

Water Purification Using Moringa Oleifera (Drumstick) Seed Powder As A Natural Coagulant

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ABSTRACT

The high cost of treated water makes most people in the rural communities to resort to readily available water sources which are normally of low quality exposing them to waterborne diseases. The present study was carried out to confirm the effectiveness of seed powder extracted from mature-dried MoringaOleifera seeds which are commonly available in most rural communities. The main objective of this work is to evaluate the antimicrobial activity and efficiency of a natural absorbent from MoringaOleifera seeds in treating river water.

During this study, surface water samples were collected for treatment by Moringa seeds in powdered form, resulting in an effective natural clarification agent for highly turbid and untreated pathogenic water. Various doses of Moringa seed powder viz. 50, 100 and 150 mg/l were taken and checked for the efficiency dose on raw water. After treatment of seed powder with water samples were analyzed for different parameter like pH, Turbidity, TDS, TS, Hardness, Jar test, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) . All parameters were reduced with increasing dose of 50, 100 and 150 mg/l seed powder respectively (except alkalinity and pH). Application of this low cost MoringaOleifera seeds is recommended for eco-friendly, nontoxic, simplified water treatment where rural and peri-urban people living in extreme poverty.

KEYWORDS:-Moringa oleifera, Natural coagulant, River water, Turbidity

I. INTRODUCTION

Chemical coagulants like Aluminium sulphate (alum), FeCl₂ are used in Municipal drinking water treatment plant for purification process. This excess use of amount of chemical coagulants can affect human health e.g. Aluminum has also been indicated to be a causative agent in neurological diseases such as pre-senile dementia. In rural and undeveloped countries people living in extreme poverty are presently drinking highly turbid and microbiologically contaminated water as they lack of knowledge of proper drinking water treatment and also not afford to use high cost of chemical coagulants. Some drinking water treatment plant in developing countries face a myriad of problems which are: large seasonal variation in raw water quality e.g. turbidity, high cost of water treatment chemicals, under dosing of chemicals leading supply of poor drinking water. To overcome chemical coagulant problems it is necessary to increase the use of natural coagulants 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 produced or extracted from microorganisms, animals or plants. One of these alternatives is *Moringa oleifera* seeds. It is a native tree of the sub-Himalayan parts of North-west India, Pakistan and Afghanistan. *Moringa oleifera* is a perfect example of a so-called “multipurpose tree”. Earlier studies have found *Moringa* to be non-toxic, and recommended it to use as a coagulant in developing countries. The use of *Moringa* has an added advantage over the chemical treatment of water because it is biological and has been reported as edible. According to Muyibi and Evison, 1994, hardness removal efficiency of *Moringa oleifera* was found to increase with increasing dosage. *M. oleifera* seeds act as a natural absorbent and antimicrobial agent as their seeds contain 1% active polyelectrolyte’s that neutralize the negatively charged colloid in the dirty water. This protein can be therefore nontoxic natural polypeptide for sedimentation of mineral particles and organics in the purification of drinking water. These *seeds* are also act as antimicrobial agent against variety range of bacteria and fungi. The seed contain number of benzyl isothiocyanate and benzyl glucosinolate which act as antibiotic. It is believed that the seed is an organic natural polymer. The active ingredients are dimeric proteins. The protein powder is stable and totally soluble in water. The coagulation mechanism of the *M. oleifera* coagulant protein has been explained in different ways. It has been described as adsorption and charge neutralization and interparticle bridging. Flocculation by inter-particle bridging is mainly characteristic of high molecular weight polyelectrolytes. Due to the small size of the *M. oleifera* coagulant protein, a bridging effect may not be considered as the likely coagulation mechanism. *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 case, microorganisms can be removed by settling in the same manner as the removal of colloids in properly coagulated and flocculated water. On the other hand, the seeds may also act directly upon microorganisms and result in growth inhibition. Antimicrobial peptides are thought to act by disrupting the cell membrane or by inhibiting essential enzymes reported that *Moringa* seeds could inhibit the replication of bacteriophages. According to Amagloh and Benang 2009, at 95.0% confidence level, there was significant difference among all the treatments at the varying loading dose concentrations on the pH. The treatments gave a range of 7.2 to 7.9 which falls within the reduced as the concentrations of the dosing solutions were increased. The reverse was observed with the *Moringa* treatment. The use of natural materials of plant origin to clarify turbid water is not a new idea cited by Ndabigengesere *et al.*, (1995). Among all the plant materials that have been tested over the years, powder processed from the seeds from *Moringa oleifera* has been shown to be one of the most effective as a primary coagulant for water treatment and can be compared to that of Alum (conventional chemical coagulant). It was inferred from their reports that the powder has antimicrobial properties. A general rule of thumb is that powder from one *Moringa* kernel to two liters of water is a good amount when water is slightly turbid, and to one liter when water is very turbid. The seeds and powder can be stored but the paste needs to be fresh for purifying the water.

