Evaluation of wastewater Treatment using Hyacinth bean peel powder as Natural coagulant

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Abstract **- Industrialization increased the growth of population and enhanced economic activity has not only generated an increased demand for clean water but also caused serious mismanagement of environmental resources. Colloidal and suspended particles such as silt, clay, finely distributed organic matter, and other microscopic creatures are accountable for the increase in turbidity of water. The most used chemical coagulants to treat wastewater are aluminum and iron salts. Research works carried out by many researchers also proven that natural coagulants have brilliant potential due to their abundant availability, less price, innocuity, multifunctional, and biodegradation. In this Hyacinth Bean peels (Dolichos lablab) is utilized as natural coagulant. Hyacinth bean peels have a modest absorption of protein (17.1 ± 1.5%). The optimum dosage of NC was found to be 3 g/L, respectively for collected sample water. The optimum pH of Hyacinth Bean peels was found to be 9.5, respectively for sample water. The optimum dosage of NC 3 g/L, respectively for Krishna Sagara Lake water. The Total hardness removal efficiency was 1000% after treatment with NC, the percentage reduction in the magnesium hardness was found to be100 % after treatment with NC, the chlorides removal efficiency was found to be 50% and residual chlorines removal efficiency was found to be 76% respectively.**

Index Terms **- Chlorides, Coagulation, hardness, Hyacinth bean peels, NC-natural coagulants, turbidity.**

I.INTRODUCTION

Increased demand for freshwater is due to growing population, enhanced economic activity, and increased industrialization but also caused misuse of natural resources. Due to poor management and over-exploitation of water resources were threatened and also environmental degradation is caused. Unsystematic method of dumping untreated wastewater and waste from chemical industries directly into lakes, rivers and drains made these water bodies pollute along with polluting land. The continuous increase in the quantity of water utilized and wastewater generated by metropolitan areas and industries all through the world also causes possible health effects and environmental difficulties. Aquatic life will get disrupted also reduces its reproductive capability due to consumption of contaminated water. Color in the wastewater gets affected due to the existence of natural metal ions, humus and peat raw material, plankton, unwanted plant, and industrialized wastes. Turbidity in water is due to suspended and colloidal material such as silt, clay, inorganic matter, finely divided organic matter and microscopic bacteria are responsible for turbid waters. Coagulation is achieved by adding ions giving the opposite charge to the colloidal particles. Generally, coagulants are positively charged when it is added it forms floc layer and thus the removal of the electrostatic surface potential of the particles, this results in destabilization fragments stick sufficiently.

The most commonly used chemical coagulants are iron and aluminum salts, these salts form unsolvable raw material i.e. ferric and aluminum hydroxides usually when reacting with magnesium and calcium hydrogen carbonates, which are usually present in water. Due to the utilization of alum in water treatment huge amount of sludges are formed, which also remains a high level of aluminum in treated samples. Consumption of a high amount of salts of alum can cause Alzheimer's disease. Due to these various reasons use of natural coagulants especially in developing countries is very important to treat surface water. Flocculation and coagulation are playing a vital role in the treatment of wastewater. In few developing societies to produce potable water for home treatment naturally available materials are to be used in the powder or in pate form to utilize the optimum

application of readily available plants for the treatment of wastewater. This present research work is mainly focused on involving the coagulant action as an alternative for the treatment of wastewater with an eco-friendly extract from plants used as coagulant agents. The main purpose of this research is to investigate the utilization of Dolichos lablab peel powder as a natural coagulant and (i) To determine the optimum dosage of coagulant. (ii) To determine the dosage for the removal of turbidity, hardness, chlorides, and residual chlorine present in Krishna Sagara Lake water. (iii) To access the efficiency of treatment of wastewater using natural coagulant

II.MATERIALS AND METHOD

Hyacinth bean (Dolichos lablab) peels were collected from the local market at Chandapura in Bangalore. The peels were washed thoroughly to remove dust and dirt from the peels collected.

A. properties of Natural Coagulant

Hyacinth bean (Dolichos lablab) peels are considered for the objective of use as a protein source. Hyacinth bean peel contains moderate protein concentration (17.1 ±1.5%). The protein insulates in hyacinth peel have good operational characteristics such as lathering, capability, solubility, and blending action. However, it has less blending action and lathering. The approximate chemical composition of hyacinth bean peels is given in Table 1.

Components	Chemical composition%
Moisture	9.8
Crude protein	14.8
Ether extract	1.4
Crude fiber	33.6
Ash	6.8
N-free extract	33.6

Table 1: Chemical composition of Hyacinth bean peels

B. Preparation of Natural Coagulants

Hyacinth bean peels are collected washed thoroughly to remove dirt and then it is dried for one week in sunlight and dried out in a hot air oven at 600 for one hour, and then it is ground in a food processor into a fine powder and again sieved. The powder of hyacinth bean peels displayed in figure1 and figure2.

