

Treatment of Automobile Waste Water using Plant-Based Coagulants

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Abstract – Automobile service station waste water is one of the heavily contaminated wastes with high impurities due to the presence of sand and particles, Oil & grease, surfactants, detergent etc. Therefore the direct disposal of waste water in to the drainage exacerbates the natural water pollution. Onsite waste water treatment is a prospective direction towards the reduction of pollution load to the municipal or combined urban waste water. A number of studies show that the introduction of natural coagulant as a substitute for chemical coagulant overcome the problem associated with the chemical coagulants. The present study is aimed to develop an integrated treatment system for Automobile waste water using Cicer arietinum, Dolichos lab lab and Strychnos potatorium.

Key Words: Automobile waste water, Natural water pollution, integrated treatment system, Cicer arietinum, Dolichos lab lab, Strychnos potatorium.

1. INTRODUCTION

Water scarcity will be a key issue for the sustainable development of a country in future. Now India is facing a water crisis and coming years it is estimated that India's population will be suffered from severe water scarcity. Large quantity of water is wasted in service stations during the washing of vehicles. We have to consider the possibilities of recycle or reuse of the waste water generated from automobile service stations. The service station wastewater represents one of the heavily contaminated wastes with high impurities. It was due to presence of sand and particles, oil and grease, surfactants, detergent, phosphates and hydrofluoric acid. Treatment methods such as coagulation, chemical oxidation, absorption and filtration, are studied to be employed in the vehicle wash industry, but many of them are cost burden. Coagulation and flocculation processes are considered as the most efficient and economical treatment method. The coagulation and flocculation treatment are one of the important stage in the wastewater treatment processes. The utilization of natural coagulants provides an alternative way to lower the coagulants and flocculants cost and to improve the water quality characteristics for safe utilization. A number of studies show that the introduction of natural coagulants as a substitute for chemical coagulants overcome the problems associated with the chemical coagulants. Treatments with natural coagulants are efficient in reducing suspended solid, COD, BOD, turbidity also coagulation and flocculation processes yields high pollutant

removal efficiency and removal of colour. The treatment process was enhanced with an integrated system comprises aeration, coagulation and flocculation, sedimentation and filtration unit to produce high quality of treated wastewater.

2. METHODOLOGY

Wastewater is collected from a service station by grab sampling method. The seeds of Cicer arietinum, Dolichos lab lab and strychnos potatorium collected and grinded in to powdered form. Rectangular skimming tank, coagulation tank, sedimentation tank and filtration tank provided as treatment system. Each parameters checked before and after treatment.

2.1 Plant-based Coagulants

Cicer arietinum, Dolichos lab lab and Strychnos potatorium are the plant-based coagulants used in the study. For the coagulant preparation Cicer arietinum and Dolichos lab lab seeds were collected and dried under sunlight for one week. Dried seeds are washed with distilled water to remove impurities. After washing the seeds were oven-dried at 100°C for 24 hours. The dried seeds were powdered and stored. Due to the hard structure, Strychnos potatorium seeds could not be powdered in a grinder. Therefore, they were immersed in 50 ml water containing 2 ml concentrated HCl. After a week, they were oven-dried for 24 hours between 103°C to 105°C and then grounded into powder form.

2.2 Filter media

Filtration is one of the step in this treatment. The filter materials used are Sand pass through IS 2.36 mm sieve, Aggregate retain on IS 20 mm sieve and Aggregate pass through IS 10 mm sieve.

2.3 Sample collection

Waste water used for the treatment process was collected from a Service station at Koyilandy, Kozhikode. The garage usually handles the operation of medium as well as light vehicles. The wastewater is generated from washing of different types of vehicle. In the service station 2 to 3 vehicles are serviced on rotation basis. The washed wastewater is then drained to municipal sewerage system through the washing bay. The Supernatant wash was collected in a 5 litres capacity plastic container.

2.4 Characteristics of waste water

The characteristics of service station waste water such as pH, Turbidity, Total Suspended Solids, Biological Oxygen Demand, Chemical Oxygen Demand, Oil and grease and sulphate were analyzed using standard methods.

2.5 Experimental setup

Integrated treatment system is used for the treatment of Automobile service station waste water. Primary unit of the treatment system is aeration tank. For this a rectangular glass tank of 32 cm x 20 cm x 20 cm is constructed. A pipe is provide in the outlet 4W air pump is attached in this tank for air supply. Next unit of system is coagulation tank. It is constructed with glass in dimension of 26 cm x 18 cm x 18 cm. Motor with paddle for agitation is fitted in the top of the coagulation tank. Third unit is sedimentation tank and is constructed in a dimension of 40 cm x 14 cm x 16 cm with glass. A pipe is provided in the outlet of the tank. Last unit in the integrated treatment system is filtration tank. It is constructed in glass with a dimension of 22 cm x 18 cm x 30 cm. A water tap is provided at the outlet of filtration tank.

