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Treatment of Carwash Waste Water and Its Reuse to Manage Water Supply

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Abstract. ***The current problem to water supply is the contamination of water resources by pollution. water pollution generally known to be caused by Domestic and Industries there are also some more Auxiliary units which producing more waste water which is not perceived yet as a cause of waste water .***

In that Car wash waste water is the major producer of waste water which is let untreated in to water bodies. Transportation of people now uses mostly personal vehicle which leads to increase of more number of individual transport mode. In that particularly usage of car as well as its maintenance leading to create more waste wash water and also utilizing more volume of water for that purpose impact the environmental water balance in many ways as the conventional treatment of waste water costing more they are not think about treatment,

So in this work the two samples was collected, and initial characterization was done and it was treated by Adsorption method with different Adsorbent which could be prepared from low cost and easily available material.

For this work Prosopis juliflora leaves (AD1)and Casuarina equisetifolia (AD2) leaves were used as adsorbent and waste cotton cloth(AC1) which is cellulosic fiber rich in carbon content was used to prepare Activated carbon

The treated water was found to be in excellent reduction level of various pollutant level as follows, the level of TSS showed 94.5% &BOD 95.4% ,COD 96.6% was reduced for the sample 1 . The pollutant due to the usage of detergent, that is the Methylene blue Anionic substances level also reduced from 1.8 mg/lit to 0.2 mg/lit of about 88.89%by prepared activated carbon(AD1).and very good reduction level of Oil and Grease was resulted by AD1,AD2,AC2 99.5%, 98.7%, 99.1%

It is evident from the result that the waste cloth material and the un wanted growth of Prosopis juliflora which has been insisted to cut down of save underground water could be used in another way for treating waste water and and to solve the problem of water management and supply.

Keywords: Total Dissolved Solids(TDS),TSS (Total Suspended Solids(TSS)Chemical Oxygen Demand(COD),Biological Oxygen Demand (BOD) ,Methylene Blue Active Substances(MBAS).Adsorbent(AD),Activated Carbon(AC)

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I. INTRODUCTION

Continuous population growth in urban areas increases demand for public services including transportation, which includes private and public cars, trucks and buses The number of vehicles,

February 28 ,2018 The Number Of New Cars Registered In State Of Tamilnadu Is 25.41 Lakhs. The Total Number Of Vehicles In The State Has Crossed 2.75 Crores. The Number Has Been Rising Consistently Over The Years The Total Transport Vehicle Population In The State Has Increased By 155 Per Cent In The Last 10 Years1. More Liters Of Water Was Consumed Per Car Discharging So Many Chemicals During Car Wash Activities The Y Are Mostly Let Out As Untreated And Directly Enters In To Our Wate Sources Like Lakes, Rivers2. The Sludge Of Vechicle Waste Water Contains Contaminants Like Sulphates Sulphites And Some Metal Pollutants And Also Elevated Levels Of Oil And Grease Creating Unacceptable Levels Of Acidity Or Alkalinity3 . Studies At Various Parts Of Nations Shown That Car Wash Service Station Is A Potential Source Soil, Air, Water Poluution4 From The Point Of One Researcher Car Wash Wastewater Recycling Needs The Initial Step Of Pretreatment For Separation Of Floating Materials And , Oils And Greases5. Further Treatment Processes Can Be Integrated To Improve The Quality Of Reclaimed Water To Be Used In The Different Washes Stages Some Of These Process/Technologies That Have Been Proposed And Tested Are Reverse Osmosis5 And Nano filtration6ultrafiltration7ultrafiltration -Activated Coal Adsorption8 Electrochemical Oxidation9 Biological Treatment; flocculation –Sedimentation And flocculation –flotation10 In These All Are Requiring More Initial Investment Which Could Not Be Considered By The Car Wash Station Owners. So In This Work First It Was Tried To Treat The Car Wash Waste Water By Adsorption Process With The Low Cost Adsorbent Which Can Be Prepared From Easily ,Available Material Source And Also Should Be Cost Effective So That It Would Be Ready To Be Adapted In The Wash Water Treatment Method.

II. MATERIALS AND METHODS

A. Sample collection

The two sample of car waste water was collected from a pit under the washing surface of car in a two different local service station (Chennai)showed in Fig.1.

Sample of waste water was collected in a 2 lit glass container and cooled to 4˚C.then transported to the laboratory for analysis of physical, chemical and biological parameters and for treatment.

Fig 1.Place of Sample collection

B. Characterization of wastewater:

The First step of work after collecting two car wash waste water was done to find its initial condition of all basic parameters generally checked for waste water analysis.

C. pH

The pH was analyzed by using pH meter. It was in acidic range (3-4).

