UTILIZATION OF PLANT BASED NATURAL COAGULANTS IN WATER TREATMENT PROCESS

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ABSTRACT:

A great problem in countries is to get clean water at low prices. This can be normally solved by adding chemical coagulants such as alum which is generally at a High cost. The application of a coagulation/flocculation process is applied in water, waste water treatment to remove turbidity, colour and organic matter. Inorganic Coagulants such as aluminium sulphate, ferric chloride and calcium carbonate are Common coagulants used in this treatment. However the sludge obtained from Treatments using aluminium salts lead to disposal problems such as aluminium Accumulation in the environment. Moreover, some studies have reported that residual aluminium sulphate may induce Alzheimer's diseases whereas synthetic organic polymers such as acrylamide, have neuro toxic and carcinogenic effects. One possible solution to these problems may be natural coagulants which are preferably alternative excellent method for removal of turbidity. The coagulants used Are vicia– faba(largebean), trigonellafoenum (fenugreek). These seeds contain Soluble cationic and anionic polyelectrolyte which shows greater ability to act as a coagulant. The advantage of selectivity of natural coagulant used is having antimicrobial property, nontoxic and low cost method for removal turbidity. And our aim is to compare the action the above coagulants and the effectiveness of alum to remove turbidity from waste as well as surface water.

Keywords: Coagulants, Vicia–Faba, Trigonella Foenum, Alum, Turbidity

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1. INTRODUCTION

The various process involved in water treatment are screening, plain sedimentation, sedimentation aided with coagulation, filtration, disinfection, aeration and softening. Coagulation is a chemical technique which is directed towards the destabilization of the charged colloidal particles. The entire process of addition of chemicals and mixing is usually referred as coagulation. The chemical coagulant using are Alum, Copperas, Chlorinated copperas, Sodium aluminate, etc. In this work, the commonly used chemical coagulant alum is replaced by seed extracts to act as a coagulant. Here we are using large bean seed and

fenugreek for the treatment of surface water.These seeds are powdered, mixed with distilled water and added with surface water to get optimum dosage. Then the coagulants are assessed based on their ability to remove the turbidity, suspended solids and some other properties. Natural coagulants from Vicia-Faba Seed (large bean) and TrigonellaFoenum-Graecum Seed (fenugreek) have been investigated. The material that has received the greatest attention is fenugreek seedwhich contain some amount of vegetable oil. Fenugreek has water soluble cationic coagulant protein which is able to reduce the turbidity of water treated. The seed extracts of Vicia-Faba contain polyelectrolyte. The extracts of large bean seed showed the ability to act as a natural coagulant. The large bean seed has a food grade nature and contains no oil. The agro based seeds which is being used are non-toxic and effective coagulant aids useful for removing turbidity and bacteria from water. The advantage of selectivity of natural coagulants used is having antimicrobial properties. The natural coagulants are the low cost method for removal of turbidity from industrial waste water and also in surface water.

2. MATERIALS AND METHODS

2.1 PREPARATION OF COAGULANTS

The coagulants are prepared by mixing the powder of the coagulants in distilled water (i.e.) 10 gram of powder in 1000ml of distilled water. Their optimum dosage is found out using optimum coagulant dosage experiment.

3. RESULTS AND DISCUSSION

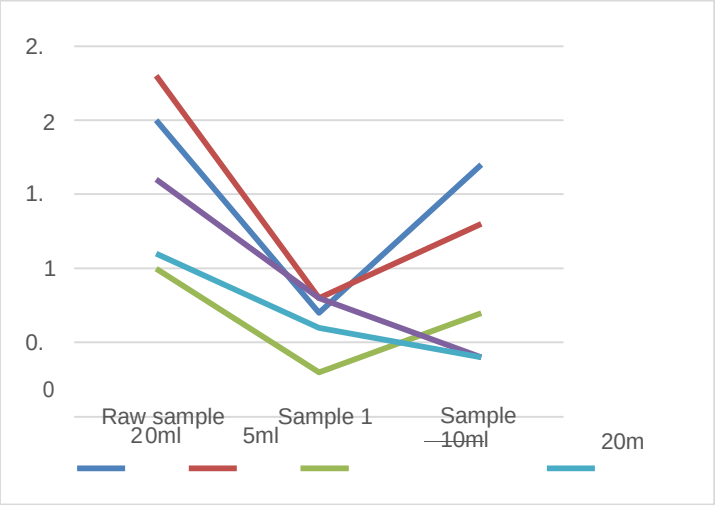
The tests are made for both raw sample and for the sample which are treated with coagulants. The results obtained are compared with each other. In the following results the raw water sample and sample mixed with coagulants are differentiated as follows.

