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A case study on low cost water treatment using Moringa oleifera (Drum Stick)

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ABSTRACT

In addition to food, shelter and clothing, water is one of our basic human needs and lack of potable water is a major cause of death and disease in our world. The purpose of this study is to provide information on household water treatment using seeds of the Moringa Oleifera tree.Ground water is a fresh water located in the core space of soil. Wells, springs and rivers constitute water supplies. Present study deals with the suitability of coagulation-flocculation process using MoringaOleifera seeds as natural coagulant for purification of water for drinking purpose. In present study various doses of MoringaOleifera seed powder like 50, 100 and 150 mg/litre were taken and checked for the efficiency dose for various water samples. After treatment of water samples with MoringaOleifera seed powder were analysed for different parameters like Turbidity, pH, Conductivity and Hardness. There is an appreciable change in all parameters except in some parameters. Application of this low cost MoringaOleifera seeds is recommended for eco-friendly, nontoxic, simplified water treatment where rural people living in extreme poverty are presently drinking highly turbid and contaminated water.

KEYWORDS

Moringa oleifera;
Canal and ground water treatment;
Natural absorbent;
Natural coagulant.

INTRODUCTION

Ground water is fresh water located in the core space of soil and rocks and water is essential for the survival of human beings. Now a days due to rapid industrialization even in rural areas, water become contaminated.

Presently there are no appropriate low cost methods available for removal of water contaminants from drinking water. There are a variety of purification methods of drinking water which are very costly and those methods cannot serve a common man effectively. Generally water is polluted due to industrial effluents and municipal waste in water bodies. So in rural areas people living in extreme poverty are drinking highly turbid and contaminated water. Generally to purify turbid and contaminated water chemical coagulants like alum are used. But excess use of chemical coagulants can affect human health. To overcome chemical coagulant problems it is necessary to increase the use of natural coagulant for drinking water treatment.

Naturally occurring coagulants are safe for human

health[3].

One of the natural coagulant available is MoringaOleifera Seeds.MoringaOleifera is a perfect example for multipurpose tree[2].

In this present study an attempt has been made to check how MoringaOleifera powder changes various properties of drinking water in a rural industrially developed areas, so that the water is suitable to drink.

MATERIALS AND METHODS

Materials

MoringaOleifera Seed Powder, water samples collected from Vamsadhara Canal Water (Sample-1), Well water at Ravivalasa Village (Sample-2), near Tekkali, Srikakulam District an industrially developed area where the main sources for drinking water are wells and Ground water at AITAM Engineering College, Tekkali (Sample-3) which is a residential area about 4000 students are drinking water every day.

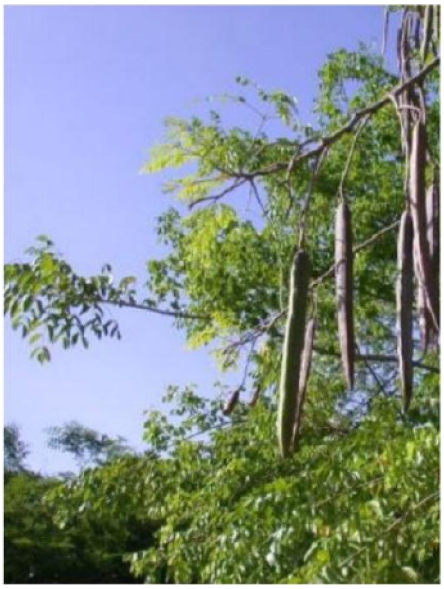


Figure 1 : Moringa oleifera Tree

Method

Good quality Moringaoleifera seeds are taken and removed its wings and coat from their seeds. Fine powder was prepared by using mortar and pestle and this powder was directly used as coagulant. Water samples were collected from Vamsadhara Canal Water (Sample-1), Industrial Area well water at Ravivalasa Village (Sample-2) and Ground water at AITAM Engineering College, Tekkali, (Sample-3), for the study purpose.

Figure 2 : Moringa oleifera seeds.

Water is treated by adding of MoringaOleifera Seed powder directly. The water quality parameters were checked before and after treatment of M.Oleifera. Doses of seed powder were selected as 50, 100 and 150 mg/litre for treatment.

