city there are around 200-300 non-registered and 95 registered service stations on the basis of no of registered service stations and streams/nalha's in Kolhapur city we have to decide to take samples or data collection for following service stations:

Name of Service Station	Location
Shri Mahalaxmi Car/Bike washing Station	Dudhali, Near ambardekar hospital.
Shri Datta Servicing Center	Y P Powar Nagar.
Shetakari Auto Servicing Center	A-Ward Shivaji Udyam Nagar.
KMT Workshop	Jawahar Nagar.
ST workshop	Tarabai Park.
Riverside Honda	Opposite to Shiroli octroi check post.
Shivganga Suzuki	E-ward Shivaji Udyam Nagar.

Table- II: List of service station selected in study area

This are the service stations which we are located on the basis of KMC registered list of service station and nalha's/streams flowing through the city. Major amount of water is discharges from this service station. The detail summary of this service station is explained in the methodology part. As Kolhapur area sited more 200 to 300 service station on an average of 3000 lits/day flow about 6,00,000 to 9,00,000 Liters of water is discharged into sanitary sewer in some cases the water is preoccupy by the ground and some of them having treatment process over the wastewater also from this huge amount of water is treated in STP's located in the city area but which is in the smaller quantity.

Our aim is to recycle the wastewater at the each of the service station. Some process like flocculation and coagulation may work for the treatment of wastewater but due to large quantity of water is discharged proper treatment should be required. Oil and grease are the major contained observed on the service station that when the car is being washed the oil and grease stick on the lower body of car will flow with the wastewater and water get polluted this requires the special treatment process so that the ecosystem remains as per the standards given by the MPCB/CPCB. The standards for different parameters of wastewater are decided by MPCB/CPCB along with the proper disposal standards for various types of industries. So, we decide the further process in next chapter.

Fig -1: Map of Kolhapur city

4. SAMPLING SITE

There are total 7 washing stations are selected and they are categorized into different station that is two of them are public transport like buses washed on the station, two service stations are having both car washing as well as bike washing, one of them is the automated car/bike washing station and one is specially for the car washing which is having showroom as well as washing station where the treatment process would be held for wastewater and another is one for specially bikes only which is also having bike showroom. This are having some specifications such that each service station having different discharge or flow.

5. SAMPLING METHOD

The sample collection takes at the outflow of wastewater at each service station. 1L glass bottle is used to collect the water sample. Grab sampling would be carried out on the field, A sample collected at particular time and place can represent only the composition of source at that time and place that is called as grab sampling. Sample will be analyzed for following experimental test listed below:

SR. NO.	TEST	UNIT	METHOD
1	pH	-	pH by electrometric method
2	TDS	mg/lit	Gravimetric analysis
3	TSS	mg/lit	Gravimetric analysis
4	BOD	mg/lit	Winkler method
5	COD	mg/lit	COD digester with refluxing flask method
6	Oil & grease	mg/lit	Separating funnel method

Table- III: Test and methods for checking quality of wastewater

These strategies received and get the necessary investigation work to set up the treatment framework dependent on this acquired outcomes.

5. OBSERVATIONS

The water analyzes for the six test and the obtained values compared with the standards of wastewater out flow as per MPCB/CPCB. In the obtained it is observed that the amount of oil and grease content in wastewater is higher in percentage also TDS and TSS are comparatively high in the amount. The test carried out for analyzing the water sample briefly explained as below:

A) pH

The experimental setup for determination pH of water sample is carried out by electrometric method. Firstly, switch on the pH meter 1hr before respectively then prepare buffer solution of known pH (4, 7 & 9.2) in separate beaker now dip the glass electrode in buffer solution of known pH i.e., 7 and adjust the pH range. Keep the temp knob at 25˚C and Repeat the procedure with another buffer solution. After calibration of instrument dip, the glass electrode in waste water sample and Note down the displayed reading.

B) TSS (Total Suspended Solids)

Dissolved solids are determined by filtering a known volume of the sample, evaporating the filtrate to dryness and weighing the residue. Settle able solids are determined by allowing coarse suspended solids, with specific gravity greater than 1, to settle under still conditions over a specific period of time. The settled sludge is evaporated to dryness and the residue is weighed to determine the efficiency of sedimentation. Weigh and clean empty crucible. Take a known volume of the sample, filter it through Whatman filter paper no. 40 and collect the filtrate. Evaporate the filtrate to dryness in a hot air oven at 103˚C. Cool the crucible to room temperature and weigh and by formulae the TSS and TDS are calculated.

C) BOD (Biological Oxygen Demand)

The Biochemical Oxygen Demand (BOD) is a standardized empirical laboratory test which measures oxygen requirement in controlled temperature and incubation conditions of aerobic oxidation of decomposable organic matter and certain inorganic matter in water, polluted waters and wastewater. The required oxygen quantity is calculated for above-mentioned oxidation processes. The research is carried out for the intent of determining sources of fresh water (rivers and lakes), waste water (domestic and industrial) as well as contaminated bodies of water intake and sea water (estuary, coastal water). The BOD of water or dirty water is the quantity of oxygen needed by uniform time and disposition for the biological decomposition of organic condensed matter. The time is normally 5 days and the temperature is 20 centigrade. Take the sample in 2 separate BOD bottles. Fill two distilled water bottles with BOD. Include 1 ml every one of phosphate buffer, magnesium sulfate, calcium chloride and ferric chloride arrangements in every single above container. Find D.O. right now. 1st day of study and water purified. Incubate at 270C for 3 days the other two bottles. Tightly put the stopper to prevent any air entry into the bottles. Determine DO content in the incubated bottles at the end of 3 days by using DO estimation method. This is the method called as Winkler method which is applied for BOD analysis of samples.

D) COD (Chemical Oxygen Demand)

When boiling with a potassium dichromate and sulfuric acid mixture that contains carbon dioxide and salt, most biological matters are lost. One sample is refluxed into the sulphuric acid mildew with an excess of dichromate against ferrous ammonium sulphate and known amounts of potassium dichromate are given.

