

Use of Sapodilla Seed and Dolichos Lablab in Treatment of Grey Water

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Abstract: The treatment of grey water has become an important concept to reuse grey water in most developed countries and countries with increasing population. Grey water is the wastewater obtained from hand basins, showers, baths, laundry tubs and kitchen sinks, excluding those from toilets or urinals. The study aims to find effective coagulant in treatment of grey water. The grey water sample collected from the household was used for the study. The initial parameters of the grey water were assessed using pH, TDS, Turbidity, COD and BOD and measured as 8.6, 1230 mg/l, 160 NTU, 3500 mg/l, 250 mg/l respectively. The natural coagulant used for the study was Sapodilla seed and Dolichos Lablab. When the coagulants such as Dolichos Lablab and Sapodilla seed were agitated with the effluent of grey water at 100 rpm, the maximum percentage change in pH, Turbidity, TDS, COD, BOD of grey water was observed i.e. for pH, at a dosage value of 8ml is 29.23% for sapodilla seed powder and 6 ml is 18.60% for dolichos lablab seed powder, for turbidity, at a dosage value of 8ml is 40.11% for sapodilla seed powder and 8 ml is 30.22% for dolichos lablab seed powder, for TDS, at a dosage value of 6ml is 56.63% for Sapodilla seed powder and 6 ml is 25.87% for dolichos lablab seed powder, for COD, at a dosage value of 6ml is 80.81% for Sapodilla seed powder and 8ml is 60.00% for dolichos lablab seed powder, for BOD at a dosage value of 6ml is 60.5% for Sapodilla seed powder and 8 ml is 48% for dolichos lablab seed powder.

Keywords: Grey water, natural coagulant, dolichos lablab, sapodilla.

1. Introduction

Water is an indispensable component for human life and other life forms. The continuing use of water makes it impure, so the purification of water is essential. Raw water coming from different sources may contaminate due to pollution in the environment. Major reason for pollution is industrialization and rapid urbanization. As we know that the Surface water either from rivers or rain fed ponds is the main source of water supply. This water is vulnerable to various forms of pollution generated from different sources mainly households, agriculture and industries. The removal of organic and inorganic material from raw water is essential before it can be disinfected for human consumption. Rainwater, grey water and desalinated sea water are considered to be good alternative resources. Grey water recycling is now accepted as a sustainable solution to the general increase of the fresh water demand, water shortages and for environment protection. Availability of unadulterated

drinking water has turned out to be rare these days because of poor land utilize management. Surface water is being dirtied by sewage, mechanical water release and keep running off from the land, while ground water is contaminated by salt water interruption and waste dumping site. This dirtied water should experience treatment forms before it can be coursed to the customers for local utilize. The process of waste water treatment is carried out in waste water treatment plant. Water treatment takes place in two ways, one is natural and other is conventional method. In natural way, it happens in the water cycle and self-cleaning of the river. Another way is conventional method of water treatment. In this method water treatment is carried out in different unit operations. The purpose of water treatment is to make water fit for domestic and drinking purpose. The water quality standards depend upon the purpose for which it will be used. So, we provide different degree of treatment according to their required quality standards, types of source of raw water and level of contamination. In the series of conventional method of treatment, the most important parameter is turbidity. It carries suspended matter such as organic matter, inorganic matter, clay, silt, coloured compound, plankton, algae and some other microscopic organism. Turbidity is generally cloudy or haziness appearance of water, and aesthetically unattractive. Turbidity imparts vital problems, in the direct use of water from natural resource. So we use various types of coagulants, depending upon their physical and chemical uses in treatment of raw water. But in the conventional method of water treatment, chemical coagulants are used for turbidity removal. The popular chemical coagulant is alum. Use of high level of alum in water treatment is hazardous for human health. It may cause disease like Alzheimer. So, in this study an attempt has been made, about the use of natural coagulants in the water treatment instead of chemical coagulants.

Use of natural coagulants in water treatment may help in reducing the health effect and cost of chemical coagulant. Some of the natural coagulants that can be used are Sapodilla seeds, Moringa oleifera, C. Cyminus, Capparis Decidua, Dolicho lablab, Cicer arietinum, Tamarind seed, etc. In rural area, the use of natural coagulant is quite popular. It has been used for more than 2000 years in India, China and Africa. This coagulant may be derived from seeds, leaves and roots of plants and trees.

