International Journal Of Advancement In Engineering Technology, Management and Applied Science (IJAETMAS)

ISSN: 2349-3224 || www.ijaetmas.com || Volume 04 - Issue 06 || June-2017 || PP. 29-35

APPLICATION OF MORINGA OLEIFERA AS ALTERNATIVE NATURAL MATERIAL FOR WATER PURIFICATION IN N/E NIGERIA.

Babagana, S[1]*, Dammo, M .N.[2] **Yadima S.G[3] , Sangodoyin, A.Y[4]**

1 Ministry of Rural Water Supply Agency Maiduguri, Nigeria
2. Department of Civil Engineering Ramat Polytechnic Maiduguri, Nigeria
3. Department of Civil and Water Resources Engineering, University of Maiduguri, Maiduguri, Nigeria
4. Department of Agricultural and Environmental Engineering, University of Ibadan, Ibadan, Nigeria

Abstract

Clean water is a serious problem, especially in developing countries like Nigeria, where conventional treatment methods are sometimes bypasede due to high cost and low availability of chemical coagulants like alum. This paper presents the application of moringa seeds extract as alternative to alum in raw water treatment. The effectiveness of Moringa oleifera seed extract in coagulation, turbidity removal and reduction of E-coli in water purification were 98.5, 99.5 and 90.6 % respectively. The percentage removal of color for storage pot was 97.5 and 64.6% respectively. This indicates that storage method of the seeds before usage for water purification also affects its coagulation properties. Storage in polythene bag and then in clay pot should be encouraged in rural communities without safe water supply. It is suggested that further investigation be conducted with other indigenous plant material to ascertain their water treatment potential.

Introduction

Safe drinking water and adequate sanitation are essential for human health and dignity (Prichard et al; 2009). Water borne and water related diseases such as diarrhea, typhoid and cholera are fast becoming endemic in certain parts of Africa (Yongabi, 2004; Pritchard et al; 2009). The conventional methods of treatment which achieves water clarification through coagulation,

ISSN: 2349-3224 || www.ijaetmas.com || Volume 04 - Issue 06 || June-2017 || PP. 29-35

flocculation, sedimentation and disinfection are processes such as often not suitable in developing economic because of the high cost and low availability of chemical coagulants and disinfectants. Moreso, the dosages and techniques involved are too cumbersome for use in most rural areas (Aho, and and Lagasi, 2012). Alum used as coagulant at local levels can have adverse effects on water (Folkard et al, 2006). Such problems as water borne and water related disease are well recognized by the international community, with Governments and non-governmental organizations (NGOs) making massive efforts over the years to solve it; yet, the problems still remains (Kalogo & Verstraete, 2000). Similarly, well documented technologies used in water treatment such as reverse osmosis, ion exchange and Ultra violet sterilization, are becoming unsustainable, unecological, expensive to run and not easy to operate and maintain particularly in Africa (Prichard et al; 2009). Chlorine is known to produce trichloromethene, a cancer precursor (Yongobi, 2004) while Aluminum sulphate has been linked with Alzheimer's diseases (Zhang et al; 2009). The cost of purchasing synthetic coagulants and disinfectants in hard currency has led to high pricing for treated water in Africa (Kebreab et al; 2005). To alleviate the prevailing difficulties, locally available materials are being exploited with a view to achieve sustainable, safe and potable water supply. Simple technologies such as the application of plant coagulants eg moringa oleifera to treat water has been extensively reported (Yongobi, 2004; Prichard et al, 2009). In North-east Nigeria, access to clean and safe water is a major problem. Poor water quality is a key cause of poor livelihood and bad health with 80% of all diseases in developing countries being water related (OECD, 2006). Children bear the greatest health burden associated with unsafe water supplies through preventable diseases like diarrhoea. In developing countries about 2 million people die every year due to diarrhoeal disease; most are children of less than 5 years of age (WHO, 2006). Other water related diseases reported in Nigeria are trachoma, schistosomiasis, ascariasis, trichuriasis, ancylostomiasis (hookworm), malaria and encephalitis (Sridhar and Oloruntoba, 2008). Unprotected water sources receive pollutants from surface runoff thus necessitating treatment at the household level. The common methods of household water treatment require coagulation / flocculation followed by sedimentation, filtration and disinfection (Adejumo et al., 2013**)**.