The amount of dichromate used to oxidize the organic matter is proportional to the amount of oxygen required. The chemical requirement for oxygen tests the oxygen necessary for the oxidation in water of all substances, organic and inorganic. The chemical oxygen demand (COD) determines the oxide required by a strong chemical oxidant, for example potassium dichromate under conditions of distillation, for the chemical oxidation of organic matter. This test is used widely to determine the degree and the capacity to purify water bodies, their efficiency and their pollution charges.

The advantage of COD determination over BOD testing is that the results can be obtained in less than 5 hours, whereas BOD measurement takes 3 or 5 days. In addition, the test is quite easy and accurate. Not many interferences are also present, as is the case with BOD.

Take two COD flasks. Place about 400mg of H2 SO4 in each flask. Add 20 ml of distilled water to flask 1(blank flask) & 20 ml of sample direct or diluted to flask2. Add 10 ml of 0.25 N K2Cr2O7 accurately using a pipette to each flask. Add 30 ml Conc. H2SO4 to each flask slowly in installments, stirring the contents carefully.

Add about 200mg of Ag2SO4 to each flask. Add 3 to 4 glass beads or rounded quartz pebbles (to minimize bumping of acid mixture during boiling). Attach both flasks to condensers or COD Digester. Heat & digest for two hours at 150oC. Cool the flasks. Add 80ml of distilled water down each condenser attached to wash down condensed organics sticking to inner surface.

Detach the flasks and cool the flasks to room temperature (This is very important. If the flask contents are at a high temperature than the titrant, then very large quantities of titrant will be used up & COD results will be erroneous). Titrate both flasks against standardized ferrous ammonium sulphate using 2 to 3 drops of ferroin indicator.

Record titrant used ml for blank flask 1 & ml for sample flask 2. COD digester with refluxing flask is a standard method adopted and sample analyzed by this method.

E) Oil and Grease

The measurement of surface and saline water, industrial and domestic waste is included in this method. It occurs in the determination of hydrocarbons, plants, oil, animal fats, wax, soap, fats and other matter that are fairly nonvolatile. For the broad variety of organic compounds which are derived in aqueous solution, the word classification applies.

The major substances dissolved with petroleum ethers or hexanes are hydrocarbons, oil, fats, waxes and higher molecular weight fatty acids. Both these compounds have a gray color and are related to water petroleum. Take 250 ml waste water sample in separating funnel and add 2- 3 ml lab solvent. Add 1-2 ml of 1: 1 H2SO4 to separating funnel and shake well. Add 10 ml petroleum ether to separating funnel and shake it again Two layers will be formed. Discard the lower layer of water.

Transfer the upper layer carefully in previously weighted crucible and Keep this crucible for heating on hot plate at 70˚C. After evaporating of solvent take final wt. of crucible. This method is called as separating funnel method and calculates the amount of oil and grease on the basis of this procedure.

We get the results of each service station at the effluent outflow of service station two samples were taken that is one is at point source that is service station wastewater outflow and another is the water from service station combines with the sanitary sewer line water or domestic wastewater that defines the clear difference between water qualities.

The following tabulation indicates the standards for wastewater outflow and these standards compared with the water sample results. Major issue in the wastewater is oil and grease percentage and it can be removed with the help of skimming. This percentage of oil and grease varies with the different service station. Obtained results correlate with the standards as per MPCB/CPCB. The comparison takes place in the form of graphical representation as below:

Parameter	Standard			
	Inland surface water	Public sewer	Land for irrigation	Marine coastal areas
Suspended solid (mg/L)	100	600	200	a) For process wastewater 100 b) For cooling water effluent 10% above total suspended matter of effluent
pH value	5.5-9.0	5.5-9.0	5.5-9.0	5.5-9.0
Oil and grease, mg/L, max.	5-10	20	10	20
Biochemical Oxygen Demand (5 day at 200), mg/L max.(BOD5)	30	350	100	100

Parameter	Standard			
	Inland surface water	Public sewer	Land for irrigation	Marine coastal areas
Chemical Oxygen Demand (COD)	250	-	-	250

Table- VI: Standards for wastewater outflow as per MPCB/CPCB

Obtained result values or the parameters tested in laboratory and getting the following result which contains pH, TDS, TSS, BOD, COD, Oil & grease content of wastewater. Graphical representation will be shown below from which we get clear idea about the comparison of service station wastewater outflow and the standards of effluent outflow. As soon as the comparison is done the treatment required for the service station based on the obtained result is discussed as the calculations are also held, they can be explained further. Process of obtaining the required output we have to decide theoretically assumptions and which are done in the calculation part:

location	Test	Results	
		Point source	Combined source
Shri mahalaxmi car/bike wash servicing center, Udyam nagar, Kolhapur.	pH	6.90	6.58
	TDS	179	454
	TSS	700	420
	Oil & grease	6.31	6.57
	BOD	40	80
	COD	180	260

Table- V: Results station for 1st

location	Test	Results	
		Point source	Combined source
Shri Datta servicing center, Udyam Nagar, Kolhapur.	pH	7.59	6.89
	TDS	996	1160
	TSS	540	760
	Oil & grease	8.4	10.39
	BOD	150	70
	COD	220	140

Table- VI: Results station for 2nd

location	Test	Results	
		Point source	Combined source
Shetkari	pH	8.05	7.72
auto servicing center, Udyam nagar, Kolhapur	TDS	584	576
	TSS	480	620
	Oil & grease	7.18	7.37
	BOD	110	60
	COD	180	120

Table- VII: Results station for 3rd

location	Test	Results	
		Point source	Combined source
KMT workshop, Budhhagargen Kolhapur.	pH	7.91	7.55
	TDS	2550	800
	TSS	500	1000
	Oil & grease	11.2	10.8
	BOD	290	200
	COD	330	360

Table- VIII: Results station for 4th

location	Test	Results	
		Point source	Combined source
ST workshop, Tarabai park, Kolhapur.	pH	8.80	8.57
	TDS	200	1000
	TSS	1900	300
	Oil & grease	15.96	10.56
	BOD	240	420
	COD	440	360

