EFFICIENCY OF MORINGA OLEIFERA SEED AS COAGULANT FOR WATER PURIFICATION

Nagaraj Parisara[1], B.R.Kiran[2], R.Purushothama[3]
[1,3]Department of Environmental Science,
Sahyadri Science College (Autonomous) , Shivamogga, Karnataka.
[2]Research & Teaching Assistant in Environmental Science, DDE,
Kuvempu University, Shankaraghatta, Karnataka, India.

Abstract

***Moringa oleifera* is a multipurpose tree and the seeds contain water soluble, positively charged proteins that act as an effective coagulant for wastewater treatment .The Environmental Science Department of Sahyadri Science college, Shivamogga, Karnataka have evaluated the potential of this plant derived material for a range of treatment applications in the laboratory and in the field using water soluble extracts of the crushed kernel. *M.oleifera* as a natural coagulant offers many advantages and effective for wastewater treatment processes. Many technological and economic issues remain to be resolved with regard to the extraction and purification of the active components within the seed kernel. The main results of this study are summarized. The prospects for the usage of *M.oleifera* seed coagulant are discussed in this paper.**

Key Words: *Moringa oleifera,* Coagulant, Water treatment, pH, Turbidity

INTRODUCTION

Water is used for several purposes by humans but level of purity of the water being consumed in very crucial since it has a direct effect on health. The conventional method of water purification using aluminium sulphate and calcium hypochlorite these puts pressure on the nation's over-burdened financial resources since they are important thereby making treated water very expensive in most developing countries and behind the reach of most rural folks. Hence, they resort to sources such as dams, streams, rivers, and lakes. Water from these sources is usually turbid and contaminated with microorganisms that cause many diseases including guinea worm and dysentery. According to Post note (2002), water borne diseases are one of the main problems in developing countries, about 1.6 million people are use contaminated water and more than a million people (of which two million are children) die from diarrhea each year (Francis Kweku Amagloh and Amos Benang, 2009).

A viable alternative is the use of crushed seed of *M.oleifera* as a natural coagulant. The seed pods are allowed to dry naturally on the tree prior to harvesting. The mature seeds are readily removed from the pods, easily shelled and then may be crushed and sieved using traditional techniques such as those employed for the production of maize flour The crushed seed powder, when mixed with water, yields water soluble proteins that possess a net positive charge (molecular weight 13 kDa and isoelectric pH 10-11). Dosing solutions are generally prepared as 1-3% solutions and are filtered prior to application to the untreated water (Sutherland et al, 1990 ; Geoff Folkard, and John Sutherland, 2001).

The use of Moringa has an added advantage over the chemical treatment of water because it is biological and has been reported as edible.. The cost of this natural coagulant would be less expensive compared to the conventional coagulant (alum) for water purification since it is available in most of the rural communities where treated water is a scarce resource (Francis Kweku Amagloh and Amos Benang,2009).

This research was carried out to confirm the effectiveness of powder extracted from mature-dried *Moringa oleifera* seeds which is commonly available in most rural communities in Shivamogga district of Karnataka. However, not much has been done in Shivamogga using Moringa as a coagulant in water purification system. The main objectives of the present study is to know the effectiveness of *Moringa* species seed as coagulant and to make out the cost effective of water treatment.

MATERIALS AND METHOD

Moringa Coagulant Preparation:

The seeds were harvested when they were fully matured. This is determined by observing if there are any cracked pods on the plant. The seeds which were plucked were cracked to obtain the seeds which were air-dried at 35^0c for two days. The shells surrounding the seeds kernels were removed using knife and the kernels were crushed using laboratory mortar and pestle into powder and then using blender to obtain a fine powder .This was a coagulant prepared from *Moringa* seed.

A Completely randomized design was used for this experiment. The treatment given were the varying concentrations of powder produced from *Moringa* seeds. Each treatment effect on the response (turbidity, pH, conductivity) was recorded and repeated 2 times each

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SAMPLE PREPARATION:

One litres of sample was taken from Tunga river and its pH and turbidity was measured and the recorded values were within the standard values which was given by World Health Organization (WHO) guidelines that is pH values has to be around 6.9-7.29, the turbidity is below 10 NTU. So, the water's pH and turbidity was increased for better observable results (synthetic water).

