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STUDY OF *DOLICHOS LABLAB-L* (INDIAN BEAN) AS A NATURAL COAGULANT FOR THE TREATMENT OF RIVER WATER

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Abstract : Water is the most essential element in all human activity. As a result of numerous human activities like population growth, climate change, and rising living standards, water supplies are steadily being depleted. Water bodies like streams, rivers, and oceans become contaminated as a result of local activity such untreated wastewater escaping from nearby industry, urbanization, agricultural activities, transportation on waterways, increasing population, etc. Present study involves the use of *Dolichos Lablab-L* (Indian Bean) as a natural coagulant for river water study. The powder of *Dolichos Lablab-L* (Indian Bean) seed was applies for river water to check the tests for natural coagulant.

All the physicochemical parameters including pH, EC, TDS, turbidity, acidity, alkalinity, chloride content, hardness, DO, and COD were measured before the treatment. When the water had been treated, the parameters including pH, turbidity, hardness, DO, and COD were maintained. As a result, turbidity reduced from 13-10 NTU at a dosage of 200mg, reduces hardness up to 15-20%, increases the DO from 4.4 – 5mg /l, & removes COD about 40% after the treatment.

Key Words: Natural Coagulation, Coagulants, *Dolichos Lablab-L*, River Water, etc.

I. INTRODUCTION

The usefulness of substances such as alum and ferric chloride as coagulants is well known. However, there are numerous drawbacks to using it, including high operational expenses, negative effects on human health, the formation of vast volumes of sludge, and the fact that it drastically affects the pH of treated water. As a result, it is preferable to replace these chemical coagulants with natural-based coagulants.*(Shamira Shaharom et al. 2019).* A naturally occurring, plant-based coagulant known as a "natural coagulant" can be employed in the coagulation-flocculation stage of wastewater treatment to lower turbidity of water is known as natural coagulation.

The purpose of this was to look at the potential of plant-based compounds as coagulants for surface water treatment. As natural coagulants, two types of locally available plant-based compounds were chosen.*(Muhamad et al., 2020)* The goal of this study was to apply natural treatment methods to obtain safe drinking water.*(Khagga et al., 2010)* The coagulation ability of *Dolichos lablab* (Hyacinth Bean) extract was evaluated using standard jar test measurements in different turbidities of water. *Dolichos lablab's* investigation as a natural coagulant was validated by its positive effective coagulation activity. An optimum dose of 200 mg of this coagulant produced 68% coagulation activity for water purification and bacteria inactivation in 60 minutes.*(Khagga et al., 2010)*. The Hyacinth Bean (*Dolichos lablab*), also called Indian Bean, is a species of bean in the family Fabaceae that is widespread as a food crop throughout the tropics, especially in Africa, India, and Indonesia. The seeds of *Dolichos lablab* were obtained in pods and only seeds from dry pods were used.(Khagga et al., 2010) This contains crude protein which helps in formation of floc and removes turbidity of water.

II. MATERIAL & METHODOLOGY

2.1 Materials

2.1.1 River Water Collection

For the present study purpose the water sample was collected from Krishna Ghat, Kurundwad which is situated in Kolhapur District. This sample was collected 1m deep from the water surface to avoid the floating matters, and the sample was collected in air tight container to preserve dissolved oxygen of the water. (16.6875° N, 74.6005° E.)

Fig. 1 River Water from 'Krishna Ghat Kurundwad'

2.1.2 Natural Coagulants Used for Study

2.1.2.1 Dolichos Lablab (L) (Indian Bean)

These seeds are brought from the grocery shop. The seeds are oven dried in the DOT's Environment Laboratory at 30°c for 24 hours. After that the powder is made using the grinder.

Fig. 2 Dolichos Lablab L (Indian Bean)

Fig 3 Dolichos Lablab L in Powdered form

2.1.3 Methodology Adopted

2.1.3.1 Physicochemical Characteristics Study of River Water Before Treatment

1. pH: pH stands for potential of hydrogen, i.e. H+ ion concentration present in the water which represents the nature of water i.e. acidic or basic state. The pH scale determines whether water is basic (alkaline) or acidic. From 0 (extremely acidic) to 14 (basic alkalinity), the pH scale is logarithmic (very alkaline).

2. Electrical Conductivity: Since dissolved solids split into positively and negatively charged ions, water's conductivity is a measure of how well it can carry an electric current.

3. Alkalinity: Natural water is typically alkaline because the bicarbonates are presence which creates the reactions in the soils that the water percolates through. It represents the buffering power of the water and measures its ability to neutralize acids. It may also be to blame, because it protects or acts as a buffer against abrupt pH changes, alkalinity is essential for fish and other aquatic life.