Table- IX: Results station for 5th

location	Test	Results	
		Point source	Combined source
Riverside honda, near tavade hotel, Kolhapur.	pH	7.90	7.10
	TDS	1850	1100
	TSS	750	350
	Oil & grease	10.62	8.75
	BOD	160	80
	COD	350	200

Table- X: Results station for 6th

location	Test	Results	
		Point source	Combined source
Shivganga suzuki, Udyam nagar, Kolhapur	pH	8.15	6.86
	TDS	1150	1160
	TSS	1700	760
	Oil & grease	10.95	10.39
	BOD	150	70
	COD	360	140

Table- XI: Results station for 7th

These results are obtained by the water samples tested in the laboratory. That is the table no.7 indicates the values of each parameter for being tested. The point source is that source in which the uniform flow of water is observed such that on service station outflow such uniform flow of water is observed. Combined source is that source of water where the service station water and domestic wastewater or sanitary sewer water get mixed or combined to form the combined flow/source.

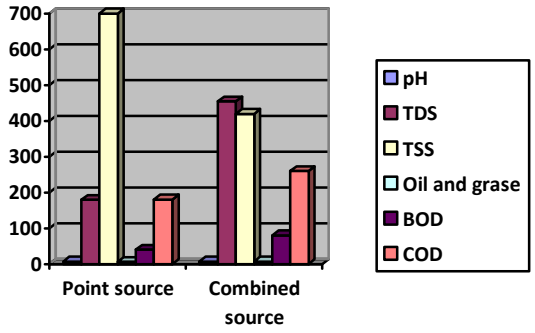
As these results get compares in graphical representation also it may be explained theoretically. The pH value obtained are in the limit of standards so that there is no requirement of pH treatment but the TDS and TSS values exceeds the standard limit the proper screening or any other method is required to treat such a settable water. Oil and grease content are higher in percentage as compared to standard so there is requirement of oily mixed water treatment. BOD is in the permissible limit that is amount of oxygen requires is in standard amount as COD is higher in amount for some service stations there is demand of treatment over that to reduce the percentage of COD.

6. RESULT

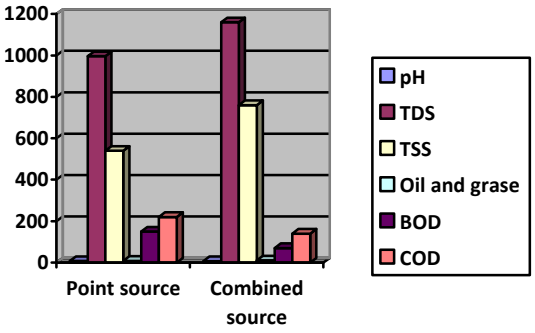
The result obtained from the testing the samples at laboratory it is clearly seen that the amount of pollution or the pollutant present in the service station wastewater plays major role in the water pollution. Here the no of collected samples of about 14.

Each service station contains two samples that is point source and combined source of wastewater outlet.

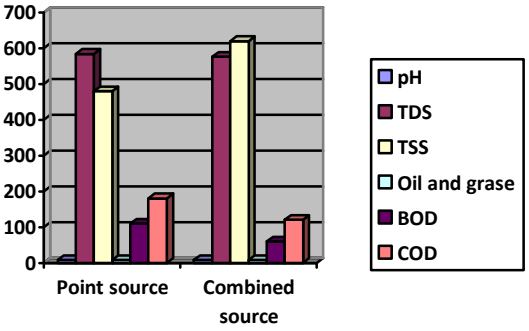
The details of each washing service station we discuss above but the graphical comparison with the standard is not done yet, so that the graphs from the study of comparison are plotted in this chapter and discussed it later on the treatment model for the service station will also be discussed in this chapter so that following are some graphs that shows the service station parameter variations for each of the washing station:



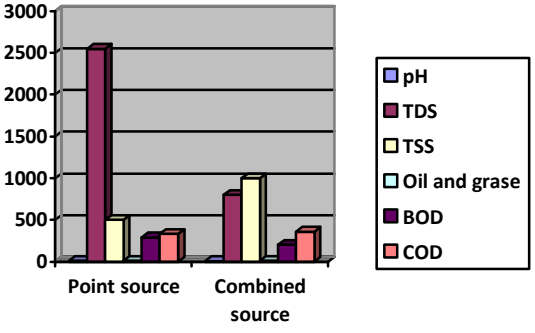
Graph– Station 1



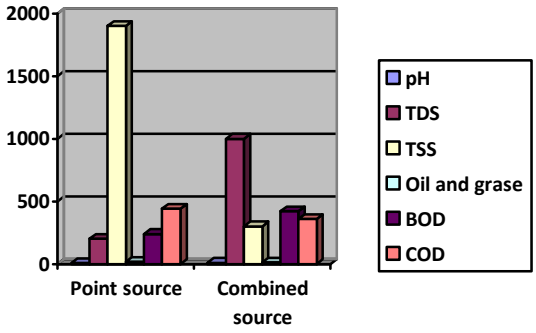
Graph– Station 2



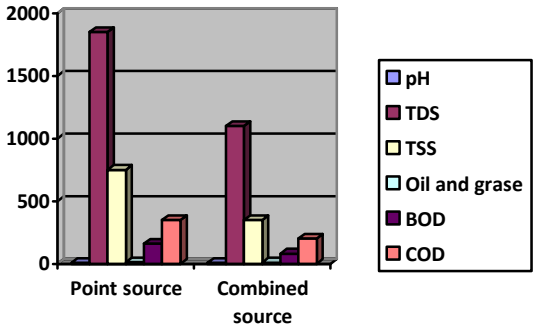
Graph– Station 3



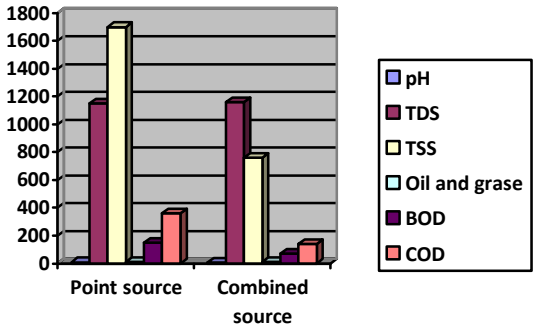
Graph– Station 4



Graph– Station 5



Graph– Station 6



Graph– Station 7

The project is aimed towards the recycle and reuses the wastewater at the location such that on the service station water discharges requires a proper management system and hence we design one prototype system for which the theory of design tank is needed on the basis of theoretical assumption prototype treatment design. Prototype model for treatment system is shown in fig.2:

