REMOVAL OF CHEMICAL AND BIOLOGICAL POLLUTANT IN WASTE WATER USING BAY LEAVES

Abstract

Industrialization, urbanization, and population growth have contaminated natural waterways, posing health and environmental risks. Coagulation, an effective primary chemical treatment method, is vital for removing contaminants. Natural coagulants, derived from plants, animals, or microorganisms, are preferred over chemical ones. This study delves into the mechanisms and types of natural coagulants, with a focus on plant-based options. It aims to enhance knowledge of eco-friendly coagulants' potential, efficiency, and barriers to commercialization. Modified coagulants are also discussed for future water treatment exploration. In 2018, the General Assembly declared clean water and sanitation a human right, vital for overall well-being. They were concerned about 900 million lacking clean water and urged aid to improve access. Bay leaf (Laurusnobilis), a shrub in the laurel family, is valued for its culinary and medicinal uses, rich in compounds like tannins, flavonoids, and essential oils. Its versatile properties range from wound healing to antibacterial and antifungal effects, making it useful in various industries.

Keywords: Coagulants; Cost-Effective; Bay Leaves;Chlorine

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I. INTRODUCTION

Due to the indiscriminate discharge of untreated waste from the tannery, textile, and other industries, municipal waste into water bodies, inadequate drainage systems, population growth, and urban encroachment, the condition of the surface water has become severely polluted. Before being consumed, all water must undergo some sort of purification. Water safety and consumer appeal are achieved using a variety of techniques. The significant seasonal change in turbidity is one of the challenges with surface water treatment. Some conventional chemicals are utilized at various stages of the treatment process for surface water. Synthetic organic and inorganic compounds are frequently utilized in various treatment units. These are typically pricey since they must be taken in higher doses and lack cost-effectiveness. Since many pollutants are also linked to issues with human health and the environment, [Kaggwa] voiced the need for an easy, affordable method of water clarifying that is also environmentally beneficial. The usage of natural coagulants has a lengthy history. For more than 2000 years, India, Africa, and China have used natural organic polymers as efficient coagulants and coagulant aids at high water turbidities. They could be produced using the seeds, leaves, and roots of plants. These organic natural polymers are intriguing since they pose no risk to human health and are inexpensive. Since they are readily available in most rural communities, natural coagulants are less expensive than traditional chemicals. To supply rural residents with safe drinking water, we have created a technological solution that combines natural coagulants and solar disinfection with turbid water treatment.

II. MATERIALS AND METHODS

1. Materials

- **History/Origin:** Bay leaf most likely originated in South Asia, from where it moved through Asia Minor and throughout the rest of the world. Bay leaves are aromatic laurel tree leaves that are used as a spice. You can get whole bay leaves either fresh, dried, or powdered. In slow-cooked dishes like soups, sauces, and stews, the leaves are added and then taken out just before serving. There are several ecological and meteorological environments where bay leaf is grown. The ideal and best conditions for quick, luxuriant development are found in wet, sandy soil that contains a lot of water or some moist atmospheric conditions close to the ocean shore (Patrakar et al., 2012).As a result, partial sun shade, sandy soil with sufficient moisture and a pH range of 4.5–8.2 are desirable. In hotter climates, leaves may also burn. In warmer climates, bay produces black fruit and fluffy yellow-white blossoms. The bay will perish in areas with prolonged cold in temperatures below 280 F. India, Pakistan, other Southeast Asian nations, some Pacific islands, Australia, the Mediterranean and Southern European coasts, Greece, Portugal, France, Turkey, Spain, Algeria, Morocco, Belgium, Central America, Mexico, Southern United States, and the Canary Islands are among the nations where bay is a common plant.

- **Chemistry of Bay Leaf:** The flavor of the bay leaf is bitter and pungent. The presence of essential oils in the plant's leaves and other components accounts for the variations in scent and aroma. In addition to steroids, alkaloids, triterpenoids, essential oils, and flavonoids, it also contains tannins, eugenol, citric acid, and glucose. The phenolic components in bay leaf extract were found to exhibit antioxidant effects.

- **Antimicrobial Activity of Bay Leaf:** With minimal inhibitory doses of 0.35 and 0.56 mg/mL, respectively, the essential oil from L. nobilis demonstrated strong antibacterial action. According to Derwich et al. (2009), the main compound in bay leaves, 1,8 cineol, may be the reason for their antibacterial properties. On seven strains of plant pathogenic fungi, L nobilis' antifungal activity was tested in vitro at doses of 50, 125, and 250 ug/mL. At a concentration of 250 liter/mL, Botrytis cinerea showed the strongest antifungal efficacy.