Raw water sample - raw water

Sample mixed with coagulant 1 - sample 1

Sample mixed with coagulant 2 - sample 2

3.1 DETERMINATION OF OPTIMUM COAGULANT DOSAGE



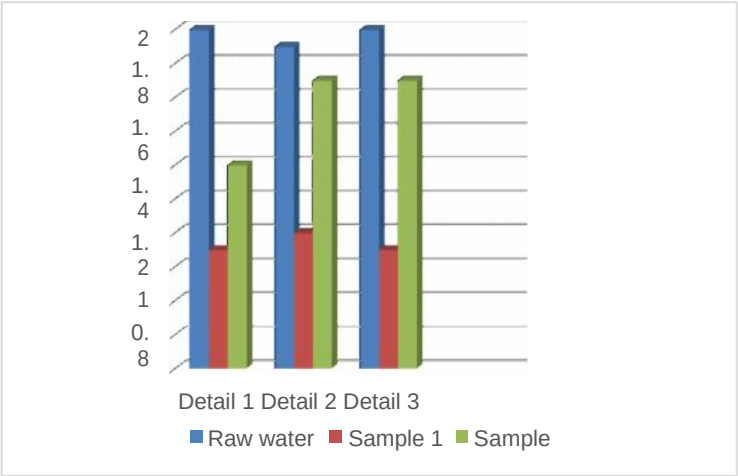
X-axis: Sample details Y-axis:

Fig 3.1 DETERMINATION OF OPTIMUM ALUM &NATURAL COAGULANT DOSAGE

From the fig: 3.1 the optimum dosage of coagulant for the sample is found and the dosage is **10ml of coagulant for both the coagulants.**

3.2 DETERMINATION OF TURBIDITY

Turbidity of the water sample is tested to know the solid materials or impurities present in the water. Turbid water cannot be used for drinking or industrial purpose hence turbid water should be treated before using.



X- axis: Sample detail

Y- axis: Turbidity in NTU

Fig 3.2 DETERMINATION OFTURBIDITY

From the figure: 3.2, the turbidity for various samples obtained is as follows

Turbidity for raw sample : **2NTU**

Turbidity for sample 1 : **0.7NTU**

Turbidity for sample 2 : **1.7NTU**

3.3 DETERMINATION OF pH

The pH value of the water is defined as the log of reciprocal of hydrogen ions present in water. If pH value of water is found to be less than 7, it will become acidic in nature; and if its pH is found to be more than 7, it will be alkaline in nature.

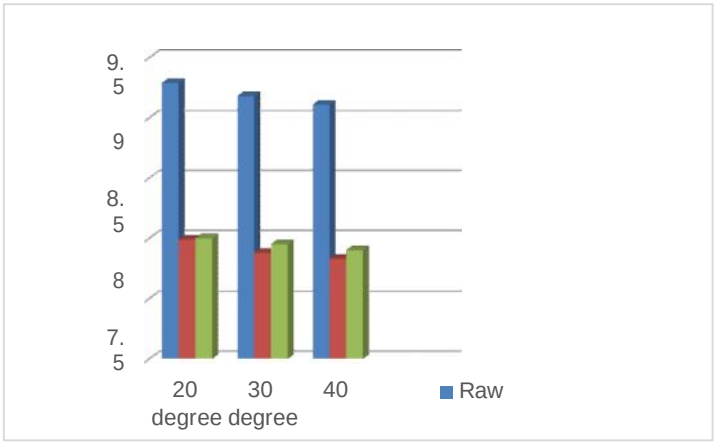


Fig 3.3 pH Vs Temperature

From the fig: 3.3, the obtained results were noted as below and it was clearly shows that the pH value decreases with increase in temperature.

pH value for raw sample : **9.19**

pH value for sample 1 : **7.9**

pH value for sample 2 : **7.95**

3.4 DETERMINATION OF CHEMICAL OXYGEN DEMAND

The amount of oxygen needed by the water for the oxidisation of chemical present in the water is defined as the chemical oxygen demand and is important since if

sufficient amount of oxygen is present in the water then it will flourish the useful aerobic bacteria and causes the decomposition of chemicals present in it.