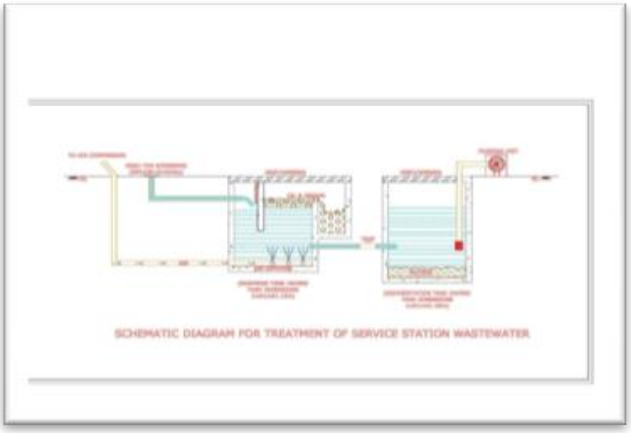


Fig -2: Prototype treatment system for treatment of service station wastewater

The prototype model consists of following components:

1) Skimming tank
2) Sedimentation tank
3) Air diffuser
4) Mesh for screening
5) Valve
6) Pumping unit
7) Vent or Opening

The design of treatment is based on theoretical assumption and practical knowledge. It can work practically as per my opinion this treatment mainly consists of two tanks one is skimming and another is sedimentation tank. Two tanks are sufficient to treat the service station wastewater. The components are described in below:

6.1 Skimming Tank

The tank which is used for the removal or disposal of oil and grease is the skimming tank. Tanks that drain oil and grate from the water build up before the sedimentation tank are skimming tanks. Municipal wastewater includes oil, fatty acids, waxes, soaps and so on. The greasy and oily substance may create a blurry smell on the settling tank surface or interfere with the process of activated sludge. In skimming tank air is expelled by an air diffuser at the bottom of the tank, along with chlorine gas. The rising air tends to coagulate or solidify the fat, causing it to climb up to the top of the tank when the protein protects by chlorine in emulsifying the fat. The fatty material is collected from the top of the tank and collected by specially designed mechanical or manual equipment.

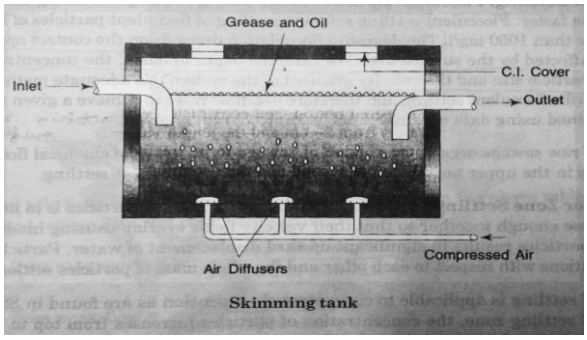


Fig. 3 – Schematic sketch for skimming tank

6.2 Sedimentation Tank

A sedimentation tank helps floating contaminants to flow gradually into the tank and thus have some cleaning of the surface or waste water. At the bottom of the tank is formed a layer of storage solids, called sludge, which is removed frequently. Suspension of solids in water those are more severe than water tends to settle gravitationally once the turbulence is delayed with the provision of stock.

The tank is called a settling tank in which the discharge is interrupted. It is called the statistical average time or detention time during which water is stored in the settling tank. Sedimentation elimination of suspended particles depends on their dimension, particle density and special gravity.

If their specific gravity resembles water and very small particles move through the filter will settle, suspended solids retained on a filter will stay in suspension. When the measurable mass collected on the base of the Imhoff cone after one hour has been settling down, dynamic solids are measured.

6.3 Air diffuser

Air diffuser: An aeration device, typical of disk, tube or plate type, used for the transmission of air into the sewage or industrial waste water is an air diffuser or membrane diffuser. Amount of oxygen is expected to separate up pollutants by microorganisms / bacteria.

The typical efficiency of a potable water diffused deck treatment aeration system is 2% /ft submergence, or 6.6% /m. When translated to mass conversion into raw or polluted water, nearly half of those figures are typically nearest.

Fine bubble device manufacturers argued that "pores" are of great efficiency with regard to the form, number and scale of a large aerated device. The aeration system has two types that is coarse bubble and fine bubble tube and which are differ from each other. Although fine bubble diffusers and coarse bubble diffusers all operate through bubble aeration, certain notable features of their nature and operation need to be defined so that they can decide which is better.

Also, for aeration process, fine bubble salt tolerant generate lower bubble diameter. Such droplets usually have a circumference of 1–3 mm. typically this small blister aeration provides Standard Oxygen Transfer Efficiency (SOTE) 2 percent or more during aeration. Fine diffusers of bubbles themselves come in a number of sizes.

We have 7, 9 and 12 inch fine bubble diffusers for urban and industrial use at SSI Aeration for strength and reliability. In contrast to coarser bubble diffusers, a large bubble diameter makes the waste water efficiently moved, choked and mixed. Cross-bladder aeration generally provides 1% or less of SOTE during ventilation. SSI offers a number of coarse bubble diffusers at different points.

6.4 Air diffuser

The mesh used for screening categorized in to the fine screen and coarse screen at which the both are used according to the site location and the outflow and turbidity of wastewater. Again, this fine and coarse screen divided into the fixed screen, band screen, disc screen, moving screen, drum screen each of them is having several functions.

