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# Treatment of Vehicle Washing Waste Water for Maximum Reuse of Treated Water and Reduce Fresh Water Consumption

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*Abstract*- **Wastewater generated from car washing activity is one of the major wastewater resources, which contribute effectively in water contamination due to the chemical characteristics of the car wastes. It is observed that ample amount of water is being used during vehicle washing and the waste water generated though the activity is directly discharge into municipal drainage system without any treatment. As vehicle washed water is not highly polluted it can be treated easily and can be reused for vehicle wash again.**

**The present work aimed to decide the treatment of waste water from servicing center and reuse the treated water for car wash and thus reduce the fresh water consumption. For study, the servicing center, The Exotica Car Detailing Studio , Ruikar Coloney, Kolhapur has been selected. Waste water samples were collected and concentration of parameters like pH, BoD, COD, TS, TDS, TSS, O & G, has been checked to know the Average concentration of these pollutant in car wash waste water. Depending on the results, the treatment of car wash wastewater finalized and with respect to same lab scale model prepared involving five process such as Collection, Screening with O & G removal, Chemical coagulation and flocculation , sedimentation and filtration.**

**The coagulation and flocculation was carried out using different dosage and Best results are obtained with the dosing 5, 10, 1.7 mg/lit of Alum, Lime and poly respectively. After passing the waste water through lab scale model treated water characteristics were checked. It is observed that designed treatment system have 65-70% overall efficiency for treatment of raw carwash wastewater. The treated carwash wastewaters meet Environmental Protection rules Discharge standards as per Schedule VI 1986 for the parameters like pH, BoD, CoD, TSS, O & G etc. to dispose the treated water into land surface or for irrigation. Thus the treated water can be discharge into same land to increase or maintain ground water level and reuse again for car wash and thus reduce the fresh water consumption.**

*Keywords*—Treatment, Parameters, Model

## I. INTRODUCTION

A car wash is defined as a non-domestic installation for external cleaning of cars. Car wash generates high amount of wastewater approximately 150 to 350 liters per vehicle Car washing consists of oil and grease leaking during engine washing, high suspended solids from brake linings, with sand and dust being washed away. All the accumulated sediments will flow to the drainage system and go into storm water system without any treatment. Hence, endangered the ecosystem when washes away to the drainage system, streams and to the receiving waters, leads to the increased environment pollution. Generally, public perceived that the wastewater from car washing is not severely contaminated compared with other industrial wastewaters. Hence, petite attention is given to the car wash industries.

Presently, India has increased in car volumes on the road together with the existing number of cars. It has boosted the car wash industry, leading to the increase in car wash service stations, particularly in rapid development and high population of the focal point area. The carwash wastewater represents one of the contaminated wastes with impurities. It was due to presence of sand and particles, oil and grease, surfactants, detergent, phosphates and hydrofluoric acid. Therefore, the direct disposal for wastewater into the drainage exacerbates the natural water pollution. On the other hand, the discharge of the car wash wastewater directly into sewerage system has negative impact and disturbs the treatment efficiency in STPs. Further, the treatment of wastewater at source might be easier and more effective than that if they have collected into one treatment plant. Due to which the separate treatment process will take sufficient time to remove most impurities and contaminants. Indeed, the treatment of small amount of wastewater does not require a complicated treatment system to produce high quality of treated wastewater. Moreover, the simple treatment system might be more efficiency to produce good quality of treated wastewater suitable for car wash again. The aim of this study is to treat car wash waste water, reuse the same again for car wash and thus reduce the fresh water consumption.

## II. AREA OF STUDY

Exotica Car Detailing Studio, Tarabai Park Kolhapur car wash center has been selected as study area. The source of the fresh water they used is ground water. The fresh water is pumped from ground and as it is hard water after passing through softner collected into storage tank having capacity 5000 lit. Mostly four wheeler car washing activity is carried out over

their as compare to two wheeler. The photographs of car washing activity at Exotica are shown below in Fig 1 & fig 2.