The coagulant was mixed with three water samplesindividually and kept on the mechanical shaker for 45 min at 110 -120 rpm. The settling time was 1-2 hours (depending on the water turbidity of different samples). After sedimentation, supernatant water is separated and the same is taken for test. The water quality parameters were checked before and after the treatment and the efficiency dose of Moringaoleifera seed powder was determined.

RESULTS AND DISCUSSION

Colour

All the three samples under study has faint brown colour before treatment with MoringaOleifera seed powder. After adding different doses of Moringa to the sample removes colour and the samples are colourless. This suggests that the MoringaOleifera seeds show absorbent properties. Good clarification is obtained if a small cloth bag filled with the powder seeds of Moringa is swirled round with turbid water. These above observations can show from TABLE 1.

TABLE 1 : Colour of all three samples before and after treatment with M.O. seed powder

Sample	Before Treatment	After Treatment		
		50mg/L	100mg/L	150mg/L
1	Faint brown	Colourless	Colourless	Colourless
2	Faint brown	Colourless	Colourless	Colourless
3	Faint brown	Colourless	Colourless	Colourless

Turbidity

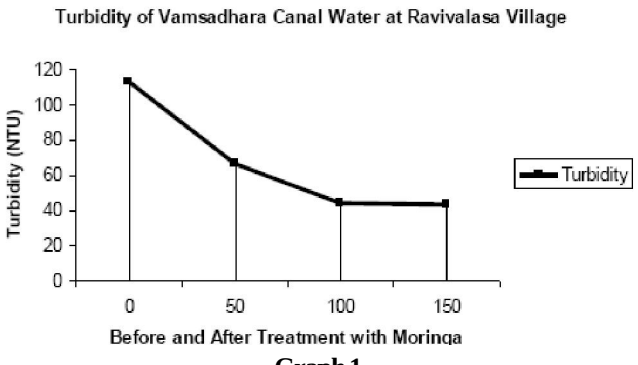
The variation of turbidity in the samples after adding MoringaOleifera Seeds are shown in the graphs and also tabular forms. Canal water (Sample-1) is more turbid than other samples Sample-2 and Sample-3. This turbidity of Sample-1 may be continuous movement of water in the river. Before treatment of MoringaOleifera, turbidity is 113 NTU in Canal water and 15.5 NTU and 14.7 NTU in other samples. In all the samples it was observed that, the use of M.O. Powder Seeds, decreases the turbidity with increasing doses.

In Samples-2 and 3, it was observed that, the turbidity decrement reaches about uniform for all the added doses. In Sample-1 i.e.,Vamsadhara Canal water the decrement in turbidity is prominent and uniform after adding MoringaOliefera dose of 100mg/litre.

Figure 3 and 4 : Decreasing of turbidity with increasing doses of M.O. powder

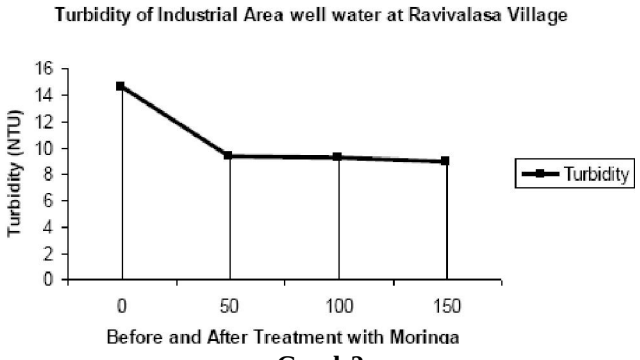
TABLE 2 : Turbidity of all three samples before and after treatment with M.O.Seed powder

Sample	Before Treatment	After Treatment		
		50mg/L	100mg/L	150mg/L
1	113	66	44	43
2	14.7	9.4	9.2	8.9
3	15.5	9.2	8.8	8.7

