Moringa Oleifera Seeds as Natural Coagulant for Water Treatment

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Abstract— With development the cost of water treatment is increasing and the quality of river water is not stable due to suspended and colloidal particle load caused by land development which causes pollution and make water unfit for consumption. During the rainy seasons the turbidity level increases and the need for water treatment chemicals increase as well, which leads to high cost of treatment which the water treatment companies cannot sustain. Due to the increased price of treatment water that reaches for drinking purpose is not properly treated. A natural alternative for water coagulant to treat the turbidity will be a great effort for water treatment for drinking purpose .Many studies have found Moringa oleifera as the best natural coagulant, that can replace aluminum sulphate (Alum) which is used widely all around the world. Moringa oleifera seeds to find the active constituents which are responsible about the coagulation mechanism and improving the coagulation property. This will help in producing this alternative locally as Moringa oleifera which is a great benefit for water treatment for drinking purpose.

Key words: Moringa Oleifera, Water Treatment, Natural Coagulant, River Water, Alternatives, Turbidity, Bioactive Constituents

I. INTRODUCTION

Water is one of the most essential requirements by human being. Water supply is a basic need required for living creatures and human being specifically. In this world the amount of resources available to living creatures are limited. About 75% of the present world population lives in the developing countries of the world. About 1.2 billion people still lack safe drinking water and more than 6 million children die from diarrhea in developing countries every year.

However, even after many quality check and technology advancements, it is untenable and unbelievable that waterborne diseases still kill on the average 25,000 people every day in developing countries while millions suffer the debilitating effects of these diseases (Kalbamatten & Burns, 1983).

Safe and pure drinking water is essential to the health and welfare of a community, and water from different sources must have some standard form of purification and treatment before consumption. Different water purification and treatment methods are used to make water safe and healthy to the consumer. The treatment method used depends on the character of the raw water. A major problem with treatment of surface water is due to large seasonal variation in turbidity (McConnachie, G.L, et al 1999).

Water treatment method in many developed countries is based on arbitrary guidelines, they particularly relate to the dosage of chemicals which is not a good approaches.

Commonly used