So natural coagulant has potential in water treatment because of their low cost, easily availability, multifunctional, biodegradable and eco-friendly characteristics. In chemical coagulation add a primary coagulant, poly Aluminium chloride (PACl) to increase the flow formation in flocculation process. Coagulation and flocculation have difference in rate of mixing. In the process of coagulation add coagulant and mix with high rate of rotation so that negative charged chemical attracts positive charge impurity on it. After coagulation we reduce the rate of mixing so that time of contact will increase. After this process, filtration takes place so that the filterable material can be removed easily. Generally, the used inorganic chemical is Aluminium. It can be costly as they are needed in excess. It also contributes to Alzheimer disease. It is, in this way, alluring to supplant these chemical coagulants with plant-based coagulants gives effective results. Efficiency of Aluminium in cold water reduces when alkalinity of that water react with Aluminium. It can affect human health and also affect the environment. For determining the optimum dose of coagulant, we use jar test apparatus. Jar test helps to perform the coagulation as well as flocculation process. To eliminate the effect of chemical coagulant we use naturally occurring coagulant in the water coagulation process. Some of the natural coagulants that can be easily found are Sapodilla, Moringa oleifera, C. Cyminus, Capparis Decidua, Dolichos lablab, T. foenum-graecum, Cicer arietinum, Tamarind seed etc. Seeds of T. foenum-graecum contain materials that can act as effective natural coagulant. The natural coagulant present in T. foenum-graecum shows its coagulation efficiency at neutral ph. Sapodilla has been observed to be palatable as well as utilized as a coagulant in grey water treatment.

2. Materials and methods

A. Preparation of fine seed powder



Fig. 1. Dolichos lablab

Dolichos lablab and sapodilla seeds were obtained from local market of Sangamner city. The whole seeds of Sapodilla seed, and Dolichos Lablab were ground to fine powder using a grinder. All ground materials were sieved through 0.4 mm membrane sieve and the fraction with particle size less than 0.4 mm was used in experiments. Dolichos lablab beans were brought from local market of Sangamner city, these beans were sun dried for 10 hours the seeds of Dolichos lablab were

obtained by removing external shell the seed kernel so obtained were crushed and then grinded to fine powder by means of domestic food blender.

Sapodilla seeds was obtained from Sangamner city, these are hard in nature they were grinded to fine powder.



Fig. 2. Sapodilla seeds

B. Preparation of the extract

The 10 g of fine powder was mixed well with 100 ml distilled water solution and the suspension was stirred using a magnetic stirrer for 10 minutes for homogeneous mixing. The solution was prepared fresh before each set of experiment.



Fig. 3. Preparation of sample

C. Collection of grey water sample

The grey water was collected from household and the characteristics of grey water was found out by carrying out various test.



Fig. 4. Collection of grey water sample

D. Experimental process

1) Jar test

The coagulation process was done by jar test experiment. 500 ml of grey water was taken in each beaker having capacity of

1L, different concentration of Sapodilla seed and Dolichos lablab were used varying from 50 mg/l to 100 mg/l. Rapid mixing was carried out first at 300 rpm speed for 1 minute and then slow mixing at 40 rpm speed for 30 minutes. the stirrer was then switched off and follow up by sedimentation for 30 minutes. The outlet was analysed for PH, turbidity, TDS.

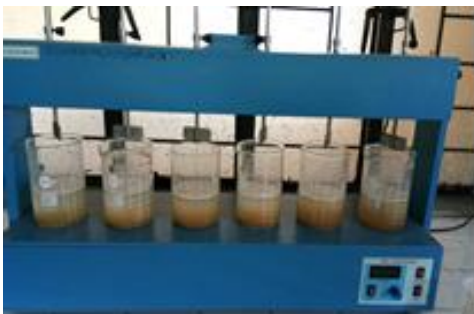


Fig. 5. Jar test apparatus

2) *Turbidity*

Turbidity of sample was measured before and after treatment using a turbidity meter in accordance with the international method of water quality measurements. Vile of turbidity meter was washed with help of distilled water. turbidity meter was calibrated before test with the help of standard solution. The sample of water was poured in the vile and turbidity of the sample was noted.

3) *pH*

After the jar test experiment, the sample of water were collected from all the jars. first the pH meter was calibrated by different pH samples with help of standard solution of pH 4,7 and 10.A probe of pH meter was washed with help of distilled water and then the pH of sample was noted.

4) *TDS*

10 g of each powdered coagulant were mixed with 500 ml grey water sample taken in a 1000 ml beaker. Then the suspensions were mixed rapidly with a Ssuspensions were allowed to stand without any disturbance for 60 minutes. Finally, the supernatant was filtered through Whatmann 40filter paper. Similar procedure was carried out for different time intervals. Total dissolved solids determined for the filtered water and the analysis was carried out according to standard methods (APHA-AWA-WPCF, 1992)

Percentage of decrease in TDS = $100 \times (\text{Initial Value} - \text{Final Value}) / \text{Initial Value}$.