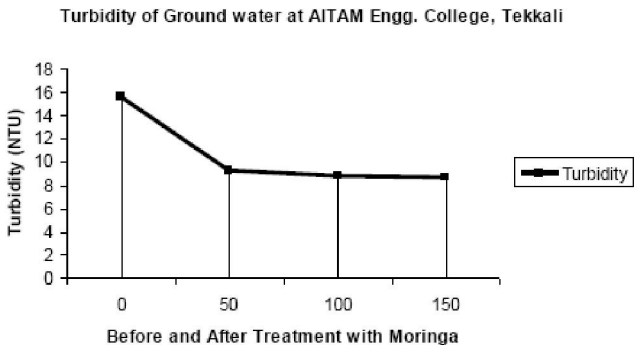


Graph 1

The above observation may be due to an improvement in the flock size and flock was settled rapidly. The overdosing resulted in the saturation of the polymer bridge sites and caused destabilization of the destabilized particles due to insufficient number of particles to form more inter-particle bridges. The high positive charge and small size suggest that the main destabilization mechanism may could beadsorption and charge neutralization. It was found that 90-99% of turbidity in treated water was removed by using M. oleifera seed powder[1]. These studies are confirmed that the seeds are highly effective inremoving suspended particles from water with medium to high levels of turbidity (Moringa



Graph 2



Graph 3

seedsare less effective at treating water with low levels of turbidity)

pH

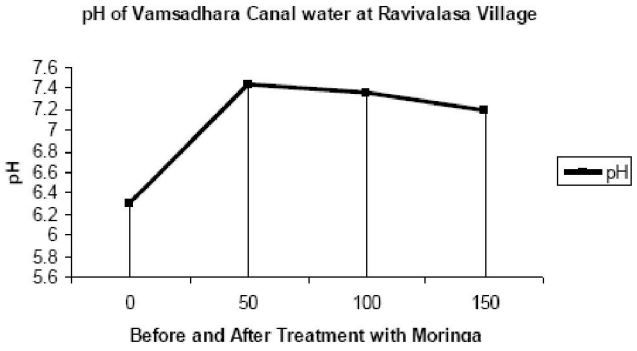
During the present study, treatment of MoringaOleifera seed powder was given to ground water (Sample 1 and 3) samples in different doses. During the analysis, it was observed that after treatment with Moringa Seed powder, pH was increased for 50mg/L and it was decreased for 100mg/L, 150mg/L doses for the above samples. After treatment the pH range was 7.57 to 7.44 in Sample-2 and 7.35 to 7.15 in Sample-3. In Sample-1 and 3 the water was acidic in nature before treatment and it was converted to the basic nature after treatment.

Treatment of MoringaOleifera seed powder was given to Canal water (Sample-1) in different doses. It was observed that before treatment the pH was 6.3 show acidic properties. After treatment with M.O.Powder, pH was increased to 7.43 at 50mg/L dose but gradually decreased to 7.35 and 7.19 by adding of M.O.powder as 100 mg/L and 150mg/L respectively. After treatment the range of pH in Sample-1 was 7.43 to 7.19 and it is within the limit of W.H.O. Standards.

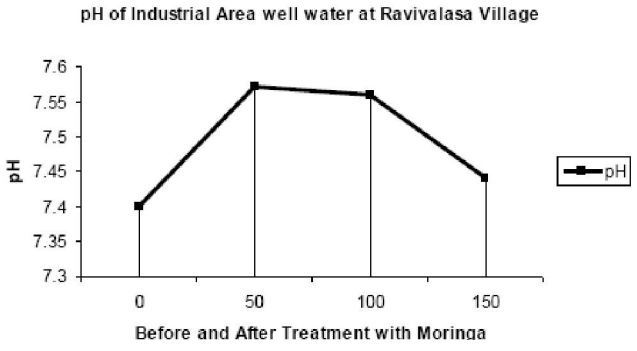
The recommended acceptable range of pH for drinking water specified by W.H.O. was 6.0 to 8.0[7]. The treatments gave a pH range of 7.57 to 7.19 which falls within the reducing trends on the concentration of the dosing solutions were increased. In some doses pH increases with increasing concentrations of Moringa as coagulant. It was reported that the action of M.O. as 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 the release of a hydroxyl group making the solution basic[4].

