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Wastewater Treatment Using Natural Coagulant

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Abstract: *Waste water treatment is essential for environmental sustainability and public health. Traditional chemicals coagulants like alum and ferric chloride are effective but can be costly and May have adverse environmental impacts. This study explores The Natural use of coagulants such as moringa oleifera, cactus, mucilage, chitosan and tannin - based extracta as Eco-friendly Alternatives for wastewater treatment, these natural coagulant help in turbidity removal. Sedimentation and pollutants reduction while begin biodegradable and non -toxic the results indicate that natural coagulant can effectively improve water Quality, reduce slduge production, and minimize chemical dependency. This approach promotes sustainable. Cost effective And green wastewater treatment solutions. Making it ideal for rural and Urban water purification systems.*

Keywords: Water purification, Moringa seeds, Antimicrobial activity, Eco-friendly treatment, River water

I. INTRODUCTION

Presently there are no appropriate low cost technologies available for removal of several commonly present ground Water contaminants. Flouride is one such copound that is widely present in groundwater worldwide. Exposure to flour Idea in drinking water has a number of adverse effects on human health including crippling skeletal fluorosis that is a Significants cause of morbidity in a numbers of regions of the world . Ground water is polluted due to industrial effulgent And municipal waste in water bodies . In rural undeveloped Countries people living in extreme poverty are presently are Drinking highly turbid and microbiologically contaminated

Water, Because they lack knowledge of proper drinking Water treatment and they cannot afford costly chemical Coagulants .To overcome chemical coagulants problems it is necessary To increase the use of natural coagulant for drinking water treatment.

Naturally occurring coagulants are usually presumed safe for human health. Some studies on natural coagulants have been carried out and various natural coagulants were produce Or extracted from microorganism, animals or plants. One of these alternatives is Moringa oleifera seeds it is native Tree of the sum- Himalayan part's of northwest. India Pakistan And Afghanistan . Moringa oliefera is a perfect example of a So called " multipurpose of tree". Earlier study have you found Moringa to be non toxic and recommended it is use as a coagulants in developing countries the use of moringa as an added advantage over the chemical treatment of water because it is biological and has been reported aa esible. According to suleymn editing hardness removal efficiency

Of morningas olefera was found to increase with increasing Dosage M. Olefera seeds Acts as a natural absorbents and Antimicrobial agent. It's seed contain 1% active polyelectrolyte That neutralize the negative charged colloid in the dirty water.

This protein can therefore be a nontoxic natural polypeptide for sedimentation of mineral particles and organics in the purification of drinking water M. Olefera seeds are also acting as antimicrobial agent against variety range of bacteria and fungi 2 . The seed contain number of benzyl isothicoyanate and benzyl glucosinolate which act as antibiotic 3. It is believed that the seed as an organic natural polymer. The active ingredients are diametric proteins the protein powder is stable at totally soluble in water . The coagulation mechanism of the M. Oliefera coagulant protein has been explained in different ways . It has been described as adsorption and charge neutrilazation and interparticle bridging is mainly characteristics of high molecular weight polyelectrolytes. Morninga oleifera. Commonly knows as drumsticks tree of micracel tree a tree negative a tropical regions, has been Increasingly studied for it's potential in waste water treatment,

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particularly through its natural coagulant properties . The seeds of morning oliefera contain proteins That can act as natural coagulant to remove contaminants From water . Here's a detailed look into how it works .

Research and studies on morning oliefera in wastewater treatment:

Serveral studies have explored the use of morning oliefera In treating Wastewater. Research shows that it can reduce up to 90-95% of turbidity and significantly lower the chemical oxygen demand (COD) and microbiological content in traded water.

Morning oleifera is effective in removing heavy metals, bacteria And other pollutants from water . Making it a versatile solutions For both surface water and sewage treatment.

Effectiveness in various wastewater:

It has been tested in various types of wastewater, including domestic, industrial and agriculture run off the effectiveness depends on factors such a concentration of morning seed powder, water quality.

limitations of morning oleifera coagulation:

Optimization of required: The amount of Moringa powder required can verypending on the turbidity and type of waste water. Over use can lead to residual organic matter . In the water, which may need fruther treatment. Not effective for all pollutants while: morning oleifera is excellent for removing suspended solids and trubidity it may not be as effective for certain dissolved contaminants such As pesticides or complex chemicals.

