INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume 5, Issue 2)
Available online at: www.ijariit.com

Moringa oleifera as a natural coagulant

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ABSTRACT

The powder obtained from the seeds of the M.olifera shown to be an effective primary coagulant for water treatment. In this paper, preliminary investigations M.olifera seed suspension for the softening of hard water is furnished. To analyse the influence of Moringaoleifera seeds in coagulant activity when used for natural raw water treatment. Water samples were collected from pond, tap and lake of Kammanahalli, Hennur Bande and Bagalur rural areas of Bangalore and are labelled as sample 1, sample 2 and sample 3 respectively. In each of the water sample, 25mg of dried M.olifera seed extract was added and allowed to settle for 1 hour 15 minutes. The parameters such as colour, turbidity, odour and pH were analyzed before and after the inoculation of M.olifera seeds of all the three water samples. The water was analysed for the parameters such as colour, odour, turbidity and pH. When the seeds are dried, crushed and added to water, the powder acts as a coagulant. Removal of efficiency was found to increase with increasing dosage of M.oleifera. The higher dosage was required to achieve equivalent residual hardness. Based on the results it is ascertained that seeds stored in dry containers at room temperature can be used as a coagulant for few years. Creation of awareness amongst the rural farmers on the usefulness of the M.olifera enables its cultivation which will have overall economic benefits to the entire country.

Keywords— *Moringa oleifera, Coagulant, Colour, Odour, Turbidity, pH*

1. INTRODUCTION

Moringaoleifera belongs to the family *Moringaceae* which is a single genus family of shrubs and trees cultivated across the whole of the tropical belt and used for a variety of purposes (Jahn 1986). Despite the importance of water as a vital resource for human existence, its supply in many developing countries is highly inadequate. Water is indeed necessary for living organisms as there is no life without water (Akoteyon et al., 2011; Nwankwoala and Nwagbogwn, 2012; Subramani et al., 2012). Provision of potable water has been a recurrent problem which requires urgent attention in many of the developing countries (Shitt et al., 2004). Most of the people living in rural and undeveloped regions do not have proper water to drink. Water available for people living in these regions is contaminated with multiple contaminants which makes them unfit for human use. In rural and undeveloped countries people living in extreme poverty are presently drinking highly turbid and microbiologically contaminated water. Because they lack knowledge of proper drinking water treatment and they cannot afford costly chemical coagulants.

Many tests have been conducted on various plants, microorganisms etc., to use them as a natural coagulant. One of the alternatives which are used as a natural coagulant is *Moringaoleifera* seed extract. *Moringa* seeds possess antimicrobial properties reported that a recombinant protein in the seed is able to flocculate gram-positive and gram-negative bacterial cells. In this study, the water was analysed for the parameters such as colour, odour, turbidity and pH. Very little research has been undertaken on the parameters affecting the effectiveness of *M.oleifera* for purification of drinking water and also there is a great need for further testing in this area. Conclusive data needs to be compiled to demonstrate the effects of various water parameters have on the efficiency of the seeds. Creation of awareness amongst the rural farmers on the usefulness of the *M.oleifera* enables its cultivation which will have an overall economic benefit to the country.

2. MATERIALS AND METHODS

2.1 Selection of sampling points

Three different water samples, pond water, tap water and lake water were collected from three different places such as Kammanahalli, Hennur Bande and Bagalur rural areas of Bangalore and are labelled as sample 1, sample 2 and sample 3 respectively. The samples were analyzed to study colour, odour, Turbidity and pH using *Moringaoleifera* seed extract.

Fig. 1: Pond water of Kammanahalli

2.2 Preparation of *Moringaoleifera* Seed Powder

Seeds of *Moringa oleifera* were collected and washed with distilled water to remove impurities and dried at 65°C for 24 hrs. The shell of the seeds was removed and kernel was ground to fine powder using a blender. The fine powder was then put into cheesecloth sack till further use.