SYNTHETIC WATER PREPARATION: The synthetic water was prepared by adding 1

ml of 1N NaOH to 200ml of river water to prepare basic water which gave the pH value 10.04. The acidic water was made by adding 0.5 ml of concentrated HCl in 200 ml of river water

This was further dispensed into 5 beakers. The volume of sample was 50 ml. Five different concentrations of the stock solutions as loading dose were prepared by weighing 0.5, 1.0, 1.5, 2.0, 2.5 g of *Moringa* powder into a beaker containing 50 ml of distilled water. The mixtures in the beaker were stirred using a glass rod to obtain a clear solution. A 50 ml of distilled water is kept as control treatment.

WATER ANALYSIS:

A 5 ml of the various concentrations of loading dose were measured in a measuring cylinder and poured into a beaker containing 50 ml of synthetic water. The solutions were mixed rapidly for 15 min using glass rod to aid in coagulant formation. The suspensions were left to stand without disturbance for 2 hr. This is the method adopted since there is no standard method for conducting the jar test. The supernatants formed were decanted or filtered by filter paper and subjected to turbidity and pH tests.

pH measurement

The pH of the sample was known using a calibrated Digital pH meter . A volume of 50 ml of the supernatants obtained from the beakers containing treated water was taken in a beaker. The pH meter was standardized by using pH 7, 3, 9 buffer solutions and then calibrated for accurate value. The pH meter probe was first inserted in distilled water to remove any ion present around the probe. Then the probe was inserted in treated water making sure it did not touch the beaker. It was not disturbed for 30

seconds. The pH reading was then taken from the LCD display after it had stabilized.

Turbidity Measurement:

The turbidity test was carried out on supernatants obtained after *Moringa* treatment. Then by using a digital Nephelometric turbidity meter 132 the turbidity of the sample was measured. Firstly the distilled water was first taken in 25 ml sampler holder and inserted into the Turbidity meter. The calibration button was pressed and instrument was calibrated to 0 NTU. Each of the samples whose values have to be determined was taken into 25 ml sampler holder and inserted into Turbidity meter. The turbidity of the sample was displayed on the LCD panel of the instrument in Nephelometric Turbidity Unit (NTU). After each reading, the Turbidity meter was calibrated again with distilled water before being used on the next sample. The values of 5 samples were taken by following the above method.

RESULTS AND DISCUSSION

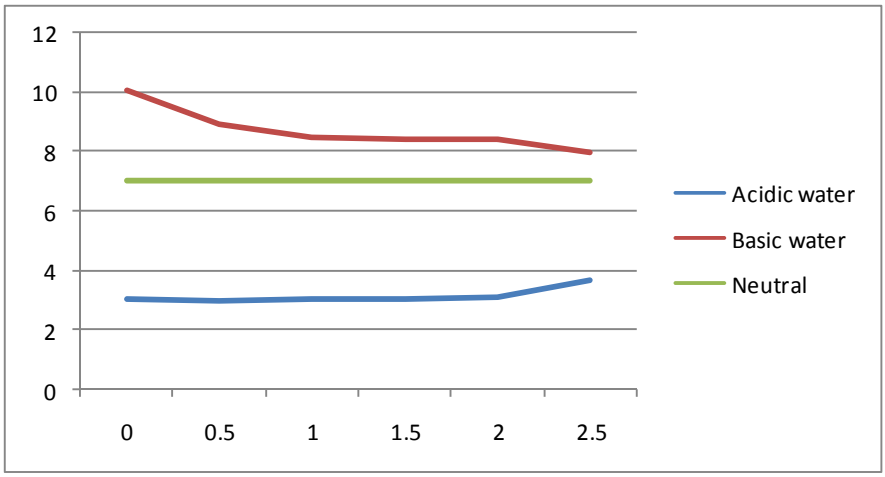
pH report:

The recommended acceptable range of pH for drinking water specified by WHO (2006) range is 6.0 to 8.0. The treated basic water's pH was reduced to pH 7.99 from pH 10.04. The difference was 2.08. The acidic water pH was slightly increased to basic from pH 3.04 to pH 3.70 the increases in pH was 0.66.