II. COMPONENTS & METHODOLOGY

Components: Water purification ,Moringa seeds , Antimicrobial Activity , Eco-friendly treatment , River water.

Methodology:

Moringa oleifera seeds the active coagulant agent is extracted from the seeds raw water collected from domestic, industrial,and agriculture sources for treatment distilled water used for seed extraction and preparation of coagulant solution glassware and laboratory equipment Beakers, measuring, cylinders, pH meter, , turbidity meter, jar test, apparatus,etc filtered media sand activated carbon or cloth for post- treatment filtration chemical reagents used for comparative analysis eg. Alum ,ferric , chloride.

Main process involved in *M. oleifera* seeds processing *Moringa oliefera* life cycle and extraction of oil from seed

Preparation of moringa oleifera coagulant seed collection and drying mature moringa oleifera seeds are collected dried, and dehulled to remove the outer shell seed powdering the kernels are ground into a fine powder using a blender or mortar and pestle coagulant solutions preparation The seed powder is mixed with distilled water usually (2-5 g/l) and stirred for 30 minutes to extract active proteins the mixture is then filtered to remove solid residues coagulation flocculation process jar test experiment the extracted moringa solluction is added to raw wastewater samples in series of beakers rapid mixing the samples are stirred at high speed 100-150rp For 2-5 minutes to insure proper dispersion of the Coagulant slow mixing the speed is reduced(30-50rpm) for 10-20 minutes allow floc formation setting period the mixture is left undisturbed for 30-60 minutes to allow suspended particles to settle at the bottom filtration and pH adjustment the supernantant is carefully decanted and passed through a sand filter or activated carbon filter to remove residual particles the pH of the treated water is checked and adjusted if necessary using time or acid .

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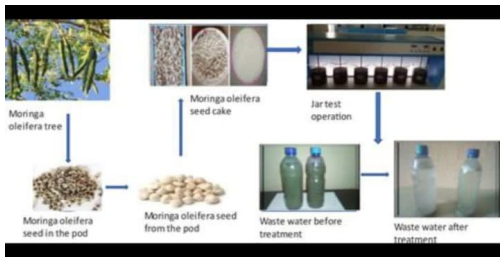
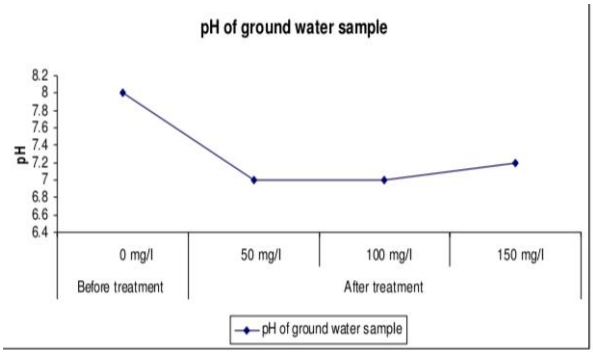


Table no.4 pH of ground water before and treatment of.M oleifera seed powder.



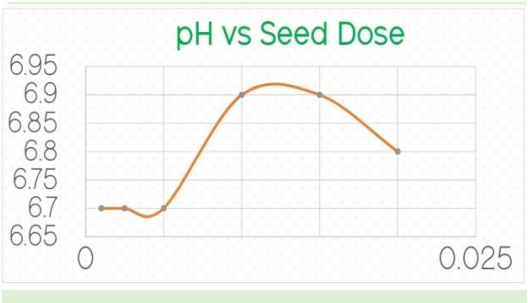
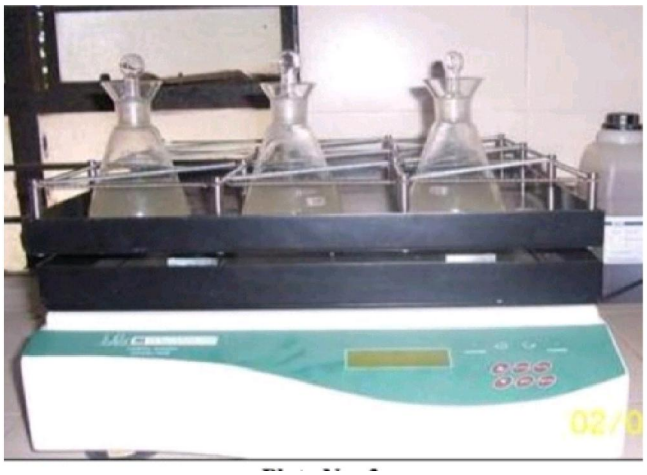


Table no.5 Raw water sample treated with. M. Oliefera seed powder and keept on the shaker for 30 min at 110-120 rmp.