ISSN: 2349-3224 || www.ijaetmas.com || Volume 04 - Issue 06 || June-2017 || PP. 29-35

The use of Moringa oleifera as a primary coagulant is more appropriate for surface waters with excessive turbidity particularly during the raining seasons. For low turbidity water Ghabremicheal, (2004) stated that it can be effectively used as a coagulant aid. Nwaiwu and Lingmu (2011) reported that the addition of Moringa oleifera seed powder did not alter the pH, temperature, salinity; electrical conductivity and total dissolve solids concentration in water. The ability of Moringa oleifera coagulant to remove bacteria from water was tested in a jar test experiment with sample water with E.coli and indicated a reduction in the bacteria count similar to that of Alum (Abaliwano et. al; 2008). This study investigates the effect of storage and application of moringa oleifera extract in coagulation, turbidity and E-coli removal in polluted water.

Methodology

The Moringa seeds were obtained from Moringa oleifera trees planted in Kayamla and surrounding villages on the outskirt of Maiduguri. The pods were manually threshed to obtain the seeds which were later divided into two parts and stored in polythene bags and pots. Raw water samples were collected from an existing borrow pit located at Modu Sulumri, a rural outskirt of Maiduguri, the Borno State capital in Northeast Nigeria. The seeds were stored in clay pots for 7 consecutive months and extracts were used to treat water on monthly bases. Microorganisms were isolated and identified in the raw water sample collected on the first month of the experiment using the method described by Monica (2006). The organism identified include, Bacillus, Proteus, Salmonella, Corynebacteria, Enterobacter, E.coli and Klebseilla. The organisms were cultivated on minimal broth medium and stored at 37^0C for 24hrs. Optimum dose for the turbidity and colour removal were determined by plotting the values of coagulant dose against turbidity and colour obtained from jar test for each month and seed. Results were subjected to statistical analysis to determine the significance between the optimum dosage for turbidity and colour removal for storage time. Antibacterial activity index (AI) for extracts of Moringa oleifera was calculated as the mean value of the zone of inhibition obtained against all individual bacteria at different extract concentration (Nwaiwu et.al; 2012).

ISSN: 2349-3224 || www.ijaetmas.com || Volume 04 - Issue 06 || June-2017 || PP. 29-35

Results and Discussion

The result of the jar test conducted using the extracts from the Moringa oleifera seeds reveal that the initial raw water pH of 6.0 was not affected by the dosing of the coagulants (seed extracts) which were stored using polythene bags and pots. The total dissolved solids and electrical conductivity were not also affected by the application of the coagulants. These were in consonant with Nwaiwu et.al. (2012) observation that the pH of the water treated with Moringa oleifera remained fairly constant and is within the allowable limits of the World Health Organization. The optimum dosage of the coagulant was found to vary slightly with time and storage method (Table 1).

Table 1.Effects of storage time and method on optimum dosage (g/l)

	Moringa Oleifera	
Time(Month)	Storage ‘’N’’	Storage ‘’P’’
0	4.5	4.5
1	4.8	4.6
2	4.8	4.7
3	4.8	4.8
4	4.8	4.8
5	4.9	4.9
6	4.9	5.0

‘’p’’=storage of seed in polythene bag and kept in a clay pot.

‘’N’’=storage of seed in clay pot.

Table 1 shows that optimum dosage of Moringa oleifera ‘’N’’ increased from 4.5 g/l to 4.9 g/l and 4.5 to 5 for storage method N and P respectively. Figure 1 shows colour removal properties of Moringa oleifera seeds for 6 months under storage method “N” with respect to time. Colour removal for Moringa oleifera vary from 98.4% to 96.1%. Figure 2 shows that for storage method P color reduction was in the range 96.9 – 98.4%. Turbidity removals of Moringa oleifera seeds