Fig.1. Photograph of under body wash activity

Fig. No.2 - Photograph of foam wash activity

## III. MATERIALS & METHODS

### a. IDENTIFICATION OF FRESH WATER CONSUMPTION AND WASTE WATER GENERATION:

To understand the total fresh water consumption, monthly data of water consumption is collected for one year from June 2018 to May 2019 is shown in the Table No. 1 below.

**Table No.-1 Total Fresh Water Consumption**

| Sr. No | Month | Water consumption per month |
|---|---|---|
| 1. | Jun-18 | 1,47,050.0 |
| 2. | Jul-18 | 1,56,950.0 |
| 3. | Aug-18 | 1,87,900.0 |
| 4. | Sep-18 | 1,96,750.0 |
| 5. | Oct-18 | 1,61,100.0 |
| 6. | Nov-18 | 1,48,450.0 |
| 7. | Dec-18 | 1,80,250.0 |
| 8. | Jan-19 | 1,50,000.0 |
| 9. | Feb-19 | 1,43,070.0 |
| 10. | Mar-19 | 1,53,000.0 |
| 11. | Apr-19 | 162,120.0 |
| 12. | May-19 | 172,655.0 |
| | In Lits | **1,959,295.0** |
| | In M3 | **1,959.30** |

### b. SAMPLE COLLECTION AND ANALYSIS:

Samples were collected from the chamber of servicing center as shown below**.** Presently, waste water collected here and then passed through the pipe to sewerage system. Samples collected from the chamber shown below:

Fig. No.3- Photograph of sample collection

The concentration of parameters like pH, BOD, COD, TS, TDS, TSS, O & G has been checked. The Table No. 2 shows concentration of parameters of four different samples as S1, S2, S3 & S4 collected at different day and time are shown below.

**Table No. 2 Inlet Concentration of Parameters**

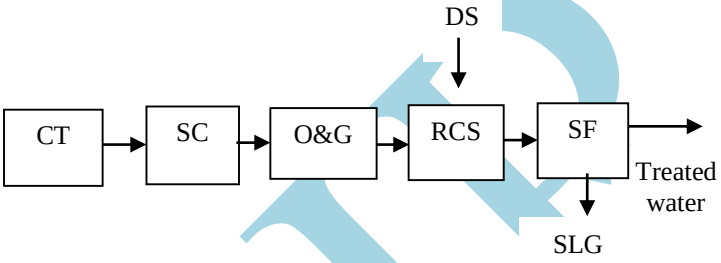
| Sr. No. | Parameters* | S-1 | S-2 | S-3 | S-4 |
|---|---|---|---|---|---|
| 1. | pH | 7.75 | 7.37 | 6.98 | 6.94 |
| 2. | O & G | 310 | 224 | 65 | 42 |
| 3. | BoD | 55 | 68 | 60 | 58 |
| 4. | COD | 520 | 1200 | 680 | 440 |
| 5. | Total Solids | 920 | 2800 | 440 | 1160 |
| 6. | Suspended Solids | 620 | 2280 | 340 | 780 |
| 7. | Dissolved Solids | 300 | 520 | 100 | 380 |

*Note: For all parameters concentration mentioned is in mg/lit & pH has no unit

**c. TREATMENT FOR WASTE WATER:**

As per the inlet characteristics mentioned in Table No. 2 it is observed that the waste water has major impurities like O & G, Solids, COD etc. for the removal of these contaminants following treatment is decided and Lab scale model has been prepared. The Process flow Diagram shown below in the Fig No.4

Fig No.4- Process Flow Diagram




CT-Collection Tank to collect car wash water
SC-Screen Chamber
O & G-Oil & Grease removal tank
RCS-Reaction Cum Settling tank
SF-Sand Filter
DS-Dosing System for Alum, Lime & poly
SLG- Sludge Collection

The lab scale model is set up in the lab having all the units arranged such as the flow should be carried out through gravity. The model is run in batch process. First unit called as Collection tank of capacity 10 lit is used to collect the waste water generated from servicing center. 15-20% solids in the form of mud, sand, particles gets settled in the collection tank. The waste water from collection tank then forwarded to Screen Chamber of capacity 6.7 lit (15 cm X 30 cm X 15 cm) to remove the floating material.