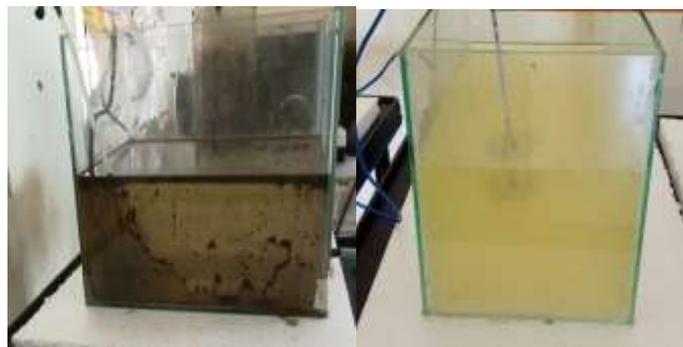


Fig-1 : Aeration tank and Coagulation & filtration tank



Fig-2 : Sedimentation tank & Filtration tank

3. RESULTS AND DISCUSSION

The coagulants are used to remove the excess parameter from service station waste water. The initial value of pH is

5.6. Treatment with Cicer arietinum and Strychnos potatorium approached neutrality even the initial waste water sample was slightly acidic in nature. Cicer arietinum is more efficient. Removal efficiency of coagulant such as Cicer arietinum, Dolichos lab lab & Strychnos potatorium at an optimum dosage of 7 g is shown in table.

Table-1 : Removal efficiency of coagulants

| Sl. No | Parameter | Influent value | Removal efficiency after treatment (%) | | |
|--------|---------------------|----------------|--|------------------|----------------------|
| | | | Cicer arietinum | Dolichos lab lab | Struchnos potatorium |
| 1 | Turbidity (NTU) | 680 | 90.88 | 81.47 | 96.32 |
| 2 | TSS (mg/l) | 4200 | 94.33 | 89.40 | 96.66 |
| 3 | BOD (mg/l) | 8976 | 87.72 | 84.09 | 85.90 |
| 4 | COD (mg/l) | 220 | 95.79 | 93.74 | 94.64 |
| 5 | Oil & grease (mg/l) | 5400 | 97.50 | 97.13 | 97.29 |
| 6 | Sulphate (mg/l) | 56 | 78.57 | 63.15 | 63.57 |

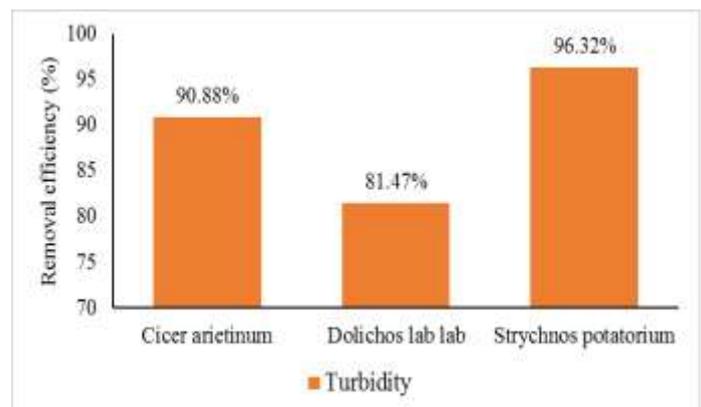


Chart -1: Removal efficiency of coagulants on Turbidity

Strychnos potatorium have greater turbidity removal. Excess coagulant did not interact with oppositely charged colloidal particles in the case of Dolichos lab lab.

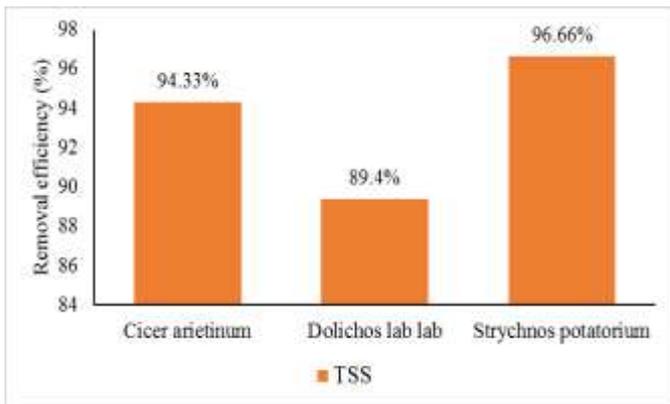


Chart -2: Removal efficiency of coagulants on TSS

Strychnos potatorium have great TSS removal. Dolichos lab lab have least TSS removal.

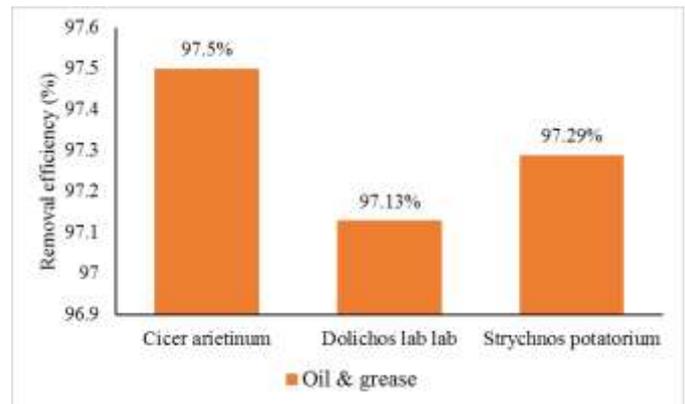


Chart -5: Removal efficiency of coagulants on Oil & grease

From the graph, Cicer arietinum have great removal of Oil & grease than other coagulants.