4. Acidity: The quantitative ability of water or solution to neutralize an alkali is known as its acidity. In plain English, this means that pH is a gauge of an aqueous solution's acidity or basicity. Acidic solutions are those with a pH under 7, and basic or alkaline solutions are those with a pH above 7. Low pH can cause copper in your household plumbing to leach into the water, leaving green stains on porcelain surfaces like bathroom sinks. Another possibility is that the water itself has a blue color.

5. Hardness: Hardness is an inherent property of water that can improve its flavour and consumer acceptability for drinking. Water's hardness is caused by calcium and magnesium minerals, which are found naturally in water. Poor soap lathering and scum are typical indicators of hard water. There are two types of hardness: temporary (carbonate) and permanent (non-carbonate). Water that has become temporarily hard can be easily made soft by boiling it.

6. Dissolved Oxygen: The volume of oxygen in the atmosphere (O2) that has been dissolved in water is known as dissolved oxygen. By aeration (rapid movement), diffusion from the surrounding air, and as a waste product from photosynthesis, enters in water. The majority of aquatic organisms require dissolved oxygen in order to survive and develop. Some organisms, like catfish, worms, and dragonflies, can survive in slightly lower concentrations of DO than others, such as fish and stoneflies, which require high concentrations of DO. Insufficient oxygen levels in water can cause adult and juvenile deaths, poor growth, failed egg or larval survival, and a shift in the species that live in a particular water body. When oxygen levels in a body of water

fall below 3 mg/L, the aquatic system's circulatory fluid balance is disturbed, which impairs cell function and ultimately results in death.

7. **Chemical Oxygen Demand:** The Chemical Oxygen Demand (COD) formula calculates the amount of oxygen needed to oxidize the organic material present in a water body at a specific temperature and time. COD is an essential indicator of water quality because it offers a baseline for determining the impact that wastewater discharge will have on the environment. Higher COD levels signify the presence of more oxidizable organic matter in the sample, and as this material degrades, the water body will once more experience low oxygen conditions. The proportion of organic material in the water that can be broken down by environmental microorganisms is shown by the BOD to COD ratio.

2.1.4 Coagulation Study Using Jar Test

1. The collected river water was tested before the treatment for various physico-chemical analysis which includes pH, E.C., TDS, Turbidity, Acidity, Alkalinity, Chloride content, Hardness, DO, COD, etc. The *Dolichos Lablab L* powder was prepared & it was tested for river water at the conc. dose of 200mg, 400mg, 600mg, 800mg, & 1000mg, for coagulation purpose with the help of jar test.
2. The sample is kept for 4 -5 minutes for mixing the coagulant and rotated about 100 rpm.
3. Switch off the apparatus and give the containers 30 to 45 minutes to settle.
4. Stirring should be reduced to 25 to 35 rpm, and mixing should go on up to 15 minutes to 20 minutes. In order to create larger flocs, particle collisions are enhanced by the slower mixing speed.
5. Then, the residual turbidity is plotted against the coagulant dose to identify the ideal circumstances.
6. The jar test was performed at different concentration of coagulant *Dolichos Lablab L* & the best coagulant dose was identified on the basis of physico-chemical characteristics of water after the treatment.

Fig. 4 Jar Test Using Natural Coagulant *DOLICHOS LABLAB L* (Indian Bean)

