

Effect of Natural Coagulants on the Treatment of Automobile Service Station Waste Water

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Abstract – In This paper the effects of natural coagulants on the treatment of automobile service station waste water has been investigated. *Moringa oleifera*, *Dolichos lablab* and *Cicer arietinum* are the natural coagulants used for the study. The treatment system was designed in four stages included, skimming tank with aeration, coagulation and flocculation, sedimentation and filtration unit to produce high quality of treated waste water. The treated waste water obtained after all the process have a considerable decrease in BOD, COD, TSS, Turbidity, Oil & grease etc.. Among the natural coagulants used in this study, *Cicer arietinum* was found most effective. The results show that it was possible to reclaim almost 90% of clear water after treatment and can be effectively reuse for vehicle washing.

Keywords - *Moringa oleifera*, *Dolichos lab lab*, *Cicer arietinum*, *Sugarcane bagasse*

I. INTRODUCTION

Automobile service stations vary from authorised service centres to small scale service stations, which undertake repair, washing and servicing of vehicles. Service station waste water is one of the heavily contaminated wastes with high impurities due to the presence of sand and particles, oil and grease, surfactants, detergent etc... Therefore, the direct disposal for wastewater into the drainage exacerbates the natural water pollution. Increasing number of Automobile service stations has seriously increased the contribution of pollution into bodies of water. 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. Coagulation and flocculation could be achieved using either natural coagulants or chemical coagulants. 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 method used in this study for the treatment of automobile service station waste water is integrated treatment system. This system consists of coagulation-flocculation process with filtration. Natural filtration system with sugarcane bagasse is used as the filter medium.

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. Reclaimed water or recycled water from service station waste water treatment is getting popularity to the fact that water saving will be benefit to both business premises and environment for instance.

II. MATERIALS

Natural Coagulants

Moringa oleifera, *Dolichos lab lab* and *Cicer arietinum* are the natural coagulants used in the study. Seeds of natural coagulants 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.



Fig.1 *Moringa oleifera* seed and seed powder



Fig.2 *Dolichos lab lab* seed and seed powder



Fig.3 *Cicer arietinum* seed and seed powder

Filter Media

(i) *Coarse Aggregates:* Two layers of gravels are used; aggregates which retain on 20mm IS sieve and aggregates which pass through 10mm IS sieve. The bottom layer of the filter is filled with 20mm aggregates with a filtration depth of 80mm. Above the bottom layer aggregates pass through 10mm sieve at a depth of 80mm is filled.

(ii) *Sand:* The filter medium should be of uniform grain size to make sure that the pores between grains are the same size so that filter's efficiency should be equal over the bed. Fine sand passing through IS 2.36 sieve is used for the sand bed. The sand is washed then filled in the filtration tank at a depth of 80mm above the coarse aggregate which pass through 10mm IS sieve.

(iii) *Sugarcane Bagasse*: Washed sugarcane bagasse was dried in oven at about 105 °C for 3 hours and 24 hours dried in sun light. Sugarcane bagasse is filled at a depth of 80mm in the filtration tank as top layer.



Aggregate retain on IS 20mm

Aggregate pass through IS 10mm

Sand

Sugarcane bagasse

Fig.4 Filter medias

III. METHODOLOGY

Rectangular skimming tank of 50cm x 25cm x 25cm is constructed with 3 baffles of 3mm thickness at 10cm height in glass. A water tap is provided in the outlet and 15W air pump is attached in this tank for air supply. Coagulation tank is constructed with glass in a dimension of 26 cm x 39cm x 26cm. Motor with paddle for agitation is fitted in the top of the coagulation tank. Sedimentation tank is constructed in a dimension of 60cm x 20cm x 24cm and a water tap is provided in the outlet of the tank. 32cm x 25cm x 45cm of filtration tank is made. 15L waste water is filled in the skimming tank. Aeration is provided from bottom by means of aeration tube for 30 minutes. Allow the waste water to settle sand and grit particles for 15 minutes. Oil and grease layer formed in the top of the tank is manually removed and outlet tap is opened. Then waste water is allow to flow in coagulation tank and 7g of powdered *moringa oleifera* is and agitate for 45minutes. After agitation waste water is pumped to the sedimentation tank and allow to settle for 1 hour. outlet tap in sedimentation tank is opened and waste water is then pass through filtration tank and filtered water is collected in a bucket. Procedure is repeated with *Dolichos lab lab* and *Cicer arietinum*.