II. RELATED WORK

Waste Water

The waste water was collected from Nasardi river which is flow through Nashik district Maharashtra. The type of sampling adopted in this study was grab sampling, consists of a single sample taken at a specific time. Samples were collected in the plastic cans and the characterization of surface water samples were conducted immediately after the sample arrived to laboratory. Care was taken not to introduce errors during sampling and storage, where contamination results from improperly cleaned sampling devices and sample containers.

Methods of purification of water

By using chemical coagulants

- Aluminum sulfate
- Aluminum chloride
- Sodium aluminate

By using Natural coagulants

- Neem
- Moringa Oleifera seeds
- Tulsi
- Aloe vera

Moringa Oleifera seeds powder-Natural coagulant

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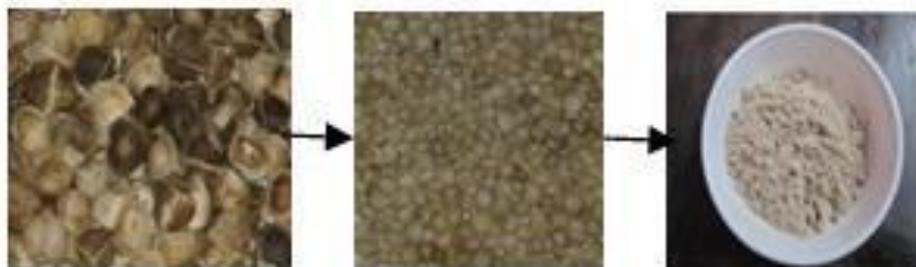


Fig.1 Preparation of Moringa Oleifera seed powder

Physical and chemical methods of analyzing the surface water

Sr. No.	Parameters	Method
1	pH	pH Meter
2	Turbidity	Nephelometer
3	TSS	Evaporation
4	TDS	Evaporation
5	Colour	-

Table No.1 Physical Tests

Sr. No.	Parameters	Method
1	Total Hardness	Titration

Table No.2 Chemical Tests

Coagulation test

Jar test is most widely used experimental methods for coagulation-flocculation. A conventional jar test apparatus will be used in experiments to coagulate sample of water using MO. It will be carried out as a batch test; the jar test apparatus involves the use of stirring device. The stirrer consists of six paddles those which are capable of rotation with the different speed. In this method six beakers of 1 liter capacity are placed, which were dosed with different amount of coagulant and run the apparatus for 45 minutes at a speed of 110 rpm then the stirred sample allowed settle floc for 1-2 hours depending on the floc size formed then the supernatant was taken to analyzed. Before operating jar test, sample is mixed homogenously, then analyze for the initial concentration of the parameters such as pH, turbidity, suspended solids, dissolved solids, total solids, hardness. Then samples are tested for desirable parameters after the jar test, then the results are plotted on graphs.



Fig.2 Schematic view of conventional jar test apparatus

III. CONCLUSION

Moringa oleifera seeds acts as a natural coagulant, flocculent, absorbent for the treatment of drinking water. It reduces the total hardness, turbidity, acidity, alkalinity, chloride after the treatment. It also acts as a natural antimicrobial active against the micro-organisms which is present in the drinking water and decrease the number of bacteria. The MPN test had shown positive which indicates the water samples are feacally contaminated and not safe for drinking. MPN test reading was reduced after treatment of higher dose at 150 mg/l of Moringa seed powder. If we can use combined Moringa oleifera seed powder and chlorine it can give best results and the water can be suitable for drinking.

Moringa oleifera seed is not giving any toxic effect. It 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 oleifera seed, sludge gets settled at the bottom of tank. Large scale treatment at village level produces large quantity of sludge which can be used as bio-fertilizers and it becomes an added advantage of this treatment.

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