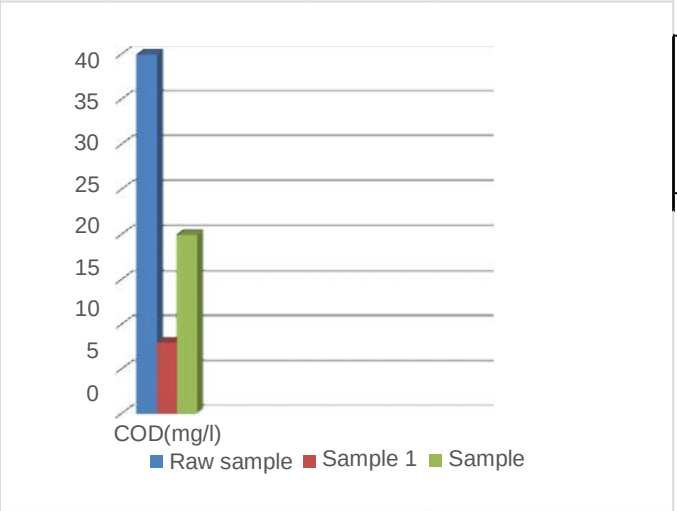


Fig 3.4 DETERMINATION OF COD

From the fig: 3.4, the determined COD for various samples are noted as follows and observed that the COD of treated sample with coagulant 1 is found to be less.

Chemical oxygen demand for raw sample: **40mg/l**

Chemical oxygen demand for sample 1 : **8mg/l**

Chemical oxygen demand for sample 2 :**20mg/l**

3.5 DETERMINATION OF CHLORIDE

Chloride is the element or group especially a salt of anion or a compound with chlorine bonded to an alkyl group. If the amount of chloride is more in water than standard then it will cause health problems to living organisms. The acceptable limit for chloride in drinkable water is 250mg/lit.

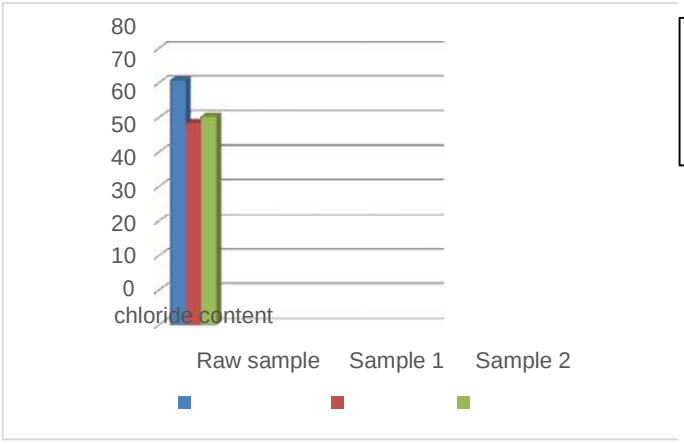


Fig 3.5DETERMINATION OF CHLORIDE

From the fig: 3.5 the chloride present in the samples was obtained as follows

Amount of chloride present in raw sample: **70.9mg/l**

Amount of chloride present in sample 1 : **58.49mg/l**

Amount of chloride present in sample 2 : **60.27mg/l**

3.6 DETERMINATION OF AMMONIA NITROGEN

Ammonia nitrogen (NH_3-N_2) is a measure for the amount of ammonia, a toxic pollutant often found in landfill leachate and in waste products, such as sewage, liquid manure and other liquid organic waste products. It is said that it is very toxic hence the ammonia nitrogen content should be very low in drinking water and land fill water.

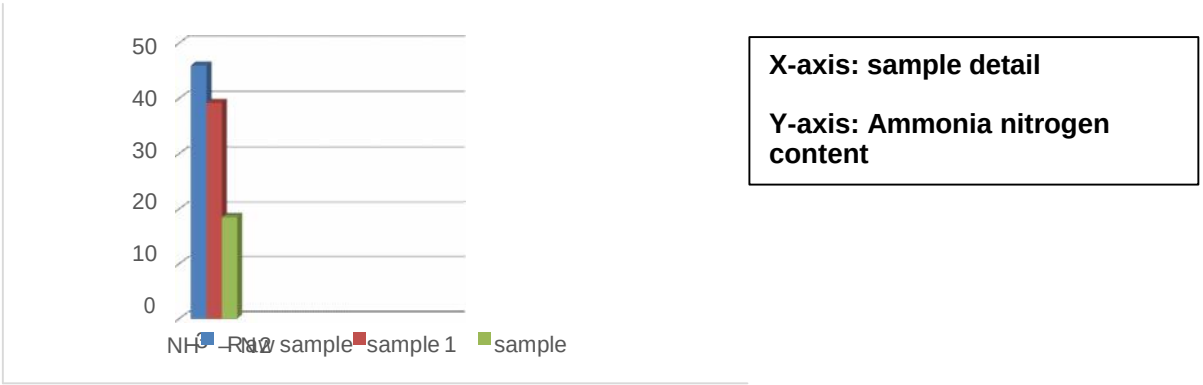


Fig 3.6 DETERMINATION OF AMMOMIA NITROGEN

From the fig: 3.6 the ammonia nitrogen present in the samples was obtained as follows