Figure1: Raw hyacinth beans

Figure2: Dried hyacinth bean peel powder

C. Optimization of pH and Coagulant Dosage

To evaluate he optimum dosage of natural coagulant jar test apparatus was used as shown in figure 3. In the jar test apparatus, 1000ml of water samples were put into each 6 one liter beakers and placed under paddles of jar test equipment. Then paddles were inserted into the jars and then the apparatus was turned on with a mixing rate of 100rpm at starting. The required amount of doses of hyacinth bean peel powder i.e. 1, 2, 3, 4, 5, and 6 g/L was added instantaneously and quickly combined for 2 minutes. Then the mixing speed was slowed down to 20-30rpm and slow downmixing is continued for 30 minutes for flocculation. Then allowed for settling at 30-40 minutes, then the treated water from each beaker is tested for various tests like Turbidity, hardness, chlorides, residual chlorine, and turbidity thus the optimum dosage of natural coagulant was noted down. The procedure was repeated for 3 trials then the

average and constant dosage of 3gm/L was noted down.

Figure3: Jar test apparatus setup

D. Treatment of Surface Water with Natural Coagulants

For this research work, a water sample was collected from the source of surface lake water i.e. Krishna Sagara lake shown in figure4 and figure5, the entire surface water belt in the GUEST LINE Industrial area near Attibele(Bangalore) is heavily contaminated with untreated industrial effluents and the standard methods of testing were carried out for physicochemical parameters. In this study, various factors such as Turbidity, Hardness, chlorides, and Residual chlorines were examined. Turbidity was measured using Nephloturbidity meter, Hardness, chlorides, available chlorine tests using a titration method.

Figure4: View of Krishna Sagara lake water

Figure5: Collection of sample lake water in can

III.RESULTS AND DISCUSSION

The optimum doses of hyacinth bean peels were carried out for Krishna Sagara lake water samples.

A. Optimum dosage and Turbidity Removal

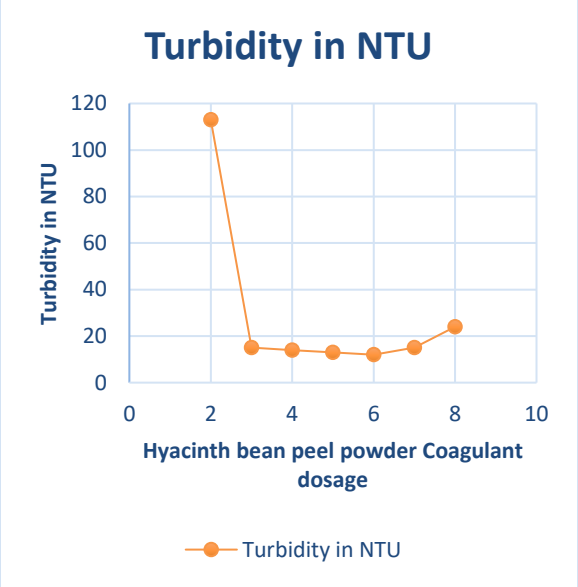
The optimum dosage was conducted with the lowest dose corresponding to the least turbidity value obtained. The optimum dosage of hyacinth bean peel powder coagulant was found to be 3g/L for the collected sample lake water. The turbidity of the wastewater sample was decreased from 113 NTU to 13 NTU and the removal efficiency of turbidity was found to be 90% by using natural coagulant, Total hardness of the sample was decreased from 471 mg/L to 0mg/L and the removal efficiency of total hardness was found to be 100%, magnesium hardness of the sample was decreased from 237 mg/L to 0mg/L and the removal efficiency of magnesium hardness was found to be 100%, calcium hardness of the sample was decreased from 234 mg/L to 181mg/L and the removal efficiency of calcium hardness was found to be 25%, chlorides of the sample were decreased from 821mg/L to 406mg/L and the removal efficiency of chlorides was found to be 51%, residual chlorine of the sample was decreased from 610 mg/L to 158mg/L and the removal efficiency of residual chlorine was found to be 75% were observed.