ISSN: 2349-3224 || www.ijaetmas.com || Volume 04 - Issue 06 || June-2017 || PP. 29-35

are also affected by the storage time. The storage time affected turbidity removal for storage method "N" with a drop from 99.7% to 97.3% in 6 months Figure 1. This is in agreement with Katayon et. al. (2006) which stated that efficiency of Moringa oleifera decreased as storage duration increased. The coagulation and turbidity removal properties vary with storage period and method with 98.3% coagulation properties in storage method ''P'' 98.3% (storage in polythene bag and inside a pot) than storage method and 97.3% in storage method ''N''. This can be attributed to the nature of the storage with seed stored in moisture impervious sealed container being in a suitable environment with minimal escape of seed moisture.

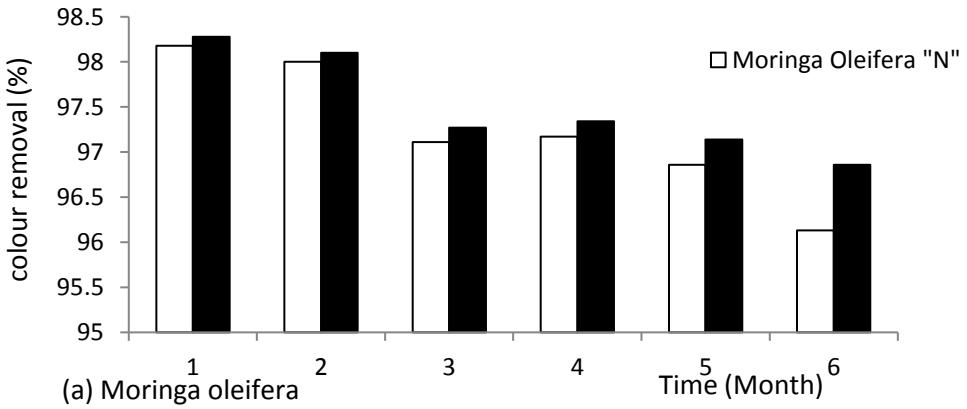

Fig 1 Effects of storage method of Moringa oleifera on color removal in polluted water

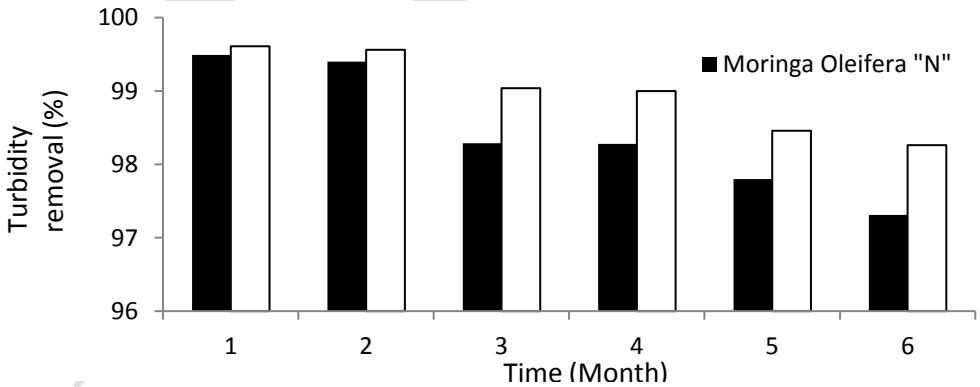

Fig.2: Effects of storage method of Moringa oleifera on turbidity removal in polluted water

This signifies that there are difference in the two storage methods for coagulation and turbidity removal properties of M. oleifera. From the foregoing, it is evident that Moringa oleifera seed has good colour removal efficiency as turbidity removal property is one of the most desirable tool of any coagulant.

Conclusion

The effect of storage duration for 6 months on the coagulation properties of moringa oleifera was insignificant. The coagulation properties of Moringa oleifera was insignificantly affected by the difference in storage method. Moringa oleifera has high coagulation properties. Storage in polythene bag inside clay pot tends to preserve the initial properties of the seed than those in clay pot without polythene bag. It is recommended that the use of polythene bag and clay pot for seed storage be propagated among rural dwellers especially when the seeds are being considered for water treatment and storage duration of up to six months. The use of indigenous plant material in water treatment should be explored by further diversifying their potentials towards treating some common chemical contaminants in surface water like potassium, phosphorus and other related compounds.