TABLE 3 : pH of all three samples before and after treatment with M.O. seed powder

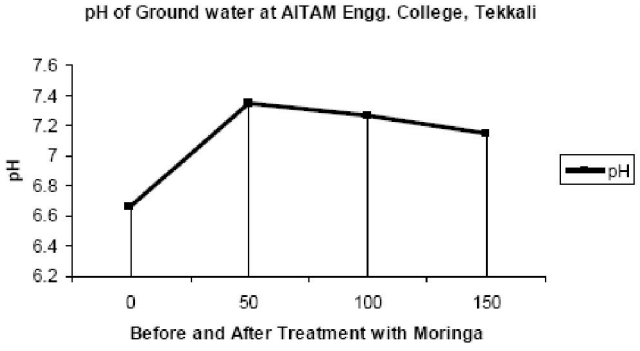
Sample	Before Treatment	After Treatment		
		50mg/L	100mg/L	150mg/L
1	6.3	7.43	7.35	7.19
2	7.4	7.57	7.56	7.44
3	6.65	7.35	7.26	7.15



Graph 4



Graph 5



Graph 6

Conductivity

The conductivity of sample ranges from 0.348 mho/cm to 0.438 mho/cm before treatment with Moringa Oleifera Seed powder.

After treatment with M.O. Seed Powder the conductivity increases in all the samples except slight decrement in one of the samples. The variation of conductivity may be due to variation of ion concentration formation due to adding of MoringaOleifera seeds. It was observed that the conductivity values were nearer to W.H.O. Standards. (1mho/cm)[7].

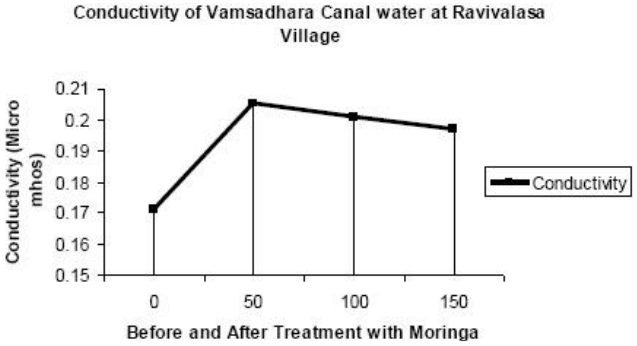
Hardness

Before treatment, the hardness of ground water samples (sample 2 and 3) are 475mg/L and 220 mg/L

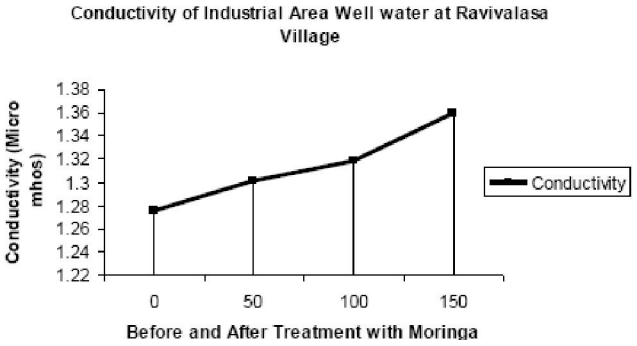
and the values are below W.H.O. Standard (500mg/L)[7]. Hardness of canal water sample (Sample-1) was 120mg/L which was well below W.H.O. Standard.

TABLE 4 : Conductivity of all three samples before and after treatment with M.O.seed powder

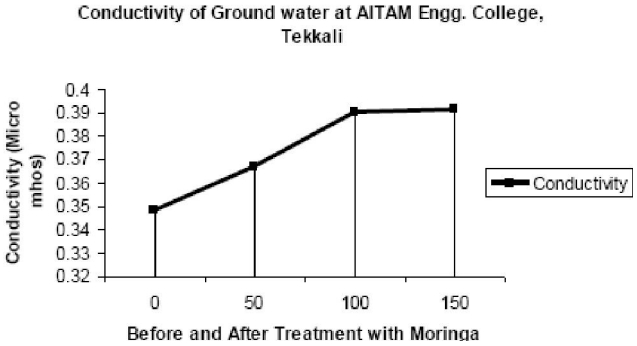
Sample	Before Treatment	After Treatment		
		50mg/L	100mg/L	150mg/L
1	0.171	0.205	0.201	0.197
2	1.275	1.301	1.318	1.359
3	0.348	0.367	0.390	0.391