Amount of ammonia nitrogen present in raw water : **45.92mg/l**

Amount of ammonia nitrogen present in sample 1 : **39.2mg/l**

Amount of ammonia nitrogen present in sample2 : **18.48mg/l**

3.7 DETERMINATION OF CALCIUM

Calcium is the fifth most abundant dissolved ion present in the water. Calcium is the trace element in living organism and it is the most important constituent of bone teeth and shells in living organism. In drinking water the amount of calcium must be 75mg/lit. If the amount is more than the standards then the treatment is required.

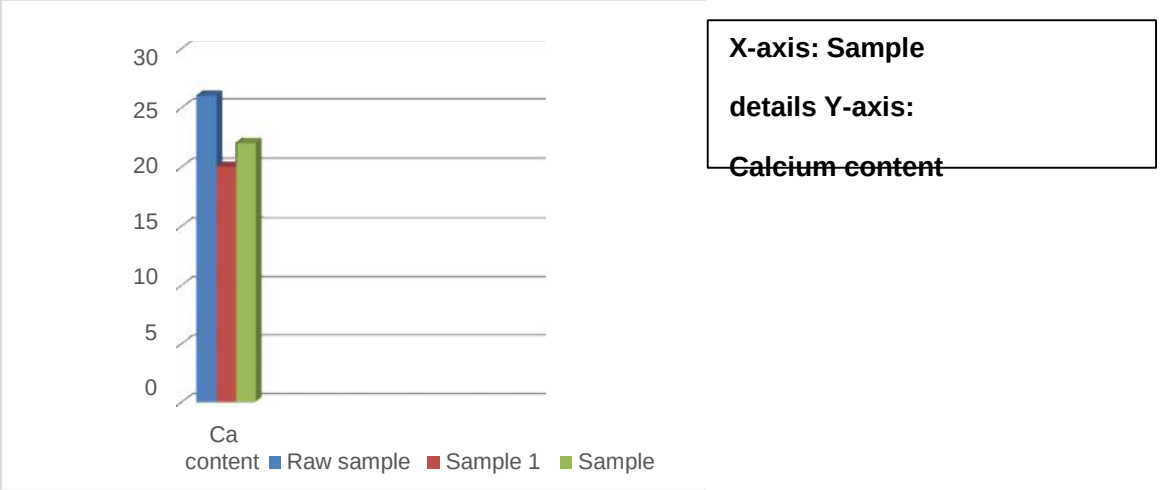


Fig 3.7CALCIUM PRESENT IN SAMPLE

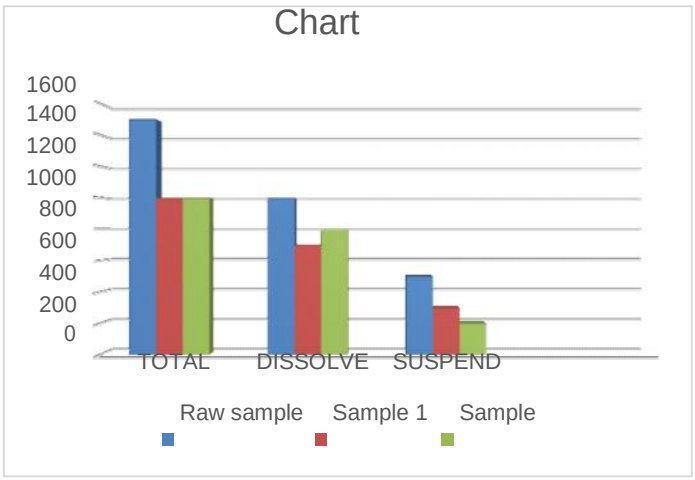
From the fig: 3.7 the amount of calcium present in the raw sample itself are found to be safe and the results obtained are as follows.