So, by using powder of *Moringa* seeds we can increase the acidic concentration of the water by increasing the dosing solutions. The basic concentration of the water can be increased by the same process, but the acid concentration increases more when compared to basic concentration. The more amount of the dosing solution has to be used in treating the water which has more acidic content in it.

The pH varies with increasing concentration of the *Moringa* coagulant. The *Moringa* a coagulant lies in the presence of water soluble cationic proteins in the seeds. This suggests that in water, the basic amino acids present in the protein of *Moringa* would accept a proton from water resulting in the release of a hydroxyl group making the solution basic. This accounted for the basic pH values observed for *Moringa* treatments.

Powder in g	**0**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**
Acidic water	3.05	3	3.04	3.09	3.15	3.7
Basic water	10.07	8.95	8.51	8.46	8.44	7.99

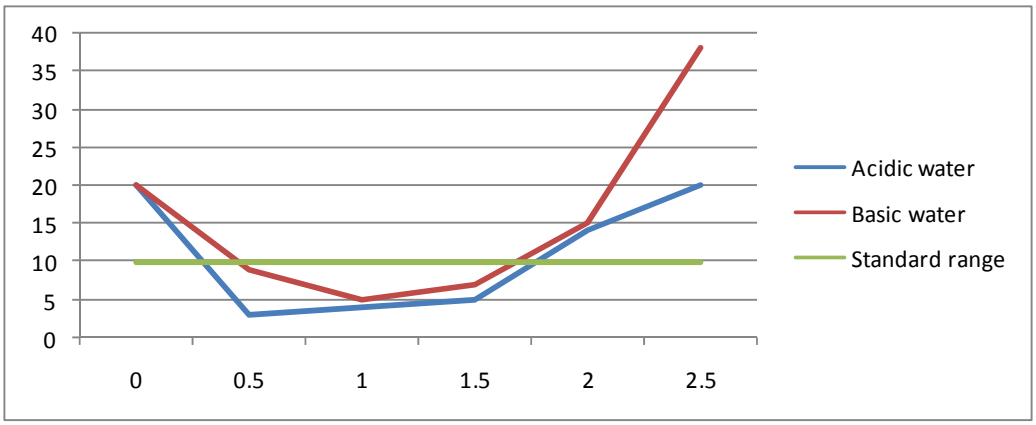


TURBIDITY REPORT:

The turbidity ranged from 3 to 20 for acidic water and 5 to 38 to basic water for all treatment used. Turbidity may be caused when the light is blocked by large particles such as silt, microorganisms, plant fibers, sawdust, wood ashes, chemicals and coal dust. Any substance that makes water cloudy will cause turbidity. The treatments used gave significant differences on turbidity. The declared WHO guideline for turbidity should be less than 10 NTU.

The seed kernels of *Moringa* according to Schwarz (2000) contain lower molecular weight water soluble proteins which carry a positive charge. When the seeds are crushed and added to water, the protein produces positive charges acting like magnets and attracting predominantly negative charged particles such as clay, silt and other toxic particles. Under proper agitation, these bound particles then grow in size to form the flocculants which are left to settle by gravity. This accounted for raw water purification.

Powder in g	0	0.5	1.0	1.5	2.0	2.5
Acidic water(NTU)	20	3	4	5	14	20
Basic water(NTU)	20	9	5	7	15	38



CONCLUSION

The results obtained show that powder from seed kernels of *Moringa* contains some coagulating properties which have to be activated from flocculation. This method can be used for water treatment in rural areas as it is readily available in their locality. The paste of *Moringa* which was made by mixing with water as to be made fresh every time when water treatment has to be done. *Moringa* seed is eco-friendly and cheaper method of purification of water and therefore, can be used in the rural areas where no facilities are available for the treatment of drinking water. After the treatment of *Moringa* seed, sludge gets settled at the bottom of tank. Large scale treatment produces large quantity of sludge which can be used as bio-fertilizers and it becomes an added advantage of this treatment. The antimicrobial activity of the *Moringa* has to be investigated to establish their effectiveness in treating waste water.

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