Graph 7



Graph 8

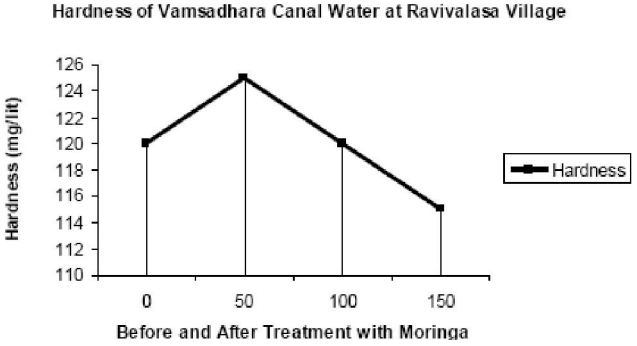


Graph 9

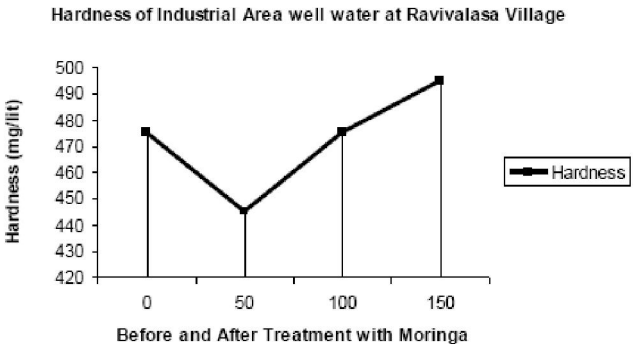
Adding of M.O.Seed powder with different does indicates that the decrement of hardness with increment of doses in Samples 1 and 3. But, there is a different result was observed for sample-2 which is located in an industrially developed areas i.e., increment of hardness by the adding of M.O.Seed Powder. (TABLE 5)

TABLE 5 : Hardness of all three samples before and after treatment with M.O.seed powder

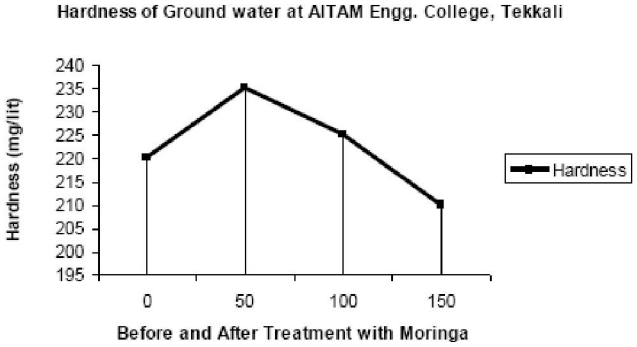
Sample	Before Treatment	After Treatment		
		50mg/L	100mg/L	150mg/L
1	120	125	120	115
2	475	445	475	495
3	220	235	225	210



Graph 10



Graph 11



Graph 12

In general, the softening mechanism was postulated to be a combination of adsorption and precipitation of the soluble hardness causing ions to insoluble solids / flocs[6]. By the above study, the desirable concentration of M.O. is 150mg/L is for Sample-1 and Sample-

3, but only 50mg/L is sufficient to softening the Sample-2. The changing of these desired dosages are depending on the Calcium and Magnesium hardness. The sample-1 and sample-3 may have the both calcium and magnesium hardness causing substances which require more M.O. than the sample-2 which may contain only the calcium hardness causing substances.

CONCLUSIONS

The results obtained show that the powder from seed kernels of M. oleifera contains some coagulating properties and acts as a flocculent, absorbent for the treatment of drinking water atloading doses of 50 mg/L, 100 mg/L and 150 mg/L and above. It reduces the total hardness, turbidity after treatment. This lends support to earlier findings of the use of powder processed from Moringa seeds as a coagulant in water purification system. Considering the fact that Moringa coagulum can be locally produced, its use in water purification should be encouraged. This is likely to reduce the highcost of the current water treatment systems.The seeds of M.Oleifera exhibited the fastest turbidity and colour removal potential.These studies have also confirmed that the seeds are highly effective in removing suspended particles from water with medium to high levels of turbidity (Moringa seedsare less effective at treating water with low levels of turbidity). M.Oleifera seed is not giving any toxic effect. It is eco-friendly method of purification of water and consequently it is being recommended for large scale water treatment use in the rural industrially developed area where no facilities are available for the treatment of drinking water.

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