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Treatment Of Waste Water By Using Aloe Vera Gel, Cactus Gel And Neem Leaf Powder

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1. ABSTRACT

This study explores the use of natural, eco-friendly materials—aloe vera gel, cactus gel, and neem leaf powder—for the treatment of wastewater. These biodegradable substances possess properties such as coagulation, adsorption, and antimicrobial activity, making them effective in reducing turbidity, chemical pollutants, and microbial content. The combination of these natural agents offers a sustainable and lowcost alternative to conventional wastewater treatment methods, contributing to environmental conservation and public health improvement.

Keywords — Wastewater treatment, Bioremediation, Neem Leaf Powder.

2. INTRODUCTION

Treatment is an innovative approach to treating waste water by using natural resources. Aloe vera, Cactus and Neem are two powerful plants that have been proven to be effective in this process. This presentation will explore the benefits and methods of using these plants for waste water treatments.

Neem leaf powder is transformed into a resource of natural coagulant. Azadirachta indica, commonly known as neem, neem tree, or Indian lilac, the tree belongs to the mahogany family Meliaceae. It is one of two varieties in the species Azadirachta and is resident in the Indian subcontinent and few parts of Africa.

It is normally grown up in tropical and semi-tropical regions.

Aloe vera plant offers a sustainable solution for the removal of various pollutants from water. Due to its chemical composition, Aloe vera has been explored as coagulant/flocculant and biosorbent for water treatment. Most of the used materials displayed significant pollutants removals depending on the used preparation methods. Aloe vera is an interesting plant that should be considered in water treatment.

Observing the need for clean water and recycling of wastewater through effective treatment to help counter the continued water scarcity facing Kenya, the study sought to explore the possibility of using cactus in the coagulation-flocculation process. The study employed an analytic literature review model, sourcing recent

and authoritative studies to investigate the effectiveness of cactus plants as coagulants, and the involved pH implications. The findings indicate that plant-based coagulants such as cactus are being considered as alternatives to conventional synthetic chemical coagulants in aspects such as costs, health effects, nonbiodegradability, altered pH in post-treatment water and corrosion and transmission problems. In addition, cactus appears to have no significant effects on the pH of treated water. However, the findings demonstrate a lack of consensus regarding the optimal pH at which cactus is best effective in coagulation.

2.2 Importance

- Wastewater treatment – Central to the study; it highlights the objective of purifying contaminated water to make it reusable or safely disposable.
- Aloe vera gel – A natural coagulant with mucilaginous properties, helping in the removal of suspended particles and reducing turbidity.
- Cactus gel – Contains natural polysaccharides and functional groups that aid in coagulation and adsorption of impurities.
- Neem leaf powder – Known for its strong antimicrobial and antifungal properties, contributing to the disinfection of wastewater.

2.3 Objective

1. To investigate the effectiveness of aloe vera, cactus and neem in purifying wastewater.
2. To study the specific properties of aloe vera, cactus and neem that can target contaminants in wastewater.
3. To compare the properties of raw waste water and treated waste water.

2.4 Methodology

In the present work, following jobs will be done to complete the project work.

1. Collection of aloe vera, cactus and neem leaf
2. Washing and cleaning aloe vera, cactus and neem leaf
3. Extraction of Gels and Neem Powder
4. Mixing and Preparation of aloe vera, cactus and neem leaf in the water sample
5. Application of mixing and preparation aloe vera, cactus and neem leaf to the water 6. Filtration of water
7. Quality Assessment of wastewater
8. Reuse or Disposal of wastewater.

3. ANALYSIS

This study investigates the effectiveness of aloe vera gel, cactus gel, and neem leaf powder as natural agents for treating wastewater. These plant-based materials exhibit coagulating, adsorptive, and antimicrobial properties, which help reduce turbidity, chemical contaminants, and microbial load. The approach offers a sustainable, eco-friendly, and cost-effective alternative to conventional wastewater treatment methods.

Analysis of the Abstract:

Clarity and Focus:

The abstract is concise and clearly states the objective—wastewater treatment using natural materials. It identifies the specific agents (aloe vera, cactus, neem) and highlights their respective functional roles (coagulation, adsorption, antimicrobial action).

Scientific Relevance:

The study aligns with the global need for sustainable water purification solutions.

Using natural materials addresses environmental concerns about chemical usage in conventional treatment methods.

Innovation:

Combining these three specific natural substances is relatively novel.

Demonstrates a multifunctional approach by integrating different mechanisms (physical and biological) of purification.

Strengths:

Emphasis on eco-friendliness, cost-effectiveness, and biodegradability.

Uses locally available and renewable resources, which is important for developing countries.

