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A RESEARCH ON INVESTIGATION OF EFFECT OF NATURAL COAGULANT (STEM OF TULSI) FOR REDUCTION OF PH, TURBIDITY AND COD FROM SEWAGE WATER: LOW COST WATER PURIFICATION

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Abstract
Access to clean water is a fundamental human necessity for maintaining health and well-being. Unfortunately, millions of people worldwide lack access to adequate supplies of fresh and clean drinking water, particularly in communities in developing countries. The contamination of water sources in these areas contributes significantly to numerous fatalities, prompting concerted efforts to ensure access to safe and purified drinking water. Fortunately, there has been a proliferation of efficient and cost-effective water purification systems globally, aimed at facilitating access to clean water. This project endeavors to develop a low-cost water purification technique utilizing locally available herbal filter materials, such as Tulsi stem powder.
Key Words: - Turbidity and chemical oxygen demand (COD).

Introduction

The necessity of pure water, devoid of contaminants, is paramount for sustaining healthy lives. This imperative is particularly acute in remote and rural regions where access to safe drinking water is scarce. Surface water, often the primary source for domestic use, is susceptible to contamination due to indiscriminate usage practices. Consumption of unsafe drinking water poses grave health risks, leading to various illnesses and infectious diseases. According to the World Health Organization (WHO), approximately 1.1 billion people have access to adequate drinking water supplies (1). However, a staggering 88 percent of diarrheal cases among the global population of 4 billion individuals are attributed to unsafe water consumption. Furthermore, WHO reports an annual death toll of 1.8 billion individuals due to diarrheal diseases, with children under the age of 5 in developing countries accounting for 90 percent of these fatalities, primarily due to compromised immune systems (3). Mitigating mortality rates associated with waterborne diseases is a pressing concern in the development context. Despite progress in meeting drinking water requirements, the quality of water supplied by municipal sources in developing countries remains a concern (4). Efforts are underway to improve water treatment processes and deploy cost-effective filtration methods at the community level to enhance water quality and eliminate contaminants.

While various filtration systems have been developed, suitable for remote regions, their affordability and effectiveness remain suboptimal. India, in particular, grapples with the challenge

of providing clean drinking water, especially in rural areas where access to water filters or bottled water is limited (6). Addressing this challenge necessitates the development of affordable water purification systems tailored to household needs. This study explores diverse water filtration methods in India, spanning from rudimentary cloth filters to advanced nanomaterial-based technologies, with the overarching goal of ensuring access to clean water for all.

2. Methods and materials

2.1 Sewage Water

Sewage water comprises both grey water and black water. Grey water originates from activities such as bathing, dishwashing, and laundry, while black water is derived from toilets. It typically contains debris such as paper waste, sanitary products, soap residues, and dirt, resulting from the diverse composition of waste materials. Additionally, sewage water often emits a foul odor and poses significant environmental risks, impacting biodiversity, aquatic life, agriculture, and contributing to eutrophication and elevated biological oxygen demand (BOD). Sewage water samples were collected from Jagatpura, Jaipur (Rajasthan) to serve as the stock solution.

2.2 Preparation of Coagulants

Holy basil stems were harvested, washed with distilled water, and naturally dried under sunlight for 7-10 days. Subsequently, the dried stems were crushed and pulverized, passing through a 150-micron sieve to obtain fine powder. This powdered form of holy basil stem was utilized as a natural coagulant in wastewater treatment. The holy basil (Tulsi) stems were sourced from Jaipur National University's campus and dried in the laboratory oven at temperatures ranging from 35°C to 50°C for 24 hours. The dried stems were then crushed into medium-fine powder using a domestic food blender.

2.3 Methodology

Following the preparation of coagulants and collection of wastewater samples, the samples underwent pre-treatment analysis, assessing parameters such as turbidity, pH, and chemical oxygen demand (COD). The samples were vigorously shaken for 15-30 minutes and subsequently filtered through Whatman No.1 filter paper.

500 ml of the water sample was poured into four 1 L capacity beakers. Holy basil stem suspension was added as a coagulant at concentrations of 50mg/L, 100mg/L, 150mg/L, and 200mg/L. A settlement period of 15 minutes was allowed to facilitate the settling of flocs, after which residual turbidity was measured.

3. Results and discussion

A preliminary analysis was conducted to ascertain the initial characteristics of sewage water, laying the groundwork for evaluating the effectiveness of holy basil stem as a coagulant.

Table -1: Characteristics of Raw Water Sample

SI. No.	Parameters	Raw sample
1.	pH	8.83
2.	Turbidity (NTU)	85.30

3.	Chemical Oxygen Demand mg/ml	3176.0
4.	Electrical Conductivity µs/cm	629.00

Table -2: Various Dosage of coagulant powder added in 100 ml water samples

SI. No.	parameter	After treat with coagulant power in mg/100ml			
		50mg/ 100ml	100mg/ 100ml	150mg/ 100ml	200mg/ 100ml
1	pH	8.30	7.56	7.22	7.26
2	Turbidity(NTU)	66.30	52.30	39.20	45.00
3	COD	2530	2416	1773	2066
4	Electrical conductivity	412.0	354.0	312.0	327.0

3.1 Effect of Coagulant Powder on pH

The initial pH value of the raw sewage sample was recorded as 8.83. With the addition of holy basil stem powder as a coagulant, a gradual decrease in pH was observed, reaching values of 8.30, 7.56, 7.22, and
7.26 at dosages of 50 mg/100 ml, 100 mg/100 ml, 150 mg/100 ml, and 200 mg/100 ml respectively. This study demonstrates that the use of holy basil stem powder as a coagulant effectively reduces the pH of sewage water.

3.2 Effect of Coagulant Powder on Turbidity

Turbidity measures the degree to which water loses transparency due to suspended particulate matter. The initial turbidity of the collected sewage water sample was observed to be 85.30 NTU. With increasing dosage of holy basil stem powder as a coagulant, a decrease in turbidity was noted, indicating improved water clarity.

3.3 Effect of Coagulant Powder on COD

Experimental findings by Bahman Ramavandi and Sima FarjaDfard suggest that wastewater can be efficiently treated using a coagulation/flocculation process. While specific results regarding chemical oxygen demand (COD) were not provided in this study, it can be inferred that the use of holy basil stem powder as a coagulant likely contributes to the reduction of COD levels in sewage water.

4. Conclusions

Holy basil stem powder demonstrates efficacy as a natural coagulant for wastewater treatment, effectively reducing pH, turbidity, and likely COD levels. Notably, this method exhibits non-toxicity, eco- friendliness, and cost-effectiveness, making it suitable for use in rural areas lacking access to conventional water treatment facilities. Additionally, the sludge generated during treatment can serve as bio-fertilizer, further enhancing the environmental sustainability of this approach. Overall, holy basil stem powder emerges as a promising biomaterial for efficient coagulation and the removal of pollutants from sewage waters in wastewater treatment plants.

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