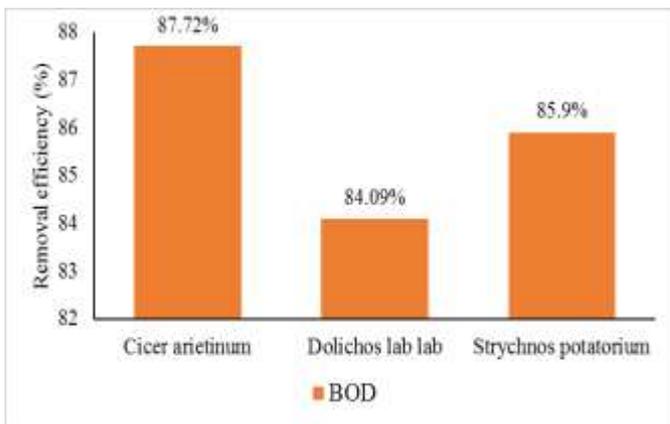


Chart -3: Removal efficiency of coagulants on BOD

Cicer arietinum and Strychnos potatorium have greater BOD removal. Dolichos lab lab have least BOD removal.

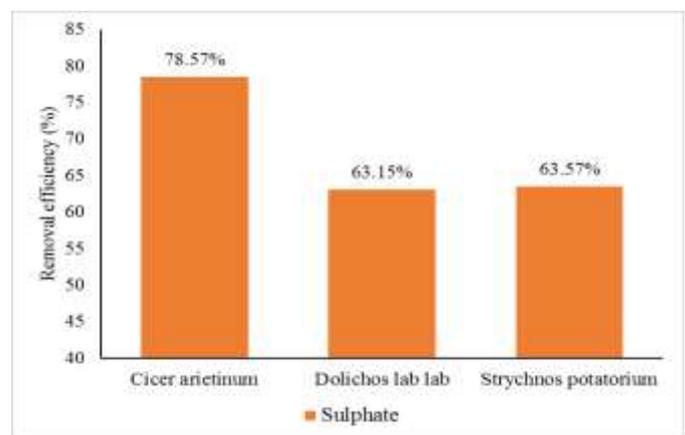


Chart -6: Removal efficiency of coagulants on Sulphate

Cicer arietinum have great sulphate removal than other coagulants. Overall the sulphate removal efficiency of the coagulant is less as compared to other parameter.

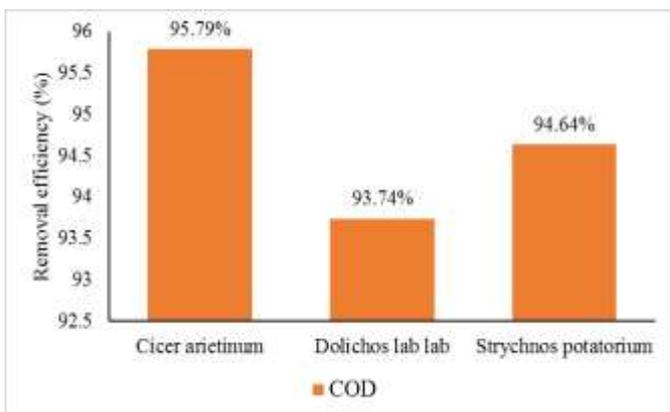


Chart -4: Removal efficiency of coagulants on COD

Among the 3 coagulants Cicer arietinum have great adaptability to remove COD in waste water. Dolichos lab lab have least COD removal than others.

4. CONCLUSIONS

As water is becoming a rare resource, the onsite reuse and recycling of Automobile wastewater are practiced in many countries as a sustainable solution to reduce the overall urban water demand. Plant-based natural coagulants have garnered growing interests from researchers over the years due to their biodegradability and environmental friendly nature. The integrated treatment system designed here with natural coagulants such as Cicer arietinum, Dolichos lab lab and Strychnos potatorium was effective for primary treatment of automobile wastewater.

This study has successfully revealed that the treatment with Cicer arietinum, Dolichos lab lab and Strychnos potatorium are efficient in removing physical and chemical parameters in the waste water. Among the three natural coagulants used in this study, Cicer arietinum was found most effective. The

seed extracts of *Strychnos Potatorum* are efficient in reclaiming wash water with 96.32 % turbidity removal and 96.66 % of TSS removal and it gives Clear water after treatment. Natural coagulants are recommendable due to environment friendly, abundant source, low price, multifunctioning, and biodegradable nature in water purification. The results show that it is possible to reclaim almost 90 % of clear water after treatment with integrated treatment system.

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