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Collection and characterization of raw water sample

The first step in the experiment is collecting a raw water samples from a waste water source this water is a excepted to have high levels of suspended solids, organic matter,andmicrobial contaminants . Before treatment, key parameters such as pH, turbidity(NTU) . Total dissolved solids (TDS) electrical conductivity (EC) , and microbial load are measured to establish a baseline for comparison. Moringa oliefera seeds contain cationic proteins that act as natura coagulant these proteins have a strong positive charge, which helps in Attracting negatively charged suspended particles.In wastewater this results in the formation of flocs That can be easily removed by sedimentation.

Table no.1 Results Table (turbidity reduction using moringa oleifera)

Coagulant Dose (mg/L)	Initial Turbidity (NTU)	Final Turbidity (NTU)	Turbidity Removal (%)	pH Change
0 (Control)	150	145	3.3%	7.2 → 7.1
50 mg/L	150	60	60%	7.2 → 7.0
100 mg/L	150	35	76.6%	7.2 → 6.8
150 mg/L	150	20	86.6 %	7.2 → 6.7
200 mg/L	150	15	90%	7.2 → 6.5

Table no. 2 Effect of moringa oleifera on trubidity removal.

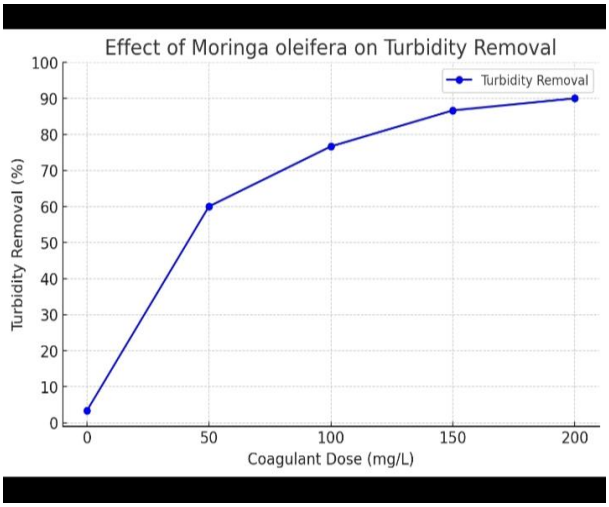

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Table no.3 sample calculation for turbidity removal (%)

Formula:

$$\text{Turbidity Removal \%} = \left(\frac{\text{Initial Turbidity} - \text{Final Turbidity}}{\text{Initial Turbidity}}\right) \times 100$$

For 100 mg/L dose:

$$\left(\frac{150-35}{150}\right) \times 100 = 76.6\%$$

Microbial load reduction:

The andmicrobial properties of moringa oliefera we're Evaluated by measuring total coliform bacteria before And after treatment using the most probable number (MPN) method.

Reduction in turbidity:

Turbidity is a critical parameter in wastewater treatment As it's indicated the presence of suspended particles the Effectiveness of moringa oliefera seed powder in turbidity Meter (NTU measurement) .

Microbial load reduction:

The antimicrobial properties of moringa oliefera we're Evaluated by measuring total coliform bacteria (CFU)M/L before and after treatment using the most probable Number (MPN) method after the conducting coagulation Process the Moringa oliefera seed powder various water Quality parameters where analyzed before and after Treatment the results were statistically evaluated to Determine the effectiveness of the natural coagulant the Reverse of the observed with the Moringa treatment The pH increase with increasing concertations of the Moringa of the Coagulant.

III. CONCLUSION

The use of natural coagulants in waste water treatment Is an Eco-friendly and cost effective alternative to Conventional chemical coagulants natural coagulant Derived from plants based or organic sources have a Demonstrated effeciant turbidity removal reduction in Suspended solids and improvement in overall water Quality.Experimental results indicate that natural coagulants such as Moringa oleifera, plant extracts, and bio-polymers can significantly improve wastewater quality, especially in rural and developing areas where access to chemical coagulants is limited. Although further research is required to optimize dosage, enhance efficiency, and assess large-scale implementation, the findings suggest that natural coagulants can be a promising alternative for sustainable wastewater treatment.

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