References

Abaliwano J. K., Ghebremichael K. A. and Amy G. L. (2008). Application of the purified Moringa oleifera coagulant for surface water treatment. Water Mill Working Paper Series No.5.UNESCO-1HE. Institute for Education pp19.

Adejumo (2013). Use Of Moringa Oleifera (Lam.) Seed Powder as a Coagulant For Purification of Water from Unprotected Sources in Nigeria. European Scientific Journal. Vol.9, No.24, :215-230

Aho, I.M. and Lagasi, J.E. (2012). A New Water Treatment System Using Moringa Oleifera Seed. American Journal of Scientific and Industrial Research. Vol3, No6, pp: 487- 492.

Ghebremichael, K. A. (2004). Moringa Seeds and Pumice as Alternative Natural Materials for Drinking Water Treatment. Ph.D. Thesis, Royal Institute of Technology, Sweden.

Folkard, G. John, S. and Rega, S.A. (2006). Water Clarification Using Moringa Oleifera Seed Coagulant.

Folkard,G.K., Grant,W.P. and Sutherland,J.P.(1992). NaturalCoagulants at pilot scale. 18th WEDC Conference Proceedings.pp. 55-58.

Kalogo, Y. and Verstraete, W. (2000). Technical Feasibility of the Treatment of Domestic Waste and Raw Water. Environmental Technology Vol. 21, pp:55-65.

Kebreab, A., Ghebremicheal Gunaratha K.K., Hongbin H., Hany B. and Gunnel D. (2005). A simple purifications and activity assay of coagulant protein from Moringa oleifera seed. Water Res, Vol. 390, pp: 2338 – 2344.

Monica,C. (2006). District Laboratory Practice in Tropical Countries, Part 2. 2nd Edition, Cambridge University Press.

Nwaiwu,N.E. and Lingmu , B.(2011). Studies on the effect of Settling time on coliform reduction using Moringa Oleifera seed powder. Jounal of Applied Phytotechnology in Environmental Sanitation,Vol. 6, pp: 279 -286

Nwaiwu, N.E.,Mshelia F.and Raufu I.A.(2012). Antimicrobial Activities of Crude Extracts of Moringa Oleifera, Hibiscus Sabdariffa and Hibiscus Esculentus Seeds against some bacteria. Jounal of Applied Phytotechnology in Environmental Sanitation, Vol.1, pp: 11-16

OECD (2006). Improving Water Management: Recent OECD experience: (online) (access date:24th January,2011).http://www.oecd.org/longabstract/0,3425,en_2649_345 37_36216566_119696_1_1_1,00.html.

Pritchard M., Mkandawire T.,Edmondson A., O'neill J.G., Kululunga G. (2009). Potential of using plants extracts for purification of Shallow well water in Malawi. Physics and Chemistry of the Earth, Vol.34, pp: 799-805.

UNICEF (1993). Control of diarrheal diseases (CDD) adapted from facts of life, Watsan Health Education Unit, 2nd Edition.Edproprint, Lagos.

UNEP (2002). Past, Present and Future Perspectives, Africa Environment outlook. United Nations Environmental Programme. Nairobi, Kenya.

Yongabi, K.A.,(2004). Studies on the potential use of Medicinal plants and macrofungi (lower plants) in water and waste water purification. Proceedings of an E-seminar organized by the International Organization for Biotechnology.

Zhang, J., Livo, Y. and Yang, H. (2006). A Preliminary Study on Cactus as Coagulation in Water Treatment. Process Biochem, Vol. 41, No3, pp: 730 – 733.

Sridhar, M. K. C., Olaseha, I. O. and Oloruntoba, E. O. (2009). Springs of Ibadan: Sustainable alternate water supplies for urban communities. The Nigerian Field, Vol.74, pp: 47-68.

WHO, (2006). Guidelines for Drinking-water Quality, 1st Addendum to the 3rd edition, Volume 1: Recommendations, World Health Organization, Geneva, Switzerland.