- **Antioxidant Activity of Bay Leaf:** L. nobilis ethanol extracts shown potent antioxidant properties. Free radical scavenging, hydrogen peroxide scavenging, superoxide anion radical scavenging, reducing power, and metal chelating assays were used to assess the antioxidant activity. At concentrations of 20, 40, and 60 gg/mL, bay leaf exhibited strong antioxidant activity in linoleic acid emulsions (94.2%, 97.7%, and 98.6% prevention of lipid peroxidation, respectively). According to Elmastasé et al. (2006), the phenolic components in ethanol extract may be the cause of the extract's antioxidant activity.

2. Methodology

- **Water Sample Collection:** Water samples were collected from the bore wells on the AIEMS campus, specifically for grab water sampling. This involved obtaining samples from various points within the bore wells. The samples were analyzed for 8 parameters: pH, turbidity (NTU), Total Dissolved Solid (TDS) (mg/L), Electrical Conductivity (EC), Alkalinity (as caco3) (mg/L), Nitrates (NO3-N), Iron (Fe), (Mg/L) Chlorides (Cl), Fluoride(F).

- **Natural Coagulant Preparation:** To prepare the natural coagulant, bay leaves were gathered. These bay leaves were allowed to dry naturally in an open environment for a period of 10 to 12 days, ensuring their complete dehydration. Once dried, the leaves were finely ground into a powdered form. This powdered material was then placed in a beaker and submerged in distilled water for a duration of 72 hours, with different concentrations of the powdered leaves being tested. Over the course of three consecutive days, the solution was stirred daily to ensure thorough mixing and interaction. Subsequently, the solution was subjected to filtration using What man no. 42 filter paper, effectively separating the solvent from the coagulant solution.

III. RESULT AND DISCUSSION

The outcomes of the sampling and sample analysis are summarized in this chapter. Eight water quality parameters have been discussed. There is also analysis and discussion of the physical and chemical characteristics. To help with understanding and result analysis, tables and other appropriate graphs have been given. Different physical and chemical data from water samples were collected and examined.

1. **Turbidity:** Turbidity of the water ranged from 100 to 296 NTU, reaching higher values during the post-monsoon. High turbidity levels were recorded in agricultural areas (stations 3 and 4) post-monsoon.

2. **pH:** Nearly every aquatic organism's biological process depends on hydrogen ion concentration. The pH changes as a result of variables such as photosynthesis, respiratory activity, industrial waste disposal, etc. The pH value may be affected by stored organic matter and the decomposition of plants, which releases CO_2 during biological oxidation and subsequently lowers the pH.

Table 1: Turbidity in the sample after adding chemical and natural coagulant

Dosage Mg/L	After Adding Chlorine	After Adding Bay Levees Solution	After Adding Bay Leaf Essential Oil
0	0.3	0.3	0.3
2	0.3	0.3	0.3
4	0.2	0.2	0.2
6	0.2	0.2	0.2
8	0.1	0.1	0.1
10	0.1	0.0	0.0

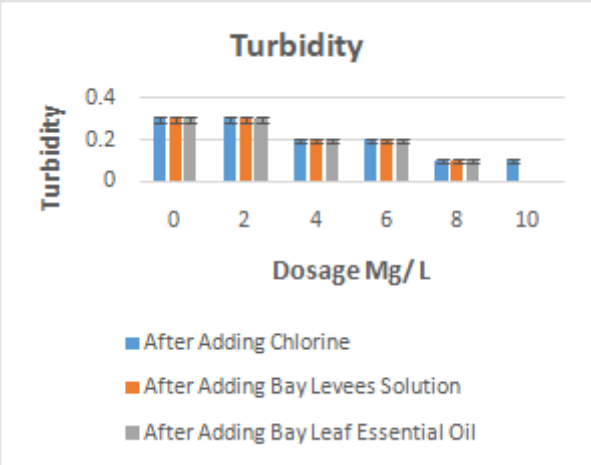
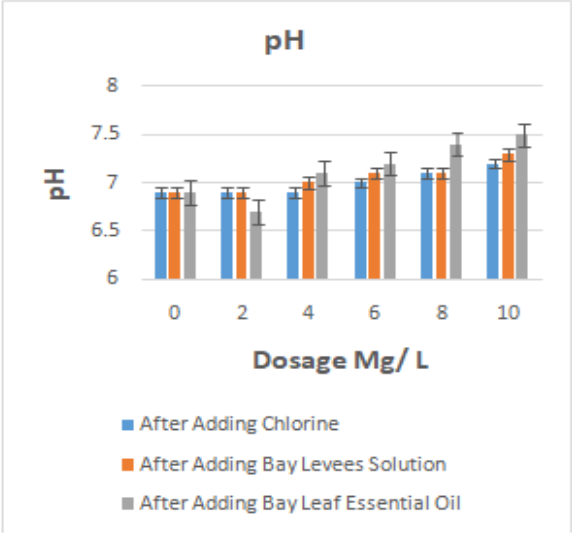


Table no 2: pH sample after adding chemical and natural coagulant

Dosage Mg/L	After Adding Chlorine	After Adding Bay Levees Solution	After Adding Bay Leaf Essential Oil
0	6.9	6.9	6.9
2	6.9	6.9	6.7
4	6.9	7	7.1

6	7	7.1	7.2
8	7.1	7.1	7.4
10	7.2	7.3	7.5



3. **Electrical Conductivity:** Lake sample electrical conductivity is found to range from 0.499 to 1.429 µS/cm. More than any other soil component, the concentration of water-soluble salts has been noted. The EC value is also influenced by soil suspension dilution. Because the overall salt and sodium content level may be determined, the risk brought on by solid waste is frequently concentrated.