Fig.5 Experimental setup



Fig.6 Aeration Tank and Coagulation Tank

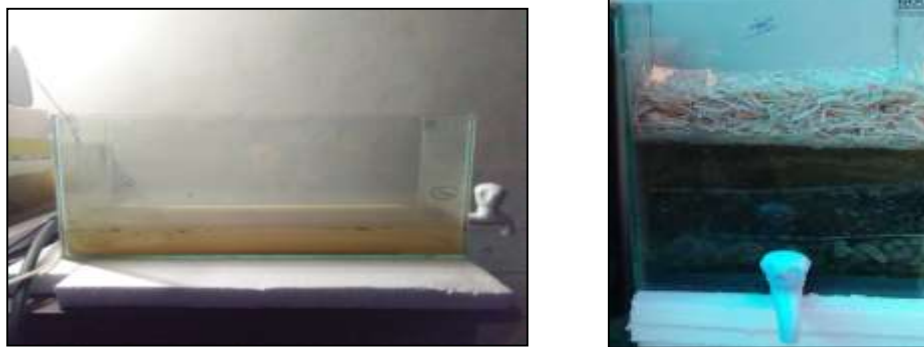


Fig.7 Sedimentation Tank and Filtration Tank

IV. RESULTS AND DISCUSSIONS

Following table shows the initial value of each parameter and value after treatment with natural coagulants.

Table.1 Test results

Sl. No	Parameter	Initial value	After treatment with		
			<i>Moringa oleifera</i>	<i>Dolichos lablab</i>	<i>Cicer arietinum</i>
1	pH	6.72	7.05	7.1	6.48
2	Turbidity (NTU)	880	0.42	4.23	BDL
3	Conductivity ($\mu\text{s}/\text{cm}$)	910	501	471	203
4	Chloride (mg/l)	205.47	43	30.4	31.82
5	Hardness (mg/l)	120	35	55	14.4
6	TDS (mg/l)	440	236	240	134
7	Iron (mg/l)	4.7	0.2	0.14	0.16
8	Alkalinity (mg/l)	105	22	55	BDL
9	Phenolic compound (mg/l)	0.36	0.01	0.018	BDL
10	Sulphate (mg/l)	50.12	40.41	14.98	11.5
11	Oil & grease (mg/l)	4120	10	54	8
12	TSS (mg/l)	8610	48	10.3	2.74
13	DO (mg/l)	14.28	14.10	14.05	14.06
14	BOD (mg/l)	240	9	48	4.1
15	COD (mg/l)	1200	53	224	26.3

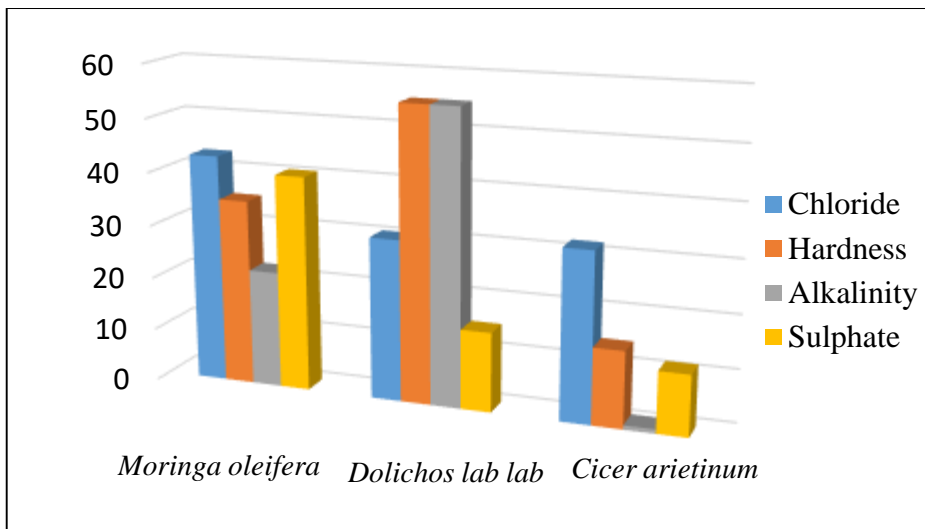


Fig.8 Comparison of coagulants for Chloride, Hardness, Alkalinity & Sulphate removal