In coarse fixed screen the safety of pumps, cylinders, tube lines, drives and associated equipment is to be provided. It is mounted before injection, main deployment or chamber with the waste water intake and is made of a network of rods or bars. Fine screen with maximum openings from 10 to 13 mm is located behind floor screens. Such screens are intended to avoid the accumulation of small waste such as rocks, barks, leaves, fish, etc. Fine fixed screen is good Fixed screens are suitable only for removing small quantities of content and sometimes only after the bar screen is mounted.

These screens have a 1-25 mm range of openings. Fine band screen consists of flexible wire mesh displays normally installed for the supply of a river. The flexible woven wire mesh is also fastened by a neighboring bar screen made of mild steel.

The orientation of such screens is vertical or horizontal. Jet is used to remove the garbage on the outside side of the panel from the interior of the displays. The mesh screen is also distributed on the basis of screening method as mechanically cleaned bar screen, manually cleaned bar screen, manually fixed bar screen depending upon the uses of these screens they are used on the site location also they may be divided on the basis of screening process as manually operated and automatically operated.

6.5 Valve

Valve is located in the middle of the skimming tank and sedimentation tank. The main function of valve is to maintain the detention time of both the tank.

Basically, the valves used for the underground constructions are observed as galvanized pipes but UPVC pipe line also used for the underground construction and has several advantages like it is durable and having a great strength against the pressure of water.

Valve having the main function in the treatment as the

detention time for each tank is maintained by the trap.

The valve operated manually by the operator as the water or wastewater enters into the first tank switch the valve into off mode that is skimming tank requires about 3-5 min of detention time to get the required result and then open the valve, water from the first tank enters the second tank when whole the water enters into second tank close the valve as done earlier so that about 2-3hrs required for the second tank to get the required output

Fig. 4 - Valve used intermediate of both tanks

Fig. 5 - UPVC pipes used for the tank construction this pipe with stand pressure up to 120 to 180Psi that depending upon the diameter of pipe.

6.6 Pumping Unit

The unit that is placed on the ground level and situated above the sedimentation tank is the pumping unit. The function of pumping unit is to lift the water which is remains after the process of sedimentation that water is used as recycle water for service station use. This water is not purified as the cleaned water but which is used for the service station to clean the car/bike. As the water is lifted by the pumping unit only that is mechanical operation necessary in the treatment.

6.7 Vent or Opening

The major aspect of treatment is the opening because the amount of oil and grease in water get separated in the skimming tank and removed these fatty acids by the manual work. Automatic operation can also be applied but due to economic system is held manual operation is necessary. As well as vents or openings are needed for the maintenance work of the tanks. The water level and the process can also be seen by the vent or opening.

7. Discussion

Treatment over the service station as we discussed in result section, we require to proper understanding of each the component. Minimum of 1500 lit/day and max of 30,000 lit/day flows are observed on the service station on the basis of our study area. The amount of water discharges from the service station is higher in the case of workshops of public transport. As we define this treatment system on the basis of assumptions the treatment may work when the practical model is prepared. The treatment system can be broadly explained as below:

When the water from service station comes to the outlet such that which is drained directly into the sanitary sewer line or storm water line the only process is screening process is held at present but due to our design treatment the screening is done by the mesh used. The mesh which we are using has several types according to function or the amount of TDS and TSS we use the required mesh that plays the role of screening.

After the screening of wastewater is done the amount of water directly entering into the skimming tank the skimming tank plays a major role in the separation of oil and grease from the water as well as heavy particles which are not soluble in water get lifted up and the separate container is provided to get the oil and grease amount into that container. Here firstly the skimming tank is having a baffle wall which plays as the major role to control the flow of water and water get diverted into the required direction. Purpose of baffle wall is to control the flow of water or the pressurize water get controlled by the baffle wall. The skimming tank also contains the air diffusers for the lifting of heavy greasy and oily partials to the upper surface of water level.

Air diffuser plays a vital role in the removing of oil and grease in water. Air diffuser has two types that are fine bubble tubes and coarse bubble tubes both are having several advantages and disadvantages over the water treatment. Here we use the air diffuser which has a layer of fine bubble as well as coarse bubble that is on over the another is placed for better diffusion of water.

Skimming tank requires about 2-5min for the process the flow is controlled by the valve which is in the mid of skimming and sedimentation tank. The pipe line should be adopted for the treatment used as PVC/UPVC type as this are better durable and high strength material. Valve should be used having such material and better durable also applicable for all the seasons.

When the water from the skimming tank is diverted after the process of skimming is done the amount of water

received by the sedimentation tank takes the further process. Sedimentation tank also called as settled tank is the tank in which the smaller particles which are not separated in the skimming tank get deposited down into the sedimentation tank. These takes about 2-3 hours for the settlement of the particles.

Once the particle get settled at the bottom of the tank the amount of water remains in the sedimentation tank get pumped up with the help of water motor pump used for domestic purpose is sufficient for the lifting of water from the tank.

Hence wastewater from the service station can be recycled and reused by this process. There are advantages and disadvantages over this process they will discussed in the conclusion part also some point that is to be taken while handling the system also be explained. Small and large scale service station works with these system some stations where there is no treatment is carried out should use such treatment it helps in the maintaining the ecosystem. Oil and grease in skimming can be disposed manually or it can be helpful for the industries where the fatty acids are required like dye industry.

6. CALCULATIONS

Skimming tank:

It is arranged in a chamber so that floating material like oil, fat, graft, etc., rises and remains on the wastewater surface until it is removed.

Surface area of a tank is calculated by,

$$\mathbf{A = \frac{6.22x10^{-3}xq}{Vr}}$$

Where,

A = surface area
q = rate of flow in ı/day
Vr = Minimum rising velocity (m/min)
= generally assumed as 0.24-0.24m/min

For each service station the surface area is calculated and on the basis of this the tank dimensions are decided:

1) Shri Mahalaxmi car/bike washing service station:

Given,

The rate of flow of wastewater per day is 2000 liters/day such that $2m^3$/day

q = $2m^3$/day

Vr = 0.25m/min (assume)

= 0.25x24x60

= 360m/day

We get the surface area as,

$$\mathbf{A = \frac{6.22x10^{-3}xq}{Vr}}$$

$$\mathbf{A = \frac{6.22x10^{-3}x2}{360}}$$

$$\mathbf{A = 0.000035\ m^2}$$

Now, provide the depth of tank as 1.5m
The length to breadth ration assume as 1.5:1
So,
L = 1.5B
LxB = 1.5 ……(as LxB = A)
B = 0.0048m
L = 0.0096m
The dimensions of the tank are 0.0096mX0.0048mX1.5m.