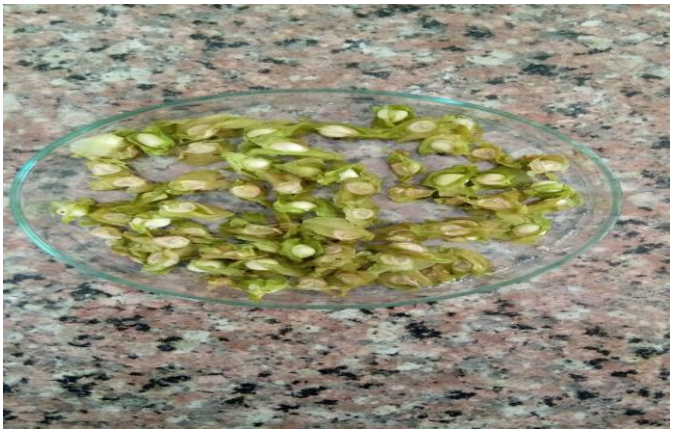

Fig 2: Seeds of *Moringaoleifera* were kept for drying purpose

Fig 3: Kernel of *Moringaoleifera*

2.3 Preparation of *Moringaoleifera* Seed Aqueous Extract

For the preparation of aqueous extracts, fine moringa seed powder of 25gms was added to 100 mL in each sample. The suspension was given vigorous shaking for 30 min using a magnetic stirrer to promote water extraction of the coagulant proteins and filtered using Whatman No.1. Before use, the filtrate was shaken again. Then samples were allowed to settle for 1hr 15 minutes.

Samples were analysed for water parameters such as colour, odour, turbidity and pH before and after inoculation of *Moringaoleifera* seed aqueous extract.

3. RESULTS

3.1 Physical Parameters

3.1.1 Colour: The color of water varies with the ambient conditions in which that water is present. While relatively small quantities of water appear to be colorless, pure water has a slight blue color that becomes a deeper blue as the thickness of the observed sample increases. The blue color of the water is an intrinsic property and is caused by selective absorption and scattering of white light. Dissolved elements or suspended impurities may give water a different color. Before treatment with *M.oleifera* sample, 1 was light grey in colour, sample 2 was found to be colourless and sample 3 was observed as brown in colour. Whereas after treating with *M.oleifera* all the samples were observed as colourless.

Fig. 4: Colour of Sample 1, 2, and 3 before inoculation of *M.oleifera* seed extract.

Fig. 5: Settling process of Sample 1, 2, and 3 after the inoculation of *M.oleifera* seed extract.

Fig. 6: Colour of Sample 1, 2, and 3 after the treatment with M.oleifera seed extract.

3.1.2 Odour: The nature of odour in water is odourless. Musty smells can arise from water that has been warmed in pipes. Flexible hoses used to fill drinking water tanks, vending machines, washing machines and dishwashers can give rise to a variety of tastes and odours such as rubbery, plastic, metallic, dry, musty, TCP or reminiscent of swimming pools. The odour of Moringaoleifera in the test samples was found to be a fishy odour in sample 1, odourless in sample 2 and pungent smell in sample 3 before treatment whereas after treatment in sample 1 fishy odour reduced abruptly, sample 2 was an odourless and pungent smell in sample 3 was highly reduced.

Table 1: Parameters studied before and after the treatment of water Samples with M.oleifera seed powder.

S. no	Parameters	Before the treatment of *Moringaoleifera* seed extract			After the treatment of *Moringaoleifera* seed extract		
		Sample 1	Sample 2	Sample 3	Sample 1	Sample 2	Sample 3
1.	pH	6.97	7.41	8.48	7	7.2	7
2.	Turbidity (NTU)	8.7	1.4	6.6	1.2	1.1	1.3
3.	Colour	Light Grey	Colourless	Brown	Colourless	Colourless	Colourless
4.	Odour	Fishy odour	Odourless	Pungent odour	Fishy odour reduced	Odourless	Pungent odour reduced