D. Total suspended solids(TSS)

Solids which are larger than 2µ are called suspended particle it can be filterable, mostly its refers inorganic particles .Turbidity and Tss are relatedas turbidity is indication of changes in TSS in a water.

E. Total dissolved solids(TDS)

TDS was analysed by 2540-C APHA.

F. Biological oxygen demand (BOD)

BOD of the car waste water sample of 3 days at 27˚C was estimated by 5210-B APHA method.

G. Chemical oxygen demand (COD)

COD is the measurement of the amount of oxygen in water consumed for chemical oxidation of pollutants. To determine the chemical oxygen demand for the car waste water sample we use 5220-B APHA method.

H. Methylene blue anionic substances (MBAS)

In car wash service station for cleaning purpose they are using strong detergents and surfactants with car wash liquids and shampoos,they are presented as MBAS when these are let to water bodies untreated it will spoil the aquatic life .so it is important to determine the MBAS pollution level[11] Major sources of surfactants entry to the water bodies and to the surface soil was in the form of cleaning agents[12]

I. Oil and Grease (O&G)

Presence of oil and grease (O&G)) leads to damage of Ecology in aquatic system[13] It is very dangerous to the all living animal, humans and plants causing cancer and Mutation[14]. Presence of O&G in water creating a film of oil layer above the water which prevents the biological activity , because the layer formation will decrease the level of Dissolved oxygen it leads to difficulty in oxidation of Microbial hydrocarbon molecules[15]

III. TREATMENT BY ADSORPTION

A. Adsorbent from plant leaves

Fresh leaves of Prosopis juliflora were and Casuarina equisetifolia collected from the Bharath institute of higher education and research campus, Chennai, Tamilnadu and the leaves were identified and authenticated by a botanist, Chennai, India. The fresh leaves were collected and washed thoroughly with fresh water. Then it was it was dried in shade. After complete drying it was ground into fine powder sample Prosopis juliflorawere adsorbentAD1 and Casuarina equisetifolia adsorbent AD2 were saved in air tight container.

B. Activated carbon Adsorbent

we are interested to treat the waste water sample with the carbon particles also as it can be produced from various carbonaceous source materials such as nutshells, coconut husk, peat, waste cloth materials, wood, coir, lignite, coal and petroleum pitch. This carbon can be used to remove pollutant from water economically, cotton cloth material is cellulosic in nature made up of elements like Carbon, Hydrogen, oxygen, In this work waste cotton cloths were taken as a source for producing activated carbon. waste cloth material was carbonized under the absence of oxygen environment and it was crushed grinded and sieved to required mesh size and then it was activated by Zncl2.again dried sample AC1kept in a air tight container for further use .

C. Preparation of Adsorption Column

For this study we designed the adsorption column set up for continuous mode of operation showed in Fig.2 , clean dry Colum was taken and first glass wool was placed inside the column which will act as a support for adsorption bed. After that to improve the stability and treatment sand bed was made to some height above the glass wool support above this layer of sand bed our prepared carbon particles of same size was packed to required depth .then another layer of sand bed was made to sandwiched the carbon.

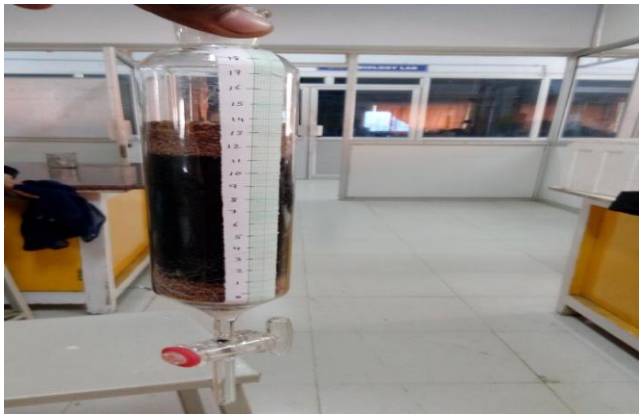

Fig 2.Glass column with sand and carbon particles

D. Treatment Of Wastewater

Two sample of Car wash water was treated as follows

Sample1- Treated with Prepared Activated carbon AC1
Sample2- Treated with Prosopis juliflorawere adsorbent AD1 and Casuarina equisetifolia adsorbent AD2, Commercial Activated Carbon AC2

E. Adsorption column set up:

For this study we designed the adsorption column set up for continuous mode of operation, clean dry Colum was taken and first glass wool was placed inside the column which will act as a support for adsorption bed. After that to improve the stability and treatment sand bed was made to some height above the glass wool support above this layer of sand bed our prepared carbon particles of same size was packed to required depth .then another layer of sand bed was made to sandwiched the carbon.

