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Water Treatment by Using Natural Coagulants

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A B S T R A C T

Among all the natural resources, water is the most crucial component. Water is necessary for a variety of daily home needs, but it must first be clean before it can be used. Access to clean, safe water is a major problem in many developing nations. Therefore, many techniques are employed to make the water pure while enticing users.

Synthetic organic and inorganic chemicals are frequently utilised in various treatment units. Since they must be taken in higher doses and are not cost-effective, this is usually pricey. Many of the compounds have also been linked to hazardous substances for the environment and human health.

Therefore, we performed a water purification method for this project. We conducted a jar test by

Keywords: Translucent concrete, light transmittance, optical fibre, light dependent resistor.

1. Introduction

1.1 General

Among all the natural resources, water is without a doubt the most important component. A major problem in many developing nations is having access to clean, safe water. Diarrhea brought on by contaminated water claims the lives of more than six million people each year. Importing chemicals for the purification of water is expensive for developing nations.

Bangladesh is severely affected by this issue. In Bangladesh, around 80% of the population lacks access to clean, safe water. In the case of Dhaka, the capital metropolis of more than 10 million city people, there is a great burden on water usage in the city due to rapid urbanisation and migration from rural areas. Due to the indiscriminate discharge of untreated sewage, the surface water in the Dhaka region is now severely polluted.

1.2 Coagulants

Common coagulants are coagulants which are inferred from common sources such as plants and creatures and are in most cases natural polymers. Focal points with common coagulants are that they are toxic-free, biodegradable, and frequently locally accessible. There exists a farge sum of normal coagulant with over 50 being detailed inquired about for water treatment. (Saleem and Bachmann 2019).

In order to reduce the forces that stabilize the colloidal particles and cause them to suspend in the water, coagulants are added to the water. Once the coagulant is presented within the water, the person colloids must total and develop greater so that the pollutions can be settled down at the foot of the measuring utencil and isolated from the water suspension (as appeared in table 1).

Table 1.1 Coagulation Influencing Factors

Coagulant Utilization	**Natural Water Properties**	**Effective Characteristics**
Use of coagulants Solubility of coagulants Dosage of coagulants Particle charge Coagulant basis	pH Alkalinity Access to bacteria Presence of elements (Cl, Na, Mn, Si, Fl, NH3, Fe) A collection of solids melted A solid suspension	Time to settle down stir 1. Rapid mixing 2. Slow mixing. The coagulant increases the volume Particle size

Different types of coagulants seem to have potential applications in treating water. Coagulants can be chemical or non-chemical. The protein with a positive charge would bind to the negatively charged particles in the arrangement to produce turbidity. The coagulant may also be a manufactured material or a common coagulant with these properties. water and wastewater treatment is the expulsion of suspended and colloidal particles, untreated matter, organisms and other substances that are harmful to life, in look of most reduced taken a toll sending, operation, support, and decreased natural impacts to the touching.

Coagulants are characterized concurring to the wastewater properties that relates to upgrade the productivity of treatment handle to attain required quality of water on guidelines (as appeared in Table 1). Coagulants ordinarily in shape of characteristic (as appeared is Table 2) & manufactured. Both coagulant points to expel toxins in a physical (solid and turbidity) or chemical (BOD and COD). Coagulants also exhibit different preferences among themselves.

Table 1.2 Natural coagulant performance

Natural Coagulants	**Turbidity**
Moringa Oleifera	83.02 %
Cactus	76.94 %
Cicer Aretinum	82.02 %

The effect of pH and coagulant dosages on the coagulation strategy was mulled over in arrange to streamline comparing to the most excellent clearing of turbidity. The ideal dose of pH will lead to the ideal conditions of Bump test. Coagulation influences the execution of the other stages of the treatment, favoring microbiological quality of the ultimate item expanding the lifetime of channels and decreasing the ultimate taken a toll of the treated water. Coagulants Extraction Coupled coagulation, flocculation step constitutes conditions of time and unsettling influence where the particles from colliding and coagulating destabilized by forming pieces can be apportioned with by sedimentation.

1.3 Objectives

• To utilize actually happening coagulants, such as alum, moringa Oleifera, Cicer arietinum, Myristica fragnans, and Sesamum indicum, to lower the level of turbidity pollutants in water.

• To simplify and protect the environment during the water purification process for residential uses.

1.4 Scope of Study

Water is a need in daily living, but it must be pure and free of contaminants like organic and inorganic impurities. In this project, we'll use a natural coagulant to cleanse raw or wastewater in order to achieve its purity.

The potential for wastewater cycling in India is enormous, particularly given the number of underground sources of pollution and the contamination of above-ground sources, such as rivers and the like. He irrigated parks, golf courses, and other landscaping using the cleaned wastewater, sometimes known as "claimed water."