2) Shri Datta servicing center:

Given,

The rate of flow of wastewater per day is 6000 liters/day such that 6 ı/day

q = 6 ı/day
Vr = 0.25m/min (assume)
= 0.25x24x60
= 360m/day
We get the surface area as,

$$\mathbf{A = \frac{6.22x10^{-3}xq}{Vr}}$$

$$\mathbf{A = \frac{6.22x10^{-3}x6}{360}}$$

$$\mathbf{A = 0.0001\ m^2}$$

Now, provide the depth of tank as 1.5m
The length to breadth ration assume as 1.5:1
So,
L = 1.5B
LxB = 1.5 ……(as LxB = A)
B = 0.0081m
L = 0.012m
The dimensions of the tank are 0.012mX0.0081mX1.5m.

3) Shetkari auto servicing center:

Given,

The rate of flow of wastewater per day is 4000 liters/day such that 6 ı/day

q = 4 ı/day
Vr = 0.25m/min (assume)
= 0.25x24x60
= 360m/day
We get the surface area as,

$$\mathbf{A = \frac{6.22x10^{-3}xq}{Vr}}$$

$$A = \frac{6.22x10^{-3}x4}{360}$$
$$A = 0.000069\ m^2$$

Now, provide the depth of tank as 1.5m
The length to breadth ration assume as 1.5:1
So,
L = 1.5B
LxB = 1.5 ……(as LxB = A)
B = 0.0068m
L = 0.01m
The dimensions of the tank are 0.01mX0.0068mX1.5m.

4) KMT workshop:

Given,
The rate of flow of wastewater per day is 30,000liters/day such that 30 ı/day
q = 30 ı/day
Vr = 0.25m/min (assume)
= 0.25x24x60
= 360m/day
We get the surface area as,

$$A = \frac{6.22x10^{-3}xq}{Vr}$$
$$A = \frac{6.22x10^{-3}x30}{360}$$
$$A = 0.00052\ m^2$$

Now, provide the depth of tank as 1.5m
The length to breadth ration assume as 1.5:1
So,
L = 1.5B
LxB = 1.5 ……(as LxB = A)
B = 0.019m
L = 0.027m
The dimensions of the tank are 0.027mX0.019mX1.5m.

5) ST workshop:

Given,
The rate of flow of wastewater per day is 10,000 liters/day such that10 ı/day
q = 10 ı/day
Vr = 0.25m/min (assume)
= 0.25x24x60
= 360m/day
We get the surface area as,

$$A = \frac{6.22x10^{-3}xq}{Vr}$$
$$A = \frac{6.22x10^{-3}x10}{360}$$
$$A = 0.00017\ m^2$$

Now, provide the depth of tank as 1.5m
The length to breadth ration assume as 1.5:1
So,
L = 1.5B
LxB = 1.5 ……(as LxB = A)
B = 0.01m
L = 0.016m
The dimensions of the tank are 0.016mX0.01mX1.5m.

6) Riverside honda:

At the service station, treatment is already performed. Four tanks of 2500 L capacity and a filtration unit is placed at the center of the tanks, which is next to the washing plant and the water is then purified in accordance with the continuous process, and water is reused at service station.

7) Shivganga suzuki:

Given,
The rate of flow of wastewater per day is 2000 liters/day such that 2 ı/day
q = 2 ı/day
Vr = 0.25m/min (assume)
= 0.25x24x60
= 360m/day
We get the surface area as,

$$A = \frac{6.22x10^{-3}xq}{Vr}$$
$$A = \frac{6.22x10^{-3}x2}{360}$$
$$A = 0.000035\ m^2$$

Now, provide the depth of tank as 1.5m
The length to breadth ration assume as 1.5:1
So,
L = 1.5B
LxB = 1.5 ……(as LxB = A)
B = 0.0048m
L = 0.0096m
The dimensions of the tank are 0.0096mX0.0048mX1.5m.

6. CONCLUSIONS

The analysis and measurements of the service station are based on a study obtained as well as the literature survey conducted during the research. This cycle has the principal benefit of recycling water in the service station. Following care should be taken while handling the treatment system:

-The mesh which is provided at the start of the treatment should be cleaned as the wastewater is continuously flowing there is production of clogs on the mesh so that the water for further process cannot be reached at desire amount.

-Air compressor is required for the air diffuser process maintain the pressure from 3psi to 5psi depend upon the

site conditions and the amount of outflow of wastewater. Chlorine dosage along with the air is effective for the disinfection in water. As per the site location the chlorine dosage with air is applied. Air diffusers are typically connected to the piping system which is supplied with the pressurized air by blower, The system commonly known as diffused aeration system or aeration grid. Aeration is used extensively for the biological oxidation of both domestic and industrial organic waste. It increases the percentage of oxygen in the water. This implies that aerobic process takes place in the air diffuser as aerobic process is a process that occurs and requires presence of oxygen pr air as opposed to an anaerobic process.

-Skimming tank requires daily extraction of oil and grease which floats on the surface of water and get into separate container which can be removed easily either by manual or automated system is available. The disposal of skimming tank will be carried out by following method:

-Deposit of skimming from the skimming tank is possible to produce soap, lubricants, paint, pitch and other items that cannot be consumed. Typically, burning or burning in the ground eliminates the slurry. If there is mineral oil and more organic and vegetables available in limited amounts. There are oils available that can be used for fuel gas production.

-Sedimentation tank requires the maintenance work. The sludge which is settled down get cleaned daily for the proper working of treatment process the pipes which are used are to be either galvanized or to be PVC so that these pipes having the great strength and durability.