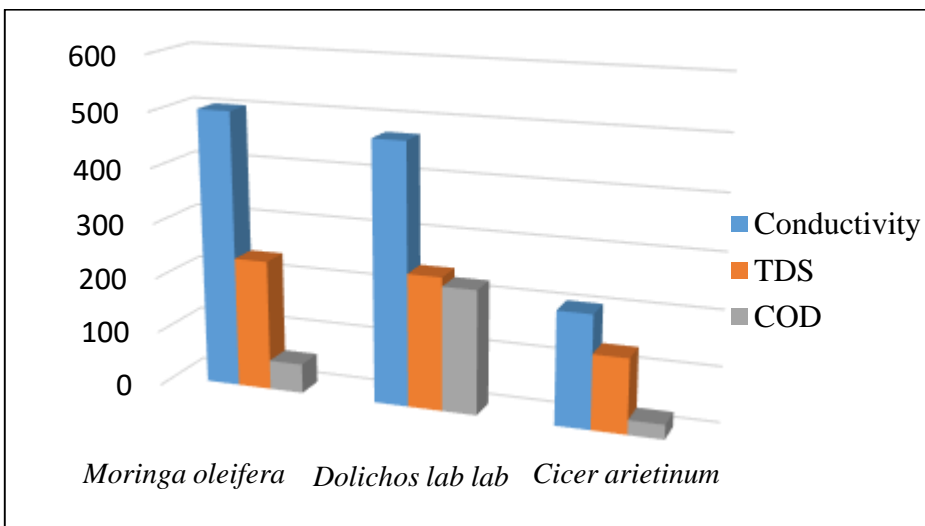


Fig.9 Comparison of coagulants for Conductivity, TDS & COD removal

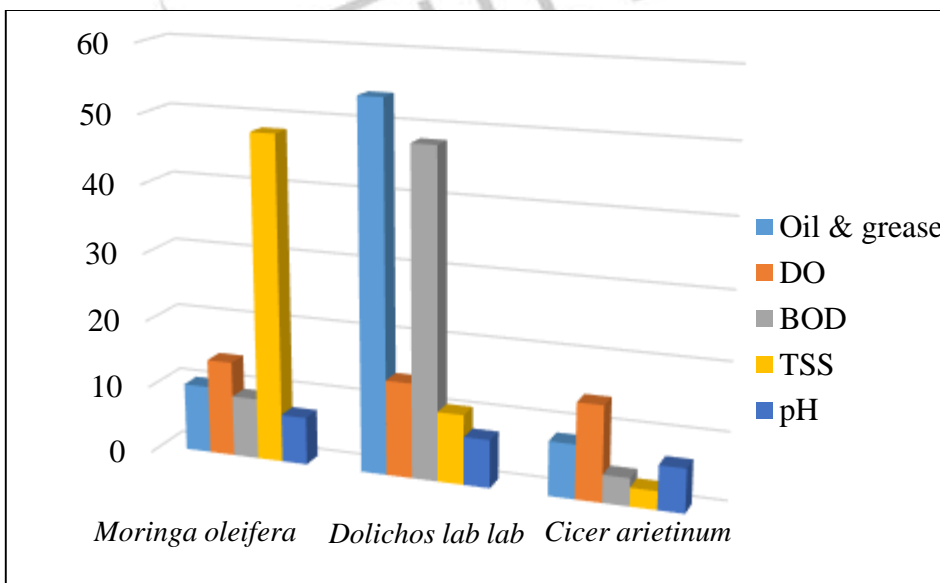


Fig.10 Comparison of coagulants for DO, BOD, TSS, pH, Oil & grease removal

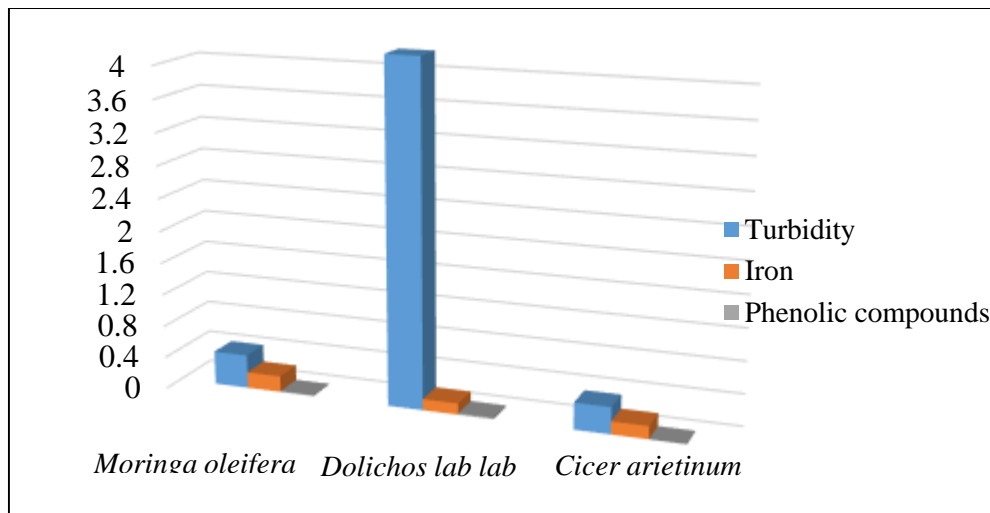


Fig.11 Comparison of coagulants for Turbidity, Iron & Phenolic compounds removal

From the above graphs it is clear that *Cicer arietinum* is efficient natural coagulant for the treatment of automobile service station waste water than *Moringa oleifera* and *Dolichos lab lab*. Turbidity, oil & grease, BOD, COD, TSS are very high in initial sample. 97.81% COD removal, 99.8% Oil & grease removal, 100% alkalinity removal, 88% hardness removal, 77.69% conductivity removal, 77.05% sulphate removal, 100% phenolic compound removal, 98.29% BOD removal, 69.54% TDS removal, 99.97% TSS removal and 100% turbidity removal obtained when *Cicer arietinum* is used. Based on findings of this study, integrated treatment system is characterized by high potential for BOD, TSS, Turbidity, COD and Oil & grease removal.



Fig.12 Service station waste water before and after treatment

V. CONCLUSIONS

From the analysis it shows that the waste water from automobile service station contains some parameters higher than the acceptable limit. This study has successfully revealed that the treatment with *Moringa Oleifera*, *Dolichos lab lab* and *Cicer arietinum* 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. *Moringa oleifera* 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. Thus it can be reused for washing vehicles, cleaning equipment, toilet flushing etc...

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