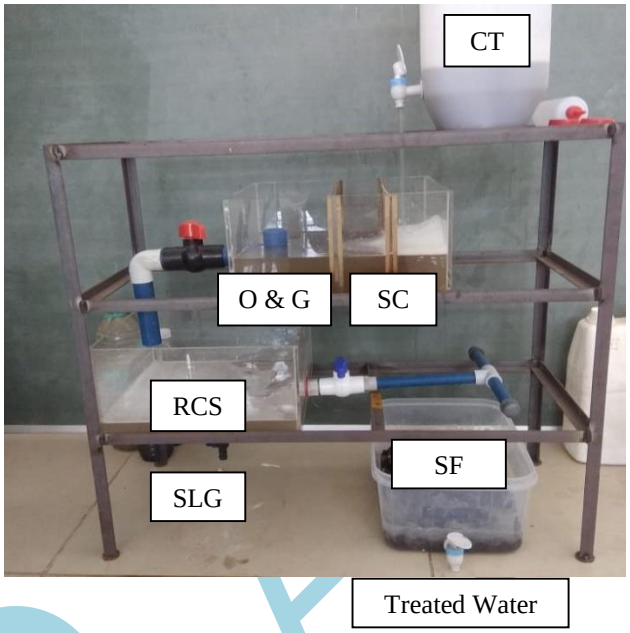



Fig No.5- Set up of Lab Scale model

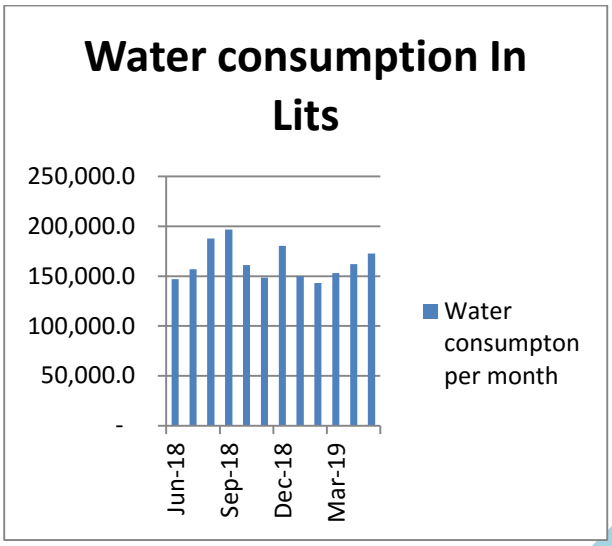
It is observed that less amount of screens are collected on the screen placed inside the Screen chamber. The effluent then forwarded to Oil & grease Trap having capacity 6.7 lit (15 cm X 30 cm X 15 cm). Due to density of oil is less than water, oil gets float on the surface of the water and that can be removed manually. Outlet is provided to O & G tank in such a way that only clear water flow to Reaction Cum Setting tank and Oil & Grease layer float on the surface. Partly O & G is removed in further process. The Reaction Cum Settling tank is having capacity 13.5 lit (30 cm X 30 cm X 15 cm). with Sludge holding capacity as 6.5 m3. Lime,Alum & poly Dosing is then carried out in the Reaction cum settling tank. The varying amount of chemicals dosage optimized and optimum dosage with maximum selling and less sludge generation is observed with the dosage of Lime 5mg/lit, Alum 10mg/lit and poly 1.7mg/lit. After addition of chemicals, mixing is carried out manually with the stirrer for 3-5 minutes and then effluent is allowed to settle with the retention period of 1.5 hrs. Coagulation, flocculation process results in the removal of impurities in the form of sludge and same gets settled in the conical hopper provided at the bottom of the tank. After retention time the supernatant from the reaction cum settling tank is forwarded to the sand filter for filtration process. The remaining traces are removed in the filtration process in Sand filter and clear water comes out as treated water. The sludge settled in conical hopper in RCS tank is removed from the bottom of the tank with help of valve provided

The trials are carried out with Batch process through model with variety of samples. The concentration of parameters like pH, BOD, COD, TS, TDS, TSS, O & G at inlet and outlet has been checked

## IV. RESULTS & DISCUSSIONS

Total fresh water consumption for the year is shown in the Table No. 1. The graphical representation shown below.




