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

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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 (Laurus nobilis), 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

# INTRODUCTION

The water condition of the surface water has become highly polluted due to indiscriminate discharge of untreated waste from the tannery, textile, and other industries, municipal waste into water bodies, poor drainage systems, population increase, and urban encroachment. Water from all sources must have some form of purification before consumption. Various methods are used to make water safe and attractive to the consumer. One of the problems with surface water treatment is the large seasonal variation in turbidity. For the treatment of surface water, some traditional chemicals are used during the treatment of surface water at its various steps. Commonly used chemicals for various treatment units are synthetic organic and inorganic substances. In most cases, these are expensive since they are required in a higher dose and do not show cost-effectiveness. Many of the chemicals are also associated with human health and environmental problems, [*Kaggwa]*, there raised a voice to develop a cost-effective, easier, and environmentally friendly process of water clarification. The history of the use of natural coagulants is long. Natural organic polymers have been used for more than 2000 years in India, Africa, and China as effective coagulants and coagulant aids at high water turbidities. They may be manufactured from plant seeds, leaves, and roots. These natural organic polymers are interesting because there is no human health danger and the cost of these natural coagulants would be less expensive than the conventional chemicals since it is locally available in most rural communities. We have developed an economically, feasible, and environmentally sound combined turbid water treatment technology with natural coagulants and solar disinfection to provide potable water to rural people.

# MATERIALS AND METHODS

## **MATERIALS**

**History/Origin**

The origin of bay leaf is most probably South Asia, from where it spread to Asia Minor and all over the world. Bay leaves are fragrant leaves from the laurel tree used as an herb. Bay leaves are available whole either fresh or dried or ground into a powder. The leaves are added to slow-cooked recipes, such as soups, sauces, and stews, and are removed before serving the dish. Bay leaf is grown in different ecologic and climatic conditions. Wet, sandy soil that has a large quantity of water or some moist atmospheric conditions close to the ocean shore is optimum and the best conditions for rapid luxuriant growth (Patrakar et al., 2012). In warmer weather, leaves may burn; therefore, partial sun shade, well-drained sandy soil that has some moisture, and a pH range of 4.5—8.2 are preferred. Bay bears black fruit and yellowish-white fluffy flowers in warmer areas. Temperatures below 280 F and extensive freezing will kill the bay. Bay is widely growing in the following countries: India, Pakistan, other Southeast Asian countries, some Pacific islands, Australia, around the coast of the Mediterranean and Southern Europe, Greece, Portugal, France, Turkey, Spain, Algeria, Morocco, Belgium, Central America, Mexico, Southern United States, and the Canary Islands

**Chemistry of bay leaf**

The Bay leaf has a sharp and bitter taste. The difference in fragrance and aroma is due to the presence of essential oils in leaves and other parts of the plant. It has flavonoids, tannins, eugenol, citric acid, carbohydrate, steroids, alkaloids, triterpenoids, and essential oils. Antioxidant properties were discovered in the extract of bay leaf to have phenolic compounds.

**Antimicrobial Activity of bay leaf**

The L. nobilis essential oil showed good antibacterial activity with minimal inhibitory concentrations of 0.35 and 0.56 mg/mL, respectively. The major constituent of bay leaf, 1,8 cineol, might be responsible for its antibacterial activity (Derwich et al., 2009). Antifungal activity of L nobilis was examined on seven strains of plant pathogenic fungi in vitro at different concentrations such as 50, 125, and 250 ug/mL. The greatest antifungal activity was obtained against the fungus Botrytis cinerea at a concentration of 250 liter/mL

**Antioxidant Activity of bay leaf**

Ethanol extracts of L. nobilis showed powerful antioxidant activities. The antioxidant activity was determined by evaluating free radical scavenging, hydrogen peroxide scavenging, superoxide anion radical scavenging, reducing power, and metal chelating assays. Strong antioxidant activity of bay leaf was observed in linoleic acid emulsion at a concentration of 20, 40, and 60 gg/mL (94.2%, 97.7%, and 98.6% inhibition of lipid peroxidation, respectively). The antioxidant activity of ethanol extract may be due to phenolic compounds present in the extract (Elmastas•é et al., 2006).

**B.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 Whatman no. 42 filter paper, effectively separating the solvent from the coagulant solution.

# RESULT AND DISCUSSION

This chapter briefly presents the results of sampling and analysis of the samples. Discussions on 8 water quality parameters have been given. Analysis and discussion on physical and chemical parameters are also included. Tables and necessary graphs have been included to better understand and analyze results. Water samples were collected and analyzed for different physical and chemical parameters from samples.

**A. 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.

**B. pH**

Hydrogen ion concentration plays an important role in the biological process of almost all aquatic organisms. The factors like photosynthesis, respiratory activity, industrial waste disposal, etc. bring out changes in the pH. The value of pH could be due to accumulated organic matter and the decomposition of vegetation which on biological oxidation gives up CO₂ which ultimately reduces 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 |

**C. ELECTRICAL CONDUCTIVITY**

The Electrical conductivity of lake samples is found to be in the range of 0.499 1.429µS/cm. The concentration of water-soluble salts was reported more than any other constituents in the soil. The EC value also depends on dilution on soil suspension. The hazard caused due to solid waste is most often concentrated because the total salt and sodium content level can be studied.

**D. ALKALINITY**

Total alkalinity in the present study total alkalinity values ranged from a 91 mg/L to 195 mg/L. The BIS (1998) acceptable limit for total alkalinity is 600mg/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 | 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 |

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |

**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.

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