3. Results and discussion

Common contaminants found in grey water are salts, food particles, oil, surfactants, microorganisms. Indeed the grey water characteristics are highly variable as influenced by factors such as lifestyle, social and cultural behaviour of residents, and water availability. Grey water sample obtained was analysed before treatment various initial investigation has been carried out by conducting test such as pH, turbidity, BOD, COD and TDS.

A. *Before treatment*

Table 1
 Characteristics of Grey Water used for the study

Parameter	Initial Investigation
PH	8.6
COD (mg/l)	3500
BOD5 (mg/l)	250
TDS (mg/l)	1230
Turbidity (NTU)	160

B. *pH*

When the coagulants such as Dolichos Lablab Seed powder, Sapodilla seed powder were agitated with grey water at 100 rpm, the percentage change in pH of the coagulants obtained is as below: Based on the readings obtained during the practical and the observations, it can be calculated that with the increase in the doses the pH reduction increase and the maximum percentage reduction of pH in obtained at a dosage value 8ml is 29.23% for sapodilla seed powder and 6 ml is 18.60% for Dolichos lablab seed powder for grey water. Graph Shows that, with the further increase in doses, pH percentage reduction which can be easily visualized from the graph.

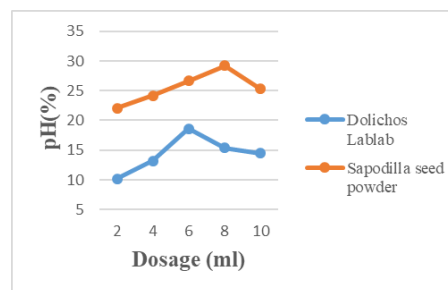


Fig. 6. Variation of the pH for different dosage of Dolichos Lablab and Sapodilla seed powder

C. *Turbidity*

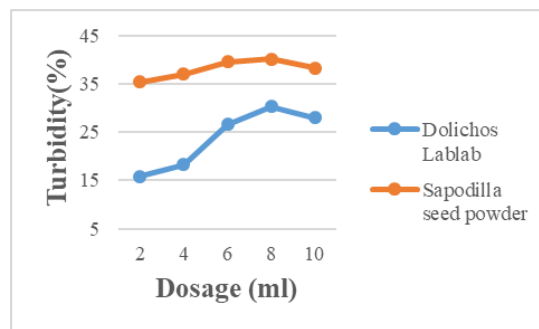


Fig. 7. Variation of the Turbidity for different dosage of Dolichos Lablab and Sapodilla seed powder

When the coagulants such as Dolichos Lablab, Sapodilla seed powder were agitated with the effluent of grey water at 100 rpm, the percentage change in Turbidity of the coagulants obtained is as below: Based on the readings obtained during the practical and the observations, it can be calculated that with the increase in the doses the turbidity reduction increase and the

maximum percentage reduction of turbidity is obtained at a dosage value 8ml is 40.11% for sapodilla seed powder and 8 ml is 30.22% for Dolichos Lablab seed powder for grey water. Graph Shows that, with the further increase in doses, Turbidity percentage reduction decrease which can be easily visualized from the graph.

D. TDS

When the coagulants such as Sapodilla seed powder, Dolichos lablab seed powder were agitated with the effluent of grey water at 100 rpm, the percentage change in TDS of the coagulants obtained is as below: Based on the readings obtained during the practical and the observations, it can be calculated that with the increase in the doses the TDS reduction increase and the maximum percentage reduction of TDS in obtained at a dosage value 6ml is 56.63% for Sapodilla seed powder and 6 ml is 25.87% for Dolichos lablab seed powder for grey water Graph Shows that, with the further increase in doses of Dolichos lablab, TDS percentage reduction decrease which can be easily visualized from the graph.