4. **Alkalinity:** The results for total alkalinity in the current investigation ranged from 91 mg/L to 195 mg/L. The allowable limit for total alkalinity according to BIS (1998) is 600 mg/L.

Table 3: Conductivity sample after adding Table 4: Alkalinity sample after adding chemicals & chemical and natural coagulant natural coagulant

Dosage Mg/L	After Adding Chlorine	After Adding Bay Levees Solution	After Adding Bay Leaf Essential Oil
0	6.6mg/l	6.6mg/l	6.6mg/l
2	6.4 mg/l	6.6 mg/l	7.1 mg/l
4	6.2 mg/l	6.9 mg/l	7.8 mg/l
6	5.7 mg/l	7.3 mg/l	8.4 mg/l
8	5.5 mg/l	7.8 mg/l	11.2 mg/l
10	5.3 mg/l	8.3mg/l	12.3mg/l

Dosage Mg/L	After Adding Chlorine	After Adding Bay Levees Solution	After Adding Bay Leaf Essential Oil
0	8.6µs	8.6µs	8.6µs
2	8.4 µs	8.4 µs	7.6 µs
4	7.9 µs	7.5 µs	6.5 µs
6	6.3 µs	6.4 µs	4.3 µs
8	5.4 µs	4.8 µs	3.4 µs
10	5.2µs	4.2µs	2.3µs

IV. CONCLUSION

The study revealed that bay leaf extracts have both antibacterial and antioxidant effects. Adding varying amounts of bay leaf solution to the sample did not alter the color or taste of the water. Natural coagulants from the bay leaf extract decreased the total dissolved solids (TDS) and turbidity of untreated water. Bay leaves are abundant in minerals like copper, potassium, calcium. The fluoride content increased with higher doses of bay leaf solution. To verify these findings, it's important to examine pH, conductivity, iron, nitrate, TDS, acidity, and alkalinity; the results showed that as the bay leaf solution increased, these factors changed accordingly. To comprehensively understand the potential of bay leaf extract, further investigation across a broader range of variables is recommended.

REFERENCES

[1] Abderrezzaqbenalia 1, Kerroumderbal : Use of acorn leaves as a natural coagulant in a drinking water treatment plant (2018-Dec).
[2] KK chahal, Mandeepkaur, Urvashi bhardwaj, Nancy singla and Nmandeepkaur : A review on chemistry and biological activities of laurusnobilis(2O17).
[3] Muhammad luqman nordin1, Abdul aziz othman2, Arifahabdul kadir2: Antibacterial and cytotoxic activities of the syzygiumpolyanthum leaf (2019- Feb)
[4] Bichi, M.H; Agunwamba, J .C., AND muyibi, S.A. ((2012) : optimization of operating conditions for the application of moringaoleifera seed extract in water disinfection using response surface methodology,african journal ,11(92), 15875-15887.
[5] Sumia O Algabri1*, Basma M Doro2, Awatf M Abadi1, Mahmoud A Shiba1 and Almonder H Salem : Bay Leaves have Antimicrobial and Antioxidant Activities
[6] Devi Rajeswari, Emad M. Eed, Ashraf Elfasakhany, Irfan AnjumBadruddin, SarfarazKamangar&KathirvelBrindhadevi: Green synthesis of titanium dioxide nanoparticles using Laurusnobilis (bay leaf): antioxidant and antimicrobial activities
[7] BirgulOzcan*1, Mari Esen1, M. Kemal Sangun2, Arzu Coleri3: Effective antibacterial and antioxidant propertiesofmethanolic extract of Laurus nobilis seed oil
[8] Marzouki H, Piras A, Salah KB, Medini H, Pivetta T, et al. (2009) Essential oil composition and variability of Laurusnobilis L. growing in Tunisia, comparison and chemometric investigation of different plant organs.
[9] Kaurinovic B, Popovic M, Vlaisavljevic S (2010) In vitro and in vivo effects of Laurusnobilis L. leaf extracts.
[10] Fukuyama N, Ino C, Suzuki Y, Kobayashi N, Hamamoto H, et al. (2011) Antimicrobial sesquiterpenoids from Laurusnobilis L. Natural Product Research