Limitations (Implied):

The abstract doesn’t mention quantitative results (e.g., % reduction in pollutants).

No mention of scalability or potential challenges in real-world application.

Applications:

Useful for rural wastewater treatment, decentralized systems, and resource-limited settings.

Potential for integration into green engineering and natural resource management strategies.

Let me know if you'd like help expanding this into a full paper or project report.

Neem leaf

Neem leaf powder

Aloe Vera Leaves

Aloe Vera Gel

Cactus Leaves

Hardness test on a neem leaf powder and aloe vera gel added in a waste

Turbidity test on a combination neem leaf powder, aloe vera gel

Hardness test on a raw waste water sample

Chloride test on raw waste water sample

pH test on aloe vera gel and neem leaf powder

Chloride test on raw waste water sample

4. RESULT

For the present study, the raw waste water sample was collected from VPS's boys' hostel & canteen in VPS's Lonavala college campus in the month of January 2025.

The hardness value of raw waste water sample 1 was found to be 150 mg/lit and sample 2 was found to be 225mg/lit. After adding combination of aloe vera gel and neem leaf powder in raw waste water sample to 20gm, 30gm and 40gm, hardness value decreases of sample 1 to 130.33 mg/lit, 98.12 mg/lit and 107 mg/lit and sample 2 to 209 mg/lit, 182.69 mg/lit and 144.75mg/lit respectively. After adding combination of neem leaf powder , aloe vera gel and cactus gel in raw waste water sample 1 to 20gm, 30 gm and 40gm, the hardness value decreases and increases to 121.01 mg/lit, 145.89 mg/lit and 152.23 mg/lit and sample 2 to 223.12 mg/lit, 240 mg/lit and 235.45mg/lit respectively.

Turbidity of raw waste water sample 1 was found to be 39.3 NTU and sample 53.2 NTU. After adding combination of aloe vera gel and neem leaf powder in raw waste water sample 1 to 20 gm, 30 gm and 40gm, turbidity value reduces to 38.8 NTU, 36 NTU and
36.70 NTU respectively. After adding combination of neem leaf powder, aloe vera gel and cactus gel in raw waste water sample 1 to 20 gm, 30 gm and 40 gm, turbidity value reduces with 52 NTU, 50.6 NTU and 1149.9 NTU respectively. After adding combination of neem leaf powder , aloe vera gel and cactus gel in raw waste water sample 1 to 20gm, 30 gm and 40gm, the turbidity value decreases to 39 mg/lit, 34.66 mg/lit and 42.3 mg/lit and sample 2 to 52.1 mg/lit, 54.01mg/lit and 53.03mg/lit respectively.

pH value of raw waste water of sample 1 was found to be 6 and sample 2 is 6. After adding combination of aloe vera gel and neem leaf powder in raw waste water sample to 20gm, 30gm and 40 gm, pH value of sample 1 is 6, 7 and 7 respectively and sample 2 is 6, 6 and 6. After adding combination of neem leaf powder, aloevera gel and cactus in raw waste water sample 20gm, 30gm and 40gm pH value of sample 1 was found to be 6, 6 and 7 and pH value of sample 2 was found to be 6, 6 and 7 respectively.

Choride of raw waste water sample 1 was found to be 53 mg/lit sample 2 was found to be 74.45 mg/lit. After adding combination of aloe vera gel, neem leaf powder and cactus gel in raw waste water sample to 20 gm, 30 gm and 40 gm, choride value increase and decrease to sample 1 is 53.4 mg/lit, 56.12 mg/lit and 60 mg/lit and increase and decrease to sample 2 is 80mg/lit, 78.6 mg/lit and 83.62 mg/lit respectively. After adding combination of neem leaf powder, aloevera gel and cactus gel in raw waste water sample with 20 gm, 30 gm and 40 gm, chloride value of sample 1 is 40.59 mg/lit, 51.36 mg/lit and 60mg/lit and sample 2 is 70.9 mg/lit, 69.7 mg/lit and
78.06 mg/lit respectively.

5. CONCLUSION

The present study successfully demonstrates the potential of natural materials—aloe vera gel, neem leaf powder, and cactus gel—as effective agents for wastewater purification. Through a series of experimental procedures, it was observed that the combination of aloe vera and neem significantly reduced the hardness, turbidity, and improved the pH level of contaminated water samples. The addition of cactus gel, when combined with aloe vera and neem, further enhanced the purification performance in certain cases, though variability was observed depending on the dosage.

Among the various proportions tested, the 30 gm/l concentration generally yielded the most balanced and effective results across parameters such as hardness, turbidity, and pH. These findings affirm the hypothesis that plant- based coagulants can serve as sustainable, eco- friendly, and costeffective alternatives to conventional chemical treatment methods.

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