Fig3.Adsorption column for sample 2

F. Continous mode of Adsorption

Raw waste water sample 1& sample 2 was treated by continuous mode of operation as shown in Fig 3,Fig 4,Fig 5 was placed in a glass tank from that continuous input stream was set through a pipe line whose another end was connected to the adsorption column as inlet at the flow rate of 25minute of 500ml and the treated water was collected from the outlet of adsorption column at the flow rate. This waste water was entered through the porous surface of sand bed layer and through adsorbent layer where the pollutants are removed by surface phenomena. Inlet of water was passed through continuous process. Then the treated water was collected from the bottom, after passing through the adsorbent bed. Total running time of process for 500ml of sample it took 1hour.This treated water is collected and they have been analyzed with the following parameters (TS, TDS, TSS, COD, BOD, MBAS) The parameters of this treated water and the waste water is to be compared.

Fig 4. Treatment of wastewater Sample1

Fig 5. Treatment of Waste water Sample 2

IV. RESULTS AND DISCUSSION

A. Level Of TDS,TSS,BOD,COD

Sample1:

Table 1. Level Of Basic parameters before and After treatment

S.No	Parameters	Method	Before treatment	After treatment	Percentage Reduction
1	Total dissolved solids(TDS)	2540-C-APHA	764 mg/l	942 mg/l	18.80%
2	Total suspended solids(TSS)	2540-D-APHA	440 mg/l	24 mg/l	94.50%
3	Biochemicaloxygen demand(BOD) 3 days at 27^0	5210-B-APHA	480 mg/l	22 mg/l	95.40%
4	Chemicaloxygendemand(COD)	520-B-APHA	1919 mg/l	66 mg/l	96.60%

The above Table.1 shows the main parameter to be considered in any waste water analysis

it was found to contain more BOD,COD of 480 and 1919 mg/ litre which is exceeding the permissible limit of Bureau of Indian standards of domestic water.Table 2:shows the result of waste water analysis after adsorption .Fro the result it can be noted that TDS of water has been increased from 764 to 944 mg/l.This is because activated carbon does not removing the all inorganic substances more over it adds some inorganic compounds to the water so that showing higher TDS.

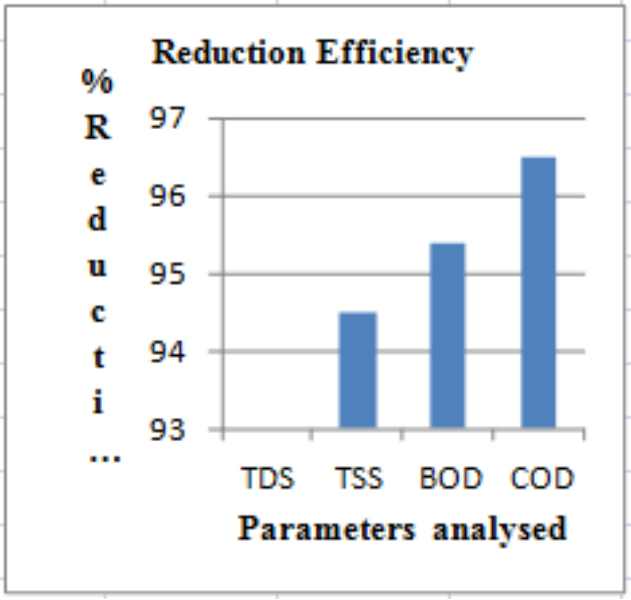

Fig.6 Reduction efficiency of basic Parameters for Sample1

Fig.6 shows that greater reduction of suspended solids of about 94.5% by reducing the TSS level from 440 to 22 mg/lit. This level of reduction achieved by the continuous flow of water itself forming a bed of suspended solid particle over the bed of prepared column. the biological oxygen demand level was perfectly reduced from 480 to 22 mg/lit which is 95.44%.the reduced level of BOD by this Activated carbon adsorption method is permissible limit of Indian standard.

Level Of TDS, TSS, BOD, COD :

Sample 2:

Table 2. Analysis of sample 2

Parameters	BeforeTreatment(Sample2)mg/l	After Treatment (Sample2) (mg/l)		
		AD1	AD2	AC2
TDS	1052	1660	1760	980
TSS	486	348	382	292
BOD	92	330	252	140
COD	396	1373	1460	1760

Table 3. Reduction level of Adsorption by various Adsorbents

S.No	Parameters	Reduction %		
		AD1	AD2	AC2
1	TSS	28.3	21.3	40

Table 3. Shows the basic parameter analysed for sample 2 after treatment with various adsorbents the TDS value showing increase because of the dissolution of plant adsorbent itself with wastewater. Presence of More oil and grease in vechicle wash and use of detergents all are responsible for increase in BOD and COD .

Table 4 shows that the the level of reduction of TSS is reasonably obtained with the treatment of waste water with commercial Activated carbon AC2 of about 40%.