Understanding and putting water recycling into practise calls for a paradigm shift away from viewing "used" water as waste and towards viewing it as a precious resource. Private strs players' entry has resulted in more.

2. Review of Literature

2.1 History of Using Coagulants

Per Pinderhughes (2004) Environmental issues related to trace minerals and sludge quality/quantity are brought on by the water treatment process using inorganic coagulants and synthetic polymers. These difficulties have become increasingly obvious as chemical precipitation has gained popularity during the past 50 years. Natural coagulants have been investigated for use in the treatment of water as a means of overcoming the environmental issues brought on by the usage of inorganic coagulants and synthetic polymers. Inorganic coagulants and synthetic polymers both represent environmental risks, whereas natural coagulants are biodegradable, non-toxic, and do not. This literature review compares more conventional inorganic coagulants and synthetic polymers to the therapeutic effectiveness and coagulation mechanisms of two of the most promising natural coagulants, cicer arietinum and Moringa oleifera. Natural coagulant in this context.

2.2 Experimental Studies on Coagulant

Sebastin Foro reported that Moringa oleifera, Cicer arietinum, and Dolichos lablah were locally accessible and easily used as natural coagulants and helped to minimise turbidity of synthetic water in the report titled "A review of selected natural coagulants in water and wastewater treatment." The experiments were conducted with standard jar set gear and artificially turbid water. The ideal mixing intensity and time were found.

extracts of Moringa oleifera that are watersoluble after dosing and filtration. Nephelometric turbidity (NTU) was reduced by Cicer arietinum and Dol chos lablab from 0 NTU and 5, 3.3, and 9.5 NTU, respectively, to 5.9, 3.9, and 11.1 NTU. When using naural coagulants, high turbidity water performed better than medium or low turbidity water. The most effective plant for reducing turbidity was Cicer arietinum (95.89%).

For water that is moderately murky

2.3 Advantages of Using Natural Plant Based Coagulants

The most benefits of utilizing actually happening plant-based coagulants as POL water treatment materials are self-evident: they are reasonable, improbable to produce water with serious pla, and exceptionally biodegradable. These benefits are especially improved in case the plant from which the coagulant is determined is local to a provincial range. Application of these coagulants could be a vital exertion in line with worldwide maintainable improvement objectives within the age of climate alter stepletion of the world's common assets and broad natural weakening. Since plant-based coagulants have been utilized to treat turbid water for numerous centuries, natural researchers have been able to identify a assortment of plant species that are appropriate for this utilize. In spite of the fact that it is evident that the coagulants are expecting to be a fundamental domestic POU innovation, there have.

3. Methodology

3.1 Material required

1. Aluminium Sulphate : Alum is another name for aluminium sulphate. A salt with the formula Al2(S04)3 is aluminium sulphate. Small dispersed particles that are exceedingly challenging for a filter to capture are frequently present in raw water. They clump together as a result of the alum, allowing them to readily fall out of the water or be captured by a filter. It is soluble in water and is primarily employed as a coagulation agent in the treatment of waste water and drinking water.

2. Cicer arietinum (chickpeas) : Chickpeas, the second most frequently cultivated legume crop after soybeans, are an essential component of the human diet's nitrogen intake and play a significant role in ensuring food security in underdeveloped nations. Natural coagulants have a promising future and are of interest to many researchers due to their wide availability, low cost, environmental friendliness, multifunctionality, and biodegradability in the water purification process. The characteristics of Cicer arietinum make it appropriate for usage as a coagulation aid. Because of the combination of the treatment methods that includes cosgislation, flocculation, and an organic coagulant known as Kabuli chickpea (Cicer ariemma L), it is possible to use this substance as an environmentally acceptable primary coagulant during water purification.

3.2 Characteristics of Water

pH: The pH of water is defined as the negative logarithm of the hydrogen iron concentration. We used a handheld pH metre to measure pH. The pH metre was calibrated in a buffer solution prior to daily usage. When the pH metre was stable for 1 minute, the pH value was recorded.

Suspended solids in total.

Analysis carried out in accordance with ISO 11923:1997 standard practise. First, a typical glassfiber filter from Sigma Aldrich with a diameter of 47 mm and a pore size of 1.2 um was weighed using an electronic scale with a resolution of 0.001 g. A 20- or 40-ml well-mixed sample was filtered through the glass-fiber filter after the filter had been weighed. The filter was then dried for at least an hour at 105 C.

3.3 Preparation of Synthetic Turbid Water

Clay components were added to tap water to create synthetic turbid water for the jar tests. One litre of tap water was mixed with about 30 g of the clay materials. To ensure an even distribution of clay particles throughout the suspension, it was agitated for around an hour. After that, it was left to rest for at least 24 hours to allow the clay ingredients to completely hydrate. To give the sample water the necessary turbidity right before coagulation, the supernatant suspension of synthetic turbid water was applied.