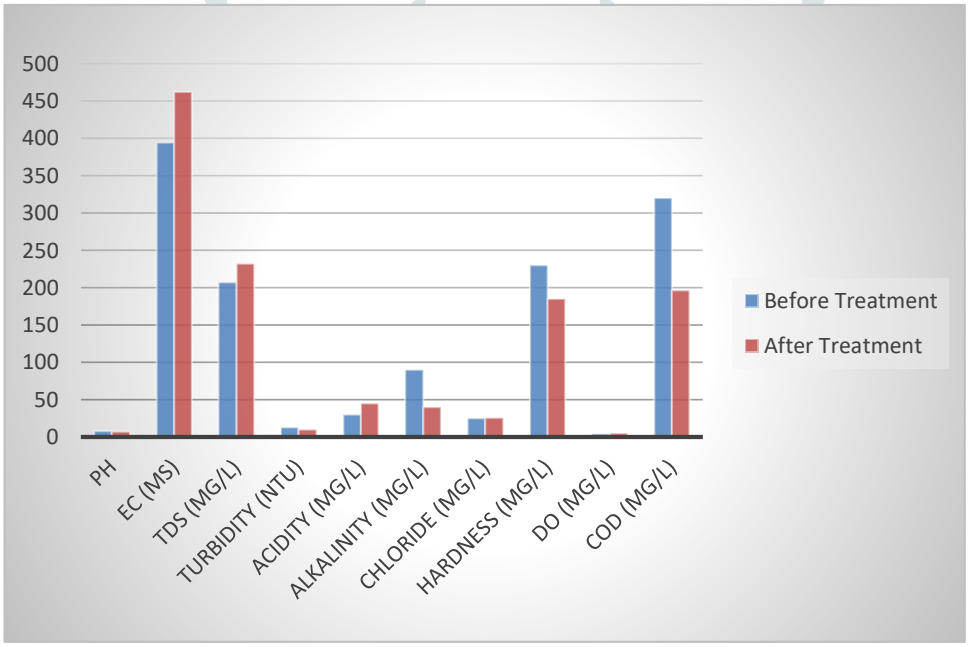
III. OBSERVATIONS FOR RIVER WATER SAMPLE

DOSAGE OF *Dolichos Lablab L*						
TESTS	**Control**	**200mg**	**400mg**	**600mg**	**800mg**	**1000mg**
pH	7.693	6.637	6.653	6.63	6.502	6.522
EC (µs)	394	462	490	518	546	574
TDS (mg/l)	207	232	245	259	273	287
TURBIDITY (NTU)	13	10	12	15	18	20
ACIDITY (mg/l)	30	45	52	55	61	69
ALKALINITY (mg/l)	90	40	40	45	50	50
CHLORIDE (mg/l)	25	25.5	27.5	30	32.5	35
HARDNESS (mg/l)	67.5	55	57.5	60	62.5	65
DO (mg/l)	4.4	5	5.3	5.4	5.5	5.6
COD (mg/l)	320	196	168	142	120	98

Table 1 Dolichos Lablab L (Indian Bean) Powder Coagulation in River Water Sample

RIVER WATER SAMPLE

Parameters	Before Treatment	After Treatment
pH	7.693	6.637
EC (µs)	394	462
TDS (mg/l)	207	232
TURBIDITY (NTU)	13	10
ACIDITY (mg/l)	30	45
ALKALINITY (mg/l)	90	40
CHLORIDE (mg/l)	25	25.5
HARDNESS (mg/l)	230	185
DO (mg/l)	4.4	5
COD (mg/l)	320	196



Graphical Representation of Optimum Dosage of Dolichos Lablab L (Indian Bean) Powder in River Water Sample

Parameters	River Water Sample Before Treatment	River Water Sample After Treatment (Optimum Dosage of 200mg)	WHO Standards
pH	7.693	6.637	6.5 - 8.5
EC	394	462	50 - 500 µs/cm
TDS	207	232	500 mg/l
TURBIDITY	13	10	1 - 5 NTU
ACIDITY	30	45	No Guidelines
ALKALINITY	90	40	200 - 600 mg/l
CHLORIDE	25	25.5	250 mg/l
HARDNESS	230	185	500 mg/l
DO	4.4	5	No Guidelines
COD	320	196	No Guidelines

Table 2 Comparison with WHO Standards & Results Obtained by Natural Coagulation with Effective Dose For River Water Sample

RESULT AND DISCUSSION

From the above study the optimum dosage for the coagulation process using *Dolichos lablab L* seed powder is 200 mg/l. The pH of Sample before treatment is 7.693 and it becomes 6.637 after the coagulation process. Electric conductivity gets increases due to presence of organic matter in the form of natural coagulant. TDS also little bit more than raw water sample. Turbidity gets reduced by 24%, alkalinity reduces up to 56% after the treatment, hardness also gets reduced up to 20%, D.O. before the treatment is 4.4 mg/l and it becomes 5 mg/l after the treatment, it shows better results for the removal of COD, it reduces nearby 70% after the treatment i.e. it was 320mg/l before treatment ad reduced up to 196mg/l after treatment.

CONCLUSION

From the above study it can be concluded that *Dolichos lablab* seeds was found to be good for water treatment. *Dolichos lablab* seed powder has effective coagulant properties. It is reasonably priced to make locally. It keeps the pH within an acceptable range, lowers physicochemical characteristics like turbidity, acidity, alkalinity, chlorides, hardness, and COD, and maintains the DO within a permitted range for selected water samples.

As it is a low-cost natural coagulant it will be very useful for household drinking water treatment especially in rural areas.

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