B . Methylene Blue Active Substances: S ample1

Table.4 Reduction of MBAS for Sample1

Parameter	Method	Before treatment	After treatment	% Reduction
Anionic detergents as (MBAS)	IS 13428 (Annex K)	1.8 mg/l	0.2	88.88%

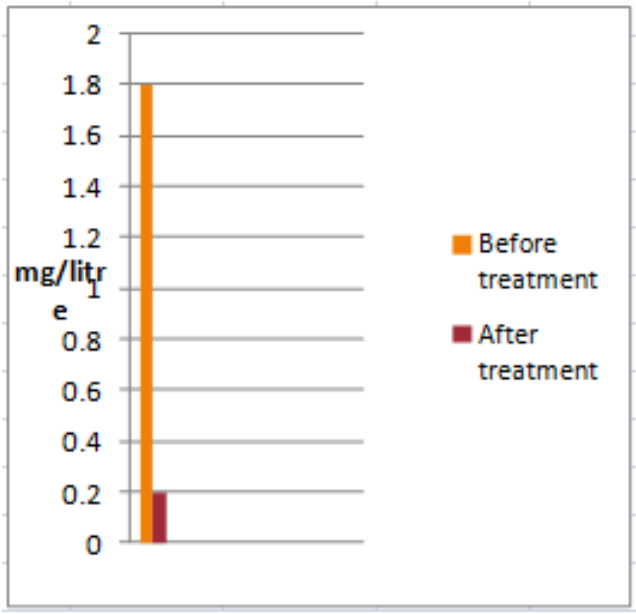

Fig 7 Percentage reduction of MBAS

From the Table. 4 it is evident that MBAS level was greatly reduced using Activated carbon prepared from the waste cloth material which is comparatively higher than the result obtained in another work reported with 80% reduction level[16] represented in Fig 7.

MBAS reduction in Sample 2

Table.5 Reduction of MBAS for Sample 2

Parameter	BeforeTreatment (Sample2) (mg/l)	After Treatment (Sample2)		
		AD1	AD2	AC2
MBAS (mg/l)	0.21	0.12	0.18	0.09
% Reduction	-	43	14.2	57

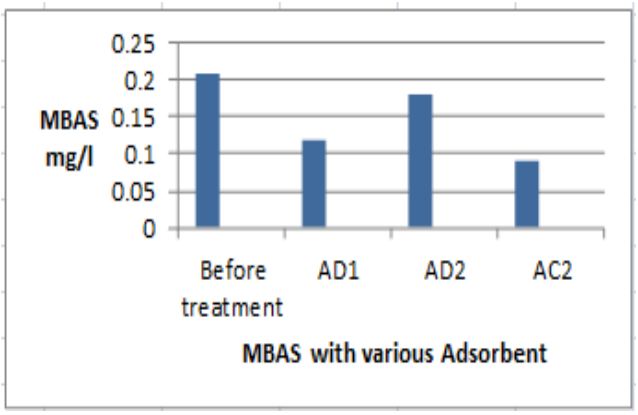

Fig.8 Reduction of surfactant level by various Adsorbents for Sample 2

When Sample 2 was treated with three different adsorbent showed Table 5. we get maximum of 57% reduction shown in Fig.8 with commercially purchased Activated carbon.

C.Oil & Grease(O&G)

Table 5. Reduction of O&G for Sample 2

Parameters	BeforeTreatment (Sample2)	After Treatment (Sample2)		
		AD1	AD2	AC2
Oil&Grease(O&G) mg/l	466	1.9	6	4
% Reduction	-	99.5	98.7	99.1

From the Table.5 We can observed that the treatment of sample two by various adsorbents was showing the best result of O&G reduction level .where as in the another work of Gravity oil separation method it was resulted for the removal of Oil and Grease and COD,TSS 80% only[17].

In the work of another researcher Fenton and Photo –Fenton method was analysed for the removal of O&G with two sample showed the result of 99.6% as maximum[18] in our work also we got the same level of reduction but with simple and economical methods on comparatively the less cost for treatment in this work .

the adsorbent used in this work was showing greater level of reduction of O&G by AD1,AD2,AC2 was 99.5, 98.7, 99.1 respectively compared to Zeolite adsorbent resulted only 80% of reduction in O&G [19]

V. CONCLUSION

In this study, we are able to perceive the impact of car wastewater service station on water pollutants.Which is so far and not considered as much. So in this we aim to study the treat ability and reuse of that wastewater in economical way, by adsorption using carbon as adsorbent which is prepared from waste materials. So, it is caused effective as well as waste was managed for beneficial. As the above treatment was giving 96% of reduction level in a contaminant. These work can be scaled up and can be installed as recycle system in such can wash service stations system. In this future this system can be integrated with any pre-treatment system for designing whole treatment plant to treat the water to drinking water standard level.

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