3.4 Jar test Operation

The most popular experimental technique for coagulation-flocculation is the jar test. In the studies, a sample of synthetically turbid water was utilised to coagulate several coagulants using a standard jar test setup. It was done in batches using four beakers and steel paddles with four spindles each as test vessels. The substance was well blended before running the jar test. Following that, the sample needs to have its turbidity and coliform count analysed to determine its original concentration. The beakers were filled with a variety of concentrations of coagulants. The entire jar test method was carried out at various speeds of rotation.The beakers were stirred at various mixing times and speeds after the necessary amount of coagulants had been added to the suspension, including quick mixing (100-120)

4. Result and Discussions

Experiment-1: Use of Alum as Coagulant

• Turbidity (initial)-240 NTU

• pH (initial)- 6.8

• Time (settlement): 40 min

Table 4.1 Use of Alum as Coagulant

Trial No.	Coagulant Dose (ml)	pH	Turbidity in NTU
1	25	6.9	15.5
2	50	6.8	15.3
3	75	7.2	6.1
4	100	7.1	7.3
5	125	7	7.9
6	150	6.7	6.5

Experiment-2: Use of cicer aritinum (Chickpeas) 1% of solution as Natural Coagulant

• Turbidity (initial)-240 NTU

• pH (initial)- 6.8

• Time (settlement): 1.00 hrs

Table 4.2 Use of cicer aritinum as coagulant

Trial No.	Coagulant Dose (ml)	pH	Turbidity in NTU
1	25	6.7	15.8
2	50	6.5	15.1
3	75	7.5	6
4	100	7	7.5
5	125	7.1	7.3
6	150	6.4	6.2

Experiment-3: Use of Sesamum indicum (sesame)1% of solution as Natural Coagulant

• Turbidity (initial)-250 NTU

• pH (initial)- 6.6

• Time (settlement): 1.30 hrs

Table 4.3 Use of Sesamum indicum (sesame) as Coagulant

Trial No.	Coagulant Dose (ml)	pH	Turbidity in NTU
1	25	6.5	15.9
2	50	6.7	15.3
3	75	7.8	6.2
4	100	7.5	7.2
5	125	7.2	7.5
6	150	6.8	6.6

After treating the water with more than three common coagulants, with a coagulant arrangement concentration of 1 percent, turbidity is obtained. From the comes about gotten it was clear that water treated with sesame seeds has gotten comparatively lesser values for turbidity. The esteem for pH was moreover gotten palatably for water treated with sesame seeds. So, sesame was chosen as the finest characteristic coagulant from the three coagulants utilized. But the result gotten for turbidity after treating the water with 1% arrangement was not palatable when compared with the chemical coagulant.

As a result, water was used to treat a 2 percent and 3 percent solution of sesame seeds. The results of treating water with sesame seed solutions of 2 percent and 3 percent are as follows in terms of turbidity and pH.

Experiment-4: Use of solution of sesamum indicum 2% of solution as Natural Coagulant

• Turbidity (initial)-240 NTU

• pH (initial)- 6.5

• Time (settlement): 1.00 hrs

Table 4.4 Use of 2% solution od sesamum seed as natural coagulant.

Trial No.	Coagulant Dose (ml)	Turbidity in NTU	pH
1	25	6.3	6
2	50	6.9	6.5
3	75	7.6	5
4	100	7.4	6.7
5	125	7.8	5.4
6	150	6.5	6.8

Experiment-5: Use of solution of sesamum indicum 3% of solution as Natural Coagulant

• Turbidity (initial)-230 NTU

• pH (initial)- 7

• Time (settlement): 1.30 hrs

Table 4.5 Use of 3% solution of sesame seed as natural coagulant

Trial No.	Coagulant Dose (ml)	Turbidity in NTU	pH
1	25	6.8	6.5
2	50	6.2	5.6
3	75	7.5	6.4
4	100	6	7
5	125	7.8	6.3
6	150	6.2	6.9

5. Conclusion

• From the experimental research that was done, sesame seed obtained lower turbidity values. Sesame was chosen as the best natural coagulant out of the three coagulants utilised because of the pH value that was achieved for water treated with sesame seeds.

• When compared to the chemical coagulant alum, the comes about for turbidity after treating the water with a 1% arrangement of sesame seeds were unsuitable.

• Sesame seed solutions of 2% and 3% were made, treated with water, and tested for turbidity and pH.

• Based on the results, it was evident that the 3% sesame seed solution had produced the lowest turbidity value of 3 NTU for the 70ml coagulant dosage.

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