3.1.3 Turbidity: Suspension of particles in water interfering with the passage of light is called turbidity. Turbidity is caused by wide variety of suspended matter, which range in size from colloidal to coarse dispersion depending upon the degree of turbulence and also ranges from pure inorganic substances to those that are highly organic in nature. Turbid waters are undesirable from an aesthetic point of view in drinking water supplies. Turbidity measurement using a turbidity tube method is based on the visual interpretation of the turbidity of water. The visual appearance of the black cross mark at the bottom of the tube, through the open end, is used for turbidity measurement. Before the treatment with Moringaoleifera, the turbidity of sample 1 was 8.7 NTU but after treatment, it got reduced to 1.2NTU. Sample 2 was observed as 1.4NTU before treatment whereas it was reduced to 1.1 NTU after the treatment with M.oleifera. Sample 3 consists of turbidity 6.6 NTU but after treatment got reduced to 1.3 NTU.

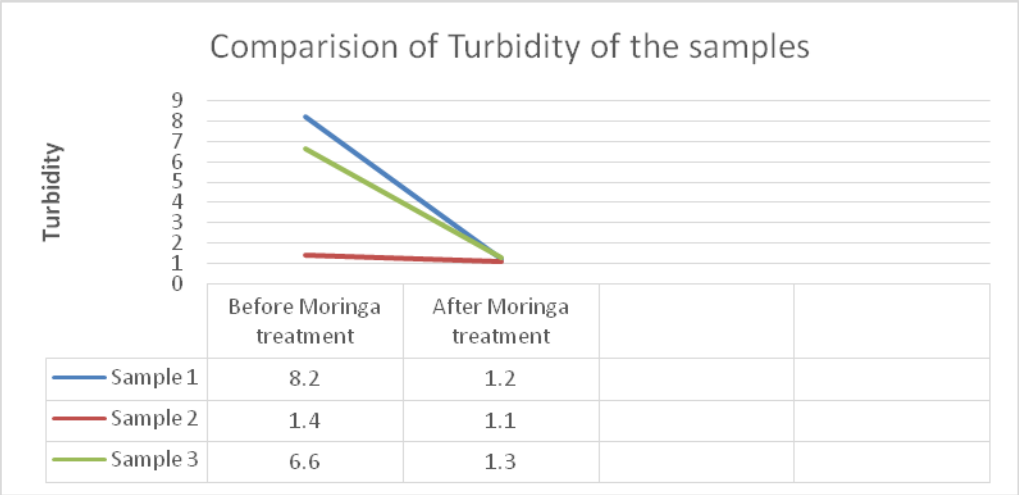

Fig. 7: Turbidity of water Samples before and after treatment of M. oleifera seed powder

3.2 Chemical Parameter

3.2.1 pH: The basic principle of electrometric pH measurement is of the activity of hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode. Glass electrode is also used instead of hydrogen electrode. The electromotive force (emf) produced in the glass electrode system varies linearly with pH. An instrument for the measurement of pH (Model: Combo) manufactured by Hanna Instruments (P) Ltd. The pH meter was calibrated with buffer solutions and the instrument was immersed in a well-mixed sample and readings were noted down (Ramteke and Moghe, 1988). The revealed that before the treatment the ph of sample 1 was found to be 6.97 whereas after treatment it was 7, the pH of sample 2 was measured as 7.41 and after treatment it got reduced to 7.2 and also in sample 3 pH was observed as 8.48 in sample 1 and reduced to 7 after treatment with *M.oleifera*.