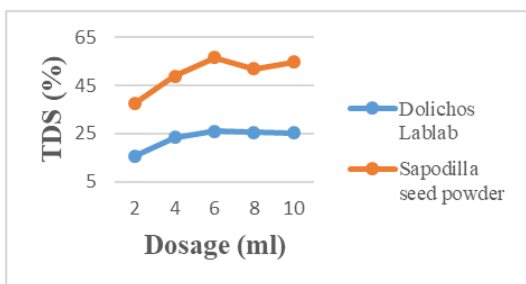


Fig. 8. Variation of the TDS for different dosage of Dolichos Lablab and Sapodilla seed powder

E. COD

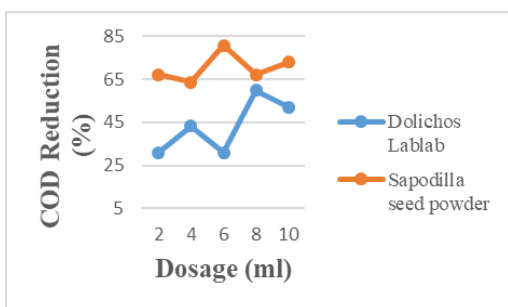


Fig. 9. Variation of the COD for different dosage of Dolichos Lablab and Sapodilla seed powder

When the coagulants such as Dolichos Lablab, Sapodilla seed powder were agitated with the effluent of grey water at 100 rpm, the percentage change in COD of the coagulants obtained is as below: Based on the readings obtained during the practical and the observations, it can be calculated that with the increase in the doses the COD reduction increase and the maximum percentage reduction of COD in obtained at a dosage value 6ml is 80.81% for Sapodilla seed powder and 8ml is 60.00% for Dolichos Lablab seed powder for grey water. Graph Shows that,

with the further increase in doses of Dolichos Lablab, COD percentage reduction decrease which can be easily visualized from the graph.

F. BOD

When the coagulants such as Dolichos Lablab seed powder, Sapodilla seed powder were agitated with the effluent of grey water at 100 rpm, the percentage change in BOD5 of the coagulants obtained is as below: Based on the readings obtained during the practical and the observations, it can be calculated that with the increase in the doses the BOD5 reduction increase and the maximum percentage reduction of BOD5 is obtained at a dosage value 6ml is 60.5% for Sapodilla seed powder and 8 ml is 48% for Dolichos Lablab seed powder for grey water Graph Shows that, with the further increase in doses, BOD5 percentage reduction decrease which can be easily visualized from the graph also.

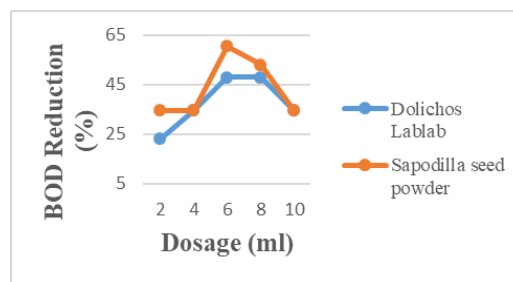


Fig. 10. Variation of the BOD for different dosage of Dolichos Lablab and Sapodilla seed powder

4. Conclusion

Generally, Alum is used as a coagulant for turbidity removal however over use of Alum may lead Alzheimer disease, thus natural coagulants like Dolichos Lablab and Sapodilla seed powder may prove to be trustworthy grey water parameters removal. When the coagulants such as Dolichos Lablab and Sapodilla seed powder were agitated with the effluent of grey water at 100 rpm, the maximum percentage change in pH, Turbidity, TDS, COD, BOD of grey water was observed i.e 1. When the coagulants such as Dolichos lablab and Sapodilla seed powder were agitated with the effluent of grey water at 100 rpm, the maximum percentage change in pH of grey water was observed by using Sapodilla seed and Dolichos lablab powder i.e. 29.23% for 8 ml dose and 18.60% for 6 ml dose applied as a coagulant respectively. 2. By using Sapodilla seed powder and Dolichos lablab seed powder it is observed that, maximum percentage removal of turbidity was found 40.11% removal for 8 ml of dosage of Sapodilla seed powder and 30.22% removal for 8 ml dosage of Dolichos lablab powder. 3. Coagulating with Sapodilla Seed Powder attained 80.81% removal efficiency for 6 ml dose, while with the Dolichos lablab seeds attained removal efficiency up to 60.00% for 8 ml of dose. 4. The maximum reduction of BOD5 found to be 60.5% and 48% by Sapodilla seed powder and Dolichos lablab seed powder respectively. 5. The result obtained through Sapodilla seed

powder and Dolichos lablab seed powder was impressive for removal of Electric Conductivity also. Sapodilla seed powder is best suited about 40.00% for 4 ml of dosage. 6. The coagulation-flocculation process efficiency using Sapodilla seed powder for percentage removal of TDS, TSS and TS was found to be 56.63%, 73.39 % and 63.24% for optimum dosages 6 ml, 10 ml, 10 ml respectively. 7. By conduction of jar test for the bio coagulants such as Sapodilla seed powder and Dolichos lablab seed powder, it is clearly seen that Sapodilla seed powder is better coagulant for treatment of grey water among Dolichos lablab seed powder.

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