Amount of calcium present in raw water: **26.05 mg/l**

Amount of calcium present in sample1: **20.038 mg/l**

Amount of calcium present in sample 2: **22.04 mg/l**

3.8 DETERMINATION OF TOTAL DISSOLVED SOLIDS



X-axis: Sample detail

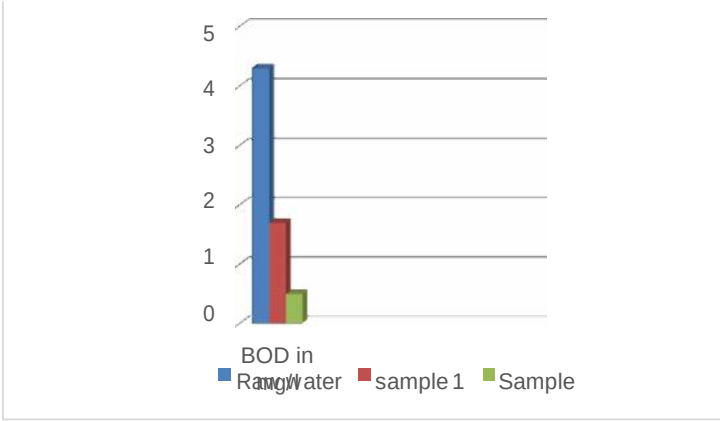
Y-axis: amount of solids in mg/lit

Fig 3.8 DETERMINATION OF AMOUNT OF SOLIDS

From the fig:3.8, it is known that the amount of solids present in the sample before and after treatment is same for total solids and low for dissolved and suspended solids**.**

3.9 DETERMINATION OF BIO CHEMICAL OXYGEN DEMAND

Biochemical oxygen demand (BOD, also called biological oxygen demand) is the amount of dissolved oxygen needed (i.e., demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period.



X-axis: Sample details

Y-axis: BOD content in sample

Fig 3.9 DETERMINATION OF BOD

From the fig: 3.9, the BOD for various samples are obtained as follows

BOD in raw sample **= 4.3 mg/l**

BOD in sample 1 = **1.7mg/l**

BOD in sample 2 = **0.5mg/l**

3.10 DETERMINATION OF HARDNESS

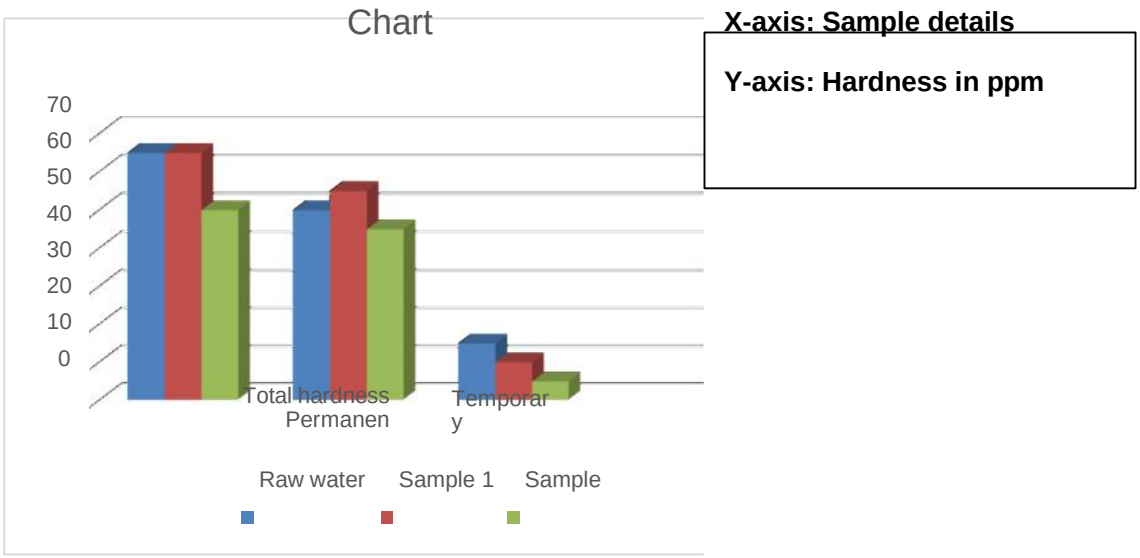


FIG 4.10 DETERMINATION OF HARDNESS

From the fig: 4.10, the amount of hardness is found to be low in the sample treated with coagulant 2

4. CONCLUSION

Vicia-Faba Seed (large bean) and Trigonella Foenum-Graecum Seed (fenugreek)have significant improvement in removing turbidity from waste water and surface water. Fenugreek acts as good coagulant and coagulant aid at higher turbidity. Both coagulants were analyzed for different parameter like pH, turbidity, Total solids, BOD, COD and other chemical tests. All parameters were reduced with increased dose of Vicia-Fabaseed powder except BOD, hardness, ammonia nitrogen. Both the extracted natural coagulant could be used successfully in surface water treatment. Among these two natural coagulants, Vicia-Faba is proved to be the best one for the removal of turbidity in water sample. And thus we conclude that Vicia-Faba can be used as coagulant in the place of alum even though it is needed slightly in large amount than alum. From economic point of view and availability if can satisfactorily replace alum. In addition to the above, it also act as a disinfectant.

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