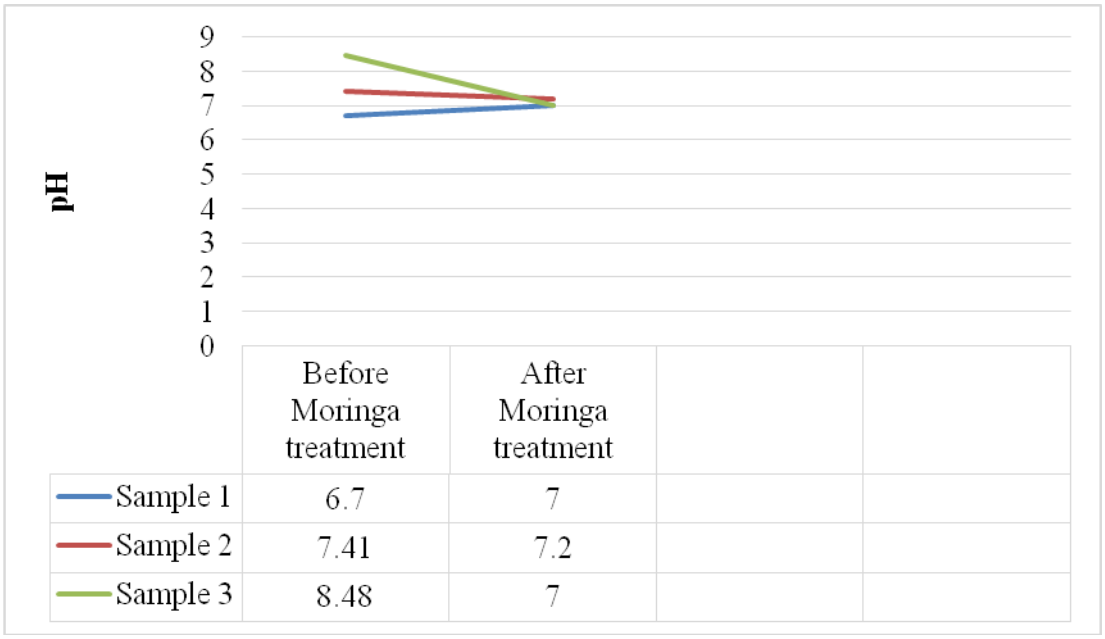

Fig. 8: pH of water samples before and after the treatment with *M.oleifera*

4. DISCUSSION

- Increased pollution level in water contributes to health hazards and leads to deterioration of the ecosystem. Hence, a qualitative and quantitative assessment of these pollutants in the water bodies must be seriously looked into. Use of M.oleifera can be inexpensive and alternative coagulant of water treatment.
- The water samples are generally coloured due to the presence of colloidal substances, inorganic impurity, aquatic growth, decomposition of vegetation and mixing of effluence.
- The water was grey in colour in sample 1 (pond), Brown in sample 2 (Lake) and colourless in sample 3 (tap) before treating with M.oleifera. After the treatment, all the water samples were found to be colourless.
- The odour of the sample 1 and 2 was pungent and fishy odour before treatment and after treatment got reduced abruptly.
- Turbidity is a measure of cloudiness in the water. The higher the turbidity, the cloudier the water appears. The water was found to be more turbid before treatment. This can be caused by soil erosion, waste discharge, urban runoff and algal bloom etc., the maximum turbidity was found in sample 1, the next high level of turbidity was found in sample 3 and least was measured in sample 1 before treatment whereas after the treatment the turbidity of all the samples was found to be reduced to normal level ranging between 1.1 to 1.3 NTU.

- pH of water is an important parameter that determines the suitability of water for various purposes. Higher values of pH fasten the scale formation in water heating apparatus and reduce the germicidal potential of chlorine (Arvind Kumar, 2002). The pH of sample 1 was acidic and sample 2 found to be alkaline before the treatment whereas after treatment pH lies in the neutral condition in all the water samples. *Moringaoleifera* seeds contain water-soluble proteins which aid in coagulation and keeps adsorption power between pH of 5-8 (Vieira et al 2010). The slight decrease in alkalinity and pH of all water samples may be due to precipitation of insoluble products of the reaction between the *Moringaoleifera* and the hardness-causing ions similar to precipitation softening using lime/soda ash. The *Moringaoleifera* seed extract appears to have the natural buffering capacity. The precipitates were light and did not settle easily.

5. CONCLUSION

With reference to the economic situation around the world, the treatment of water by using *M.oleifera* is highly recommended. The study concludes that *M.oleifera* is more effective and it reduces pH and turbidity, odour and colour. The greater the turbidity, the efficiency of coagulating extracts also increases regardless of time. However, a still adequate study on various other parameters of water needs to be tested with *M.oleifera* to conclude the definite procedure and dosage for the use of the plant as a natural coagulant for water treatment.

6. REFERENCES

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