IV.EXPERIMENTAL RESULTS

A. Turbidity

Sl no	SAMPLE	Hyacinth bean peel powder Coagulant dosage in gm/L	Turbidity in NTU
1	Per-testing	-----	113
2	Post-testing of water	1gm/L	15
3	Post-testing of water	2gm/L	14
4	Post-testing of water	3gm/L	13
5	Post-testing of water	4gm/L	12
6	Post-testing of water	5gm/L	15
7	Post-testing of water	6gm/L	24

Table2: Removal of turbidity with different dosages of hyacinth peel powder

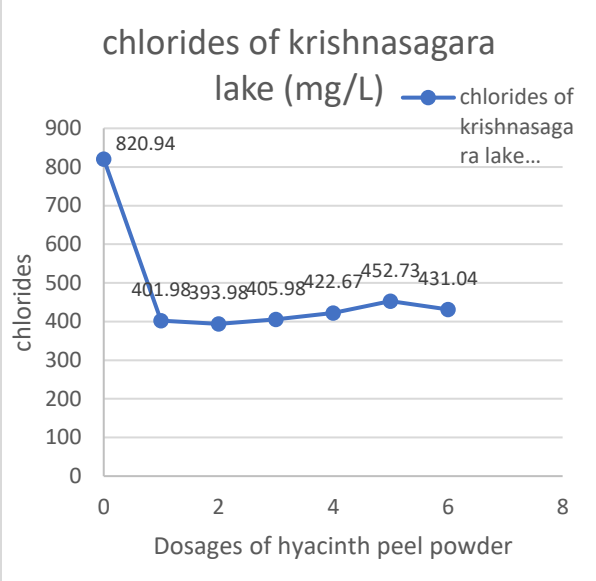


Graph 1: Removal of turbidity using NC

B. Chlorides

Sl no	SAMPLE	Hyacinth bean peel powder Coagulant dosage in gm/L	Chlorides test values in (mg/L)
1	Per-testing	-----	820.94
2	Post-testing of water	1gm/L	401.98
3	Post-testing of water	2gm/L	393.98
4	Post-testing of water	3gm/L	405.98
5	Post-testing of water	4gm/L	422.67
6	Post-testing of water	5gm/L	452.73
7	Post-testing of water	6gm/L	431.04

Table3: Removal of chlorides with different dosages of hyacinth peel powder

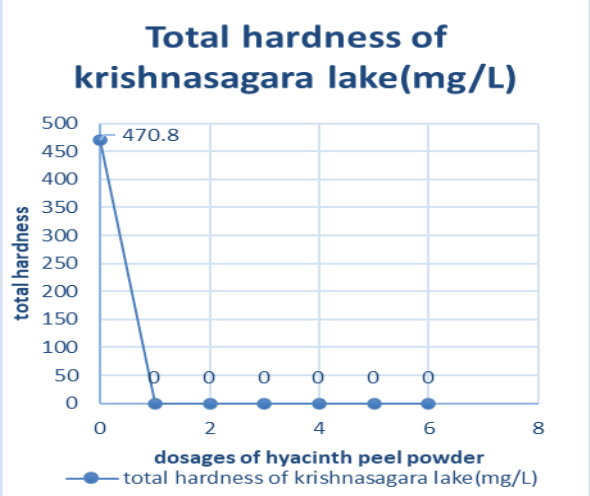


Graph 2: Removal of chlorides using NC

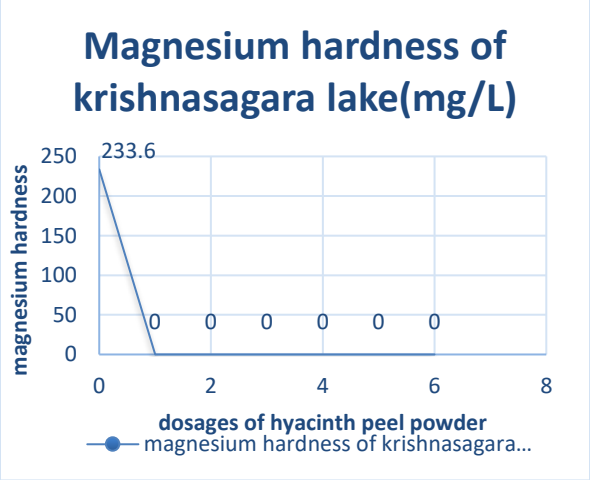
C. Hardness

Sl no	SAMPLE	Hyacinth bean peel powder Coagulant dosage	Total Hardness test values in (mg/L)	Magnesium Hardness test values in (mg/L)	Calcium Hardness test values in (mg/L)
1	Per-testing	-----	470 .8	233. 6	237.2
2	Post-testing of water	1gm/L	AB	AB	189
3	Post-testing of water	2gm/L	AB	AB	185.64
4	Post-testing of water	3gm/L	AB	AB	181.44
5	Post-testing of water	4gm/L	AB	AB	209.16
6	Post-testing of water	5gm/L	AB	AB	177.24
7	Post-testing of water	6gm/L	AB	AB	169.68