-Valve which is used having a higher strength because the pressure of water will be handled by this valve. This are some advantageous and care taking point for the treatment process

-Disadvantage of tank is that it requires the periodic maintenance such that scum and sludge cleaned daily also mesh used for screening will properly clean so that the amount of water flow maintained. Pumping station may also require some maintenance after some day. Air compressor having also periodic maintenance.

Other methods to treat the service station water are:

6.1 Grease trap:

A grate trap is a storage mechanism (a form of trap) designed to interact with most grades and solids, before accessing a drainage system for wastewater. Popular waste water includes oils accessing the sewage network and treatment plants for the creation of a liquid waste layer.

During anaerobic digestion this scum layer is very slowly digested and invaded by microorganisms. Fat, oils, and greases (FOGs) entering sewers are reduced by traps. These are manufactured from a wide range of items, such as steel, plastics, concrete and cast iron. The volume ranges between 35 and 45,000 liters and higher and can be placed over the ground also below the ground.

When the flow enters the grease trap, solid particles sink down and the lightest fat and oil float upwards. The water is then fed relatively fat-free in the normal septic system. The solids on the bottom, liquid oil and grease must be drained periodically, close to the filling of the septic tank.

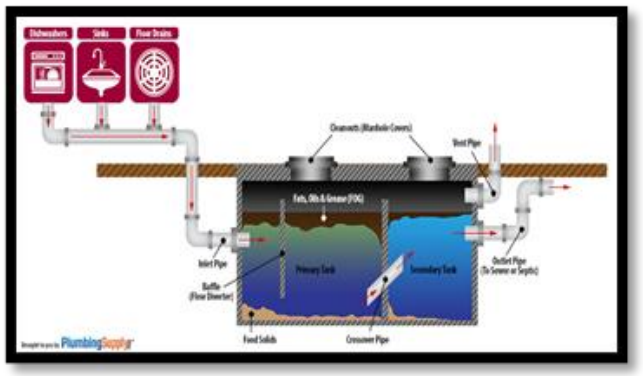


Fig. 6 – Grease trap

6.2 Techno- Commercial Offer for Effluent Treatment Plant (ETP) for Car Wash Effluent by Flagship India:

Following figure represent the treatment system held by the Flagship India for car washing:

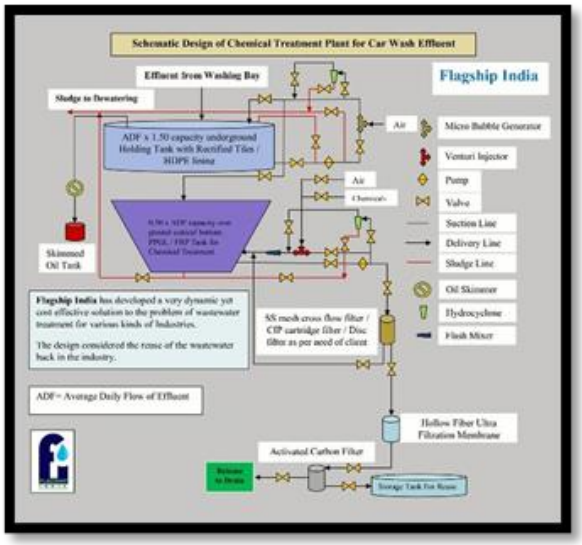


Fig No.7: Flagship India treatment plant over car wash service stations

Treatment consists of following steps or the operation features of the treatment are as follows:

Car washer effluent is collected from the collecting pit and flows into underground RCC / HDPE lined collecting tank cum equalization by gravity (or by pump if that may be required in a specific case).

Compacted air from the gracefully source gave by the customer is gone through diffusing layers to mix air to help oil buoyancy and microbial corruption with the assistance of unique microbial consortia in the tank

presented by Flagship India. Effluent is re-circulated through transfer pump via Micro Bubble Generator to induce micro bubble in the effluent forcing the oil and grease to separate and float up.

Continuous oil removal is provided by belt type oil skimmer. Removed oil is taken to a sump for reselling or disposal. Hydro cyclone is used to partially remove sludge during recirculation flow. Transfer of raw effluent from underground collection tank into Batch Type chemical treatment chamber mounted on a skid (above ground) is done by pump with level control arrangement for automatic operation. Automatic online dosing of chemicals by venture injection system for chemical precipitation/neutralization is done before passing through spiral flow Cyclonic flash mixer. Hydro cyclone is used to remove sludge during recirculation flow. Add Bentonite @ 100-500 ppm (gm/M3) or up to the point when floating oil has disappeared after through mixing if oil skimmer is not installed.

It will also help in coagulation and quicker precipitation of sludge. Add Alum solution/Poly-Aluminum Chloride (PAC) slowly till coagulated particles show pin flocks. Test a small batch in a beaker to determine the exact dose. This addition of Alum / PAC will also help in Phosphorus removal. Add Chitosan @ 1 ppm (1gm/M3) if oil is present in the raw effluent and or Polyelectrolyte (such as the one supplied by SNF, Ashland-Hercules or equivalent) @ 10-50 ppm (gm/M3) till the pin flocks have turned into larger flocks and are clearly visible. If need be, small batch test should be conducted to determine the dose. At this point as the flocks will have clearly formed which means the coagulation is complete. So, it will be time for flocculation to begin. Check the pH. If it is in the acidic side, add pre-diluted lime/caustic solution till the pH reaches 7~7.5 while stirring well through mechanical stirrer or pump recirculation whatever is in the design.

Till this point if you are using a mechanical stirrer use it at 120-150 RPM for 10-15 min. Add pre-diluted anionic PAM (Poly-acryl-amide) in pre-diluted solution @ 2-10 ppm (2 gm to 10 gm of PAM powder/ M3) up to the point when all the flocks have come together and formed larger and quickly settling flock. In case of readymade PAM solution is used, the dose will be accordingly to the situation and strength of the preparation. During this flocculation phase use the stirrer at 10-20 RPM for 2-5 min. Stop all agitation and let the flocks settle down. Flocculated solids are now allowed to settle to the bottom of the chamber. Sludge from underflow goes to sludge drying bed for dewatering and subsequent municipal discharge.