From the graph it is observed that the variation in the water consumption is due to variation in the number of vehicles coming for washing per day, season, number of working days etc. Total water consumption for the period is 1959. Cubic Meter and the same amount of waste water is being generated and released to drainage system without any treatment. If we provide the treatment to waste water then we can save upto 80-90% of fresh water consumption by reusing the treated water. The samples with different time & date with their inlet and outlet concentration are shown below in the Table No. 3

| Samples | | S-1 | | S-2 | | Permissible limit for inland surface water or for irrigation |
|---|---|---|---|---|---|---|
| Sr. No. | Parameters* | I | O | I | O | |
| 1. | pH | 7.7 | 7.12 | 8 | 7.56 | 5.5-9 |
| 2. | O & G | 30 | 9.2 | 88 | 10 | 10 |
| 3. | COD | 800 | 200 | 700 | 300 | 250 |
| 4. | BOD | 110 | 11 | 60 | 10 | 30 or 100 |
| 5. | TS | 960 | 288 | 560 | 179 | # |
| 6. | TSS | 600 | 86.4 | 180 | 44.8 | 100 or 200 |
| 7. | TDS | 360 | 201.6 | 380 | 134.4 | # |

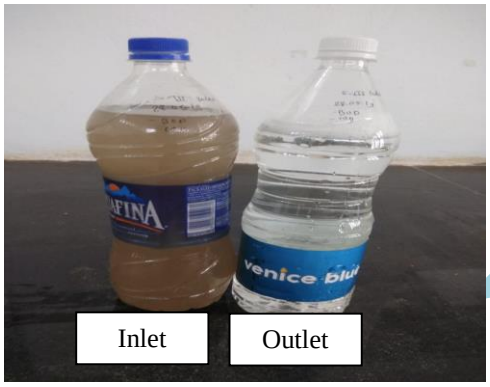
| Samples | | S-3 | | S-4 | | Permissible limit for inland surface water or for irrigation |
|---|---|---|---|---|---|---|
| Sr. No. | Parameters * | I | O | I | O | |
| 1. | pH | 7.86 | 7.1 | 7.5 | 8.25 | 5.5-9 |
| 2. | O & G | 14 | 8.3 | 190 | 9.3 | 10 |
| 3. | COD | 500 | 200 | 300 | 200 | 250 |
| 4. | BOD | 100 | 28 | 90 | 30 | 30 or 100 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 5. | TS | 860 | 301 | 600 | 210 | # |
| 6. | TSS | 460 | 94 | 340 | 84 | 100 or 200 |
| 7. | TDS | 400 | 208 | 260 | 126 | # |

*Note: For all parameters concentration mentioned is in mg/lit & pH has no unit #- Not specified in standards
TS-Total Solids
TSS-total Suspended solids
TDS- Total Dissolve solids
I – Inlet of sample O- Outlet of sample

Fig No.6-photograph of Inlet & outlet of Sample-2




From above table it is observed that in inlet Solids and O & G are main impurities. As there is less amount of biodegradable organic matter is present in the inlet less BOD concentration is observed at inlet and outlet. The efficiency of removal of for O&G is 70-75%, COD-55 to 60%, BOD-75-80% ,TS-60-70%, TSS-75 to 80% and TDS -50-60% . The wet sludge generation is 2.5 to 3.5 mg/lit and same can be dried to reduce volume and dispose off.

## V. CONCLUSION

It can be concluded that the integrated treatment scheme designed here is effective for treatment of raw car washes wastewater. The overall treatment is having nearly 65-70% efficiency and the treated water can be discharge to inland surface water body as per the EPA rules (1986) Schedule VI or can be used for irrigation as per Effluent Discharge standards. Moreover, providing such treatment to service center will reduce the burdon on municipal sewage treatment plants. Also, reuse of treated water will reduce the burdon on fresh water sources. For this particular case as mentioned above the souce of water is ground water so we can also percolate the treated water into nearby ground which will increase or maintain the ground water level so that the same will be reused for vehicle washing. Thus the overall study will focused on saving water and reducing water pollution.

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