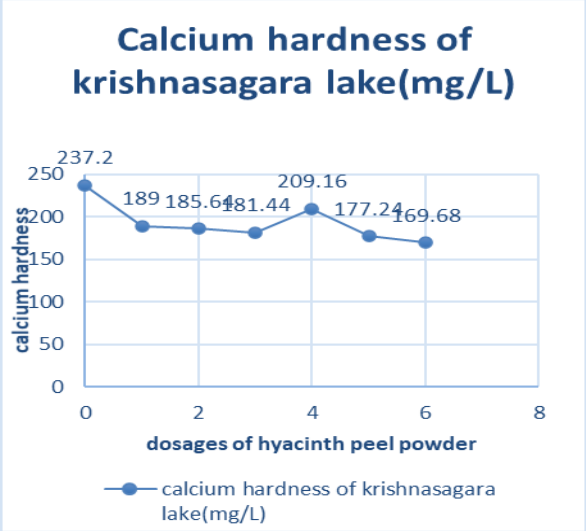
Table4: Removal of hardness with different dosages of hyacinth peel powder



Graph 3: Removal of Total hardness using NC



Graph 4: Removal of Magnesium hardness using NC

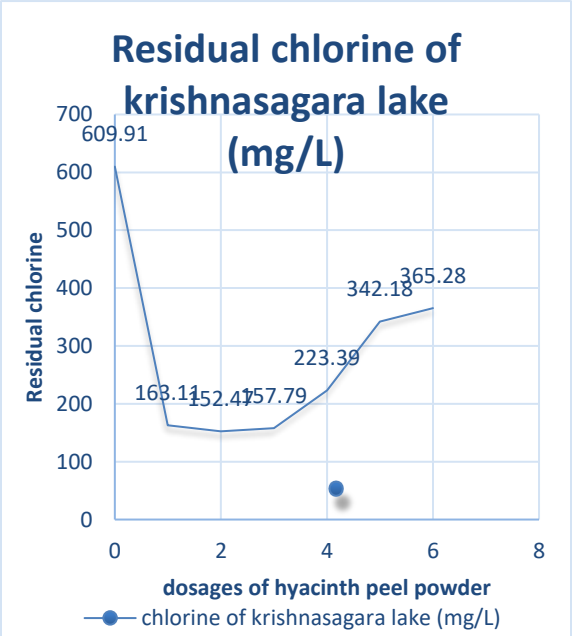


Graph 5: Removal of Calcium hardness using NC

D. Residual chlorines

Sl no	SAMPLE	Hyacinth bean peel powder Coagulant dosage	Chlorides test values in (mg/L)
1	Per-testing	-----	609.912
2	Post-testing of water	1gm/L	163.116
3	Post-testing of water	2gm/L	152.47
4	Post-testing of water	3gm/L	157.79
5	Post-testing of water	4gm/L	223.39
6	Post-testing of water	5gm/L	342.18
7	Post-testing of water	6gm/L	365.28

Table5: Removal of residual chlorine with different dosages of hyacinth peel powder



Graph 6: Removal of Residual chlorine using NC

V.CONCLUSION

From this current research work, it is been determined that natural coagulants like hyacinth bean peel powder can be used to check the effectiveness in wastewater treatment. Generally, the availability of safe and clean water is a little tough especially in rural areas because generally during the rainy season water will be muddy and full of sediments, due to the shortage of cleaning

agents people drink contaminated with colloidal particles. Therefore, using locally available, plentiful, and inexhaustible natural coagulants gives the solution to treat wastewater. The techniques implicated are inexpensive, conventional, simple to execute, and reduces mortality and morbidity due to water-borne diseases and this will improve public healthiness in rural regions. In this current research, the turbidity removal efficiency was found to be 90%, the removal efficiency of total hardness was found to be 100%, the removal efficiency of magnesium hardness was found to be 100%, the removal efficiency of calcium hardness was found to be 25%, the removal efficiency of chlorides was found to be 51%, the removal efficiency of residual chlorine was found to be 75% after treatment with a natural coagulant hyacinth bean peel powder, respectively for Krishna Sagara lake water sample. Therefore, it can be concluded that NC can be used as coagulants for the treatment of wastewater.

VI.APPLICATIONS, ADVANTAGES, AND DISADVANTAGES OF HYACINTH BEAN PEEL POWDER

Applications of hyacinth bean peel powder

- To identify a feasible, simple, nearby obtainable coagulant.
- Eco-friendly water treatment proficiency is further suitable for the earth to protect it from pollution influenced by chemical coagulants.
- Review the optimum dosages of hyacinth bean peel powder for exclusive intensities to remove chlorides.
- Removal efficiency is very high in hyacinth bean peel powder.

Advantages of hyacinth bean peel powder

- It is non-toxic and consistent for intake
- Secure for drinking.
- Hyacinth bean peel is abundant in organic compounds
- Hyacinth bean peel has high-level nutrients and moderate proteins.
- Hyacinth bean peel has lignin
- Hyacinth bean peels are a great source of acid

Disadvantages of hyacinth bean peel powder

- Accessibility of dried hyacinth bean peel is a bit complicated.
- It involves a huge amount of increasing collection of waste peels.
- The odor may influence after using in water treatment.

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