Treated effluent from top goes to intermediate holding tank or directly from the chemical treatment tank for filtration as may be the design according to requirement. Filtration starts with 10-micron Stainless Steel Mesh filtration / Disc Filter / Sand Filter to be followed by Activated carbon Filter Modules taking out microorganisms, color, Suspended Solids. Hollow Fiber Ultra Filtration Membrane Filter is used as an option before Activated Carbon Filter to remove microorganisms, if that is needed.

Treated effluent after filtration unit can be used back in the car washing directly or via softener as per recommendation of the Car Washing Equipment Supplier, making this ecofriendly industry.

REFERENCES

[1] M.N. Asha, K.S. Chandan, "Recycling of Waste Water Collected from Automobile Service Station", Elsevier, 2015, pp.289-297.

[2] S.Nimal and Abdul Akber Shanaz Fathima, " Recycling automobile service station wash center", International journal of civil engineering and technology, April 2018, pp.795-802.

[3] A A Al-Gheethi, R M S R Mohamed, M A A Rahman1, M R Johari1 and A H M Kassim, "Treatment of Wastewater From Car Washes Using Natural Coagulation and Filtration System", IOP conf. series Materials Science and Engineering, July 2016.

[4] W.J. Lau, A.F. Ismail, S. Firdaus, "Car wash industry in Malaysia: Treatment of car wash effluent using ultrafiltration and nanofiltration memberanes", Elsevier, November 2012, pp.26-31.

[5] Debabrata Mazumder and Somnath Mukherjee, "Treatment of automobile service station wastewater by coagulation and activated sludge process", International Journal of Environmental Science and Development, February 2011, pp.64-69.

[6] J.C. Campos, R.M.H. Borges A.M., Oliveira Filho, Nobrega, G.L. Sant'Anna, "Oilfield wastewater treatment by combined microfiltration and biological process", Water research Elsevier, April 2001, pp.95-104.

[7] C. Fall, C. M. Lopez-Vazquez, M. C. Jimenez-Moleon, K.M. Ba, C. Diaz-Delgado, D. Garcia-Pulido and M. Lucero-Chavez, "Carwash wastewaters: Characteristics, volumes and treatability by gravity oil separation", Revista Mexicana de Ingenieria Quimica, July 2007, pp.175-184.

[8] R. N. Zaneti, R. Etchepare and J. Rubio, "Car wash wastewater treatment and water reuse – a case study", Water science and technology, January 2013, pp.82-88.

[9] S. Adish Kumara, A. Kokila, J. Rajesh Banu, "Biodegradation of automobile service station wastewater", Desalination and water treatment, May 2013, pp.4649-4655.

[10] Swapnil M. Kamble, "Water pollution and public health issues in Kolhapur city in Maharashtra", International journal of scientific and research publication", January 2014.

[11] A M Manilal, M G Harinarayanan Nampoothiri, P A Soloman, "Removal of oil and grease from automobile garage wastewater using electro-coagulation", IOP Conf. Series: Materials Science and Engineering, June 2017.

[12] Dr. Krishna M. K, Dr. Manjunath H.N, Ayesha siddiqa, "Treatment of service station wastewater using electro-coagulation process", International Journal of Research Granthalaya, July 2017, pp.348-353.

[13] Pranita P. Wadkar and Sachin J. Mane, "Low cost treatment to automobile wastewater service center", Global Research and Development Journal of Engineering, March 2016, pp.238-240.

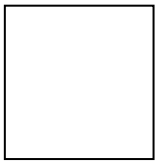
[14] Carlos Banchon, Alexandra Castillo, Paola Posligua, "Chemical interation to clean up highly polluted automobile service station wastewater by bioadsorbant-coagulation-flocculation", Journal of Ecological Engineering, January 2017, pp.1-10.

[15] Mrs. Bharati S. Shete and Dr. N. P. Shinkar, "Use of membrane to treat car wash wastewater", International Journal for Research in Science & Advanced Technologies, 2014, pp.13-19.

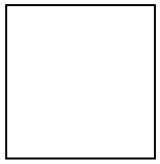
[16] Rohan A. Walzade, Aditya G. Koul and Prof. Gaurav B. Daware, "degradation of pollutants from automobile service station by using heterogeneous photocatalysis", International Journal of Trend in Research and Development, 2016, pp.151-154.

[17] Ishwar P. Patil, Prof. Hemant D. Wagh and Prof. (Dr.) Arun Kumar Dwivedi, "Water recycle and reuse-a case study of NMIMS University campus", International Journal of Engineering Invention, September 2013, pp.10-17.

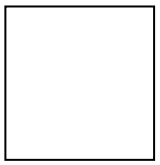
BIOGRAPHIES



Mahesh Ananda Lokhande received his M.tech in Environmental science and technology from Departement of technology, Shivaji University. Currently working as Assistant Professor in Department of Civil engineering, D Y Patil technical campus, Talsande, Kolhapur.



Girish Shrinivas Kulkarni received his M.E in Environmental Engineering from Shivaji university & Doctor of Philosophy in Civil (Environmental) Engineering under Faculty of Engineering & Technology, Walchand College of Engineering, Sangli affiliated to Shivaji University, Kolhapur on Techno-economical feasibility of using Solar Energy for Environmentally sustainable Buildings. He has got experience in many fields such as, 1.5 Years in Public Works Department of Maharashtra State Government as Asst. Engineer, 11 Years Deputy Registrar (Civil) Shivaji University, Kolhapur, presently working as 'Director' Department of Technology, Shivaji University, Kolhapur from May, 2010 onwards. He is Trustee Dnyandeep Education & Research Foundation, Sangli., Member Environmental Protection & Research Foundation, Sangli, Member Institution of Engineers (India). 13 M.tech scholars have been awarded under his supervision and currently he is supervising 5 PhD scholars.



Shrikant Malhararao Bhosale received his M.E in Structures from Shivaji University. Currently working as Assistant Professor in Department of technology Shivaji university Kolhapur. He worked as a Deputy registrar (Civil) in Shivaji university. 03 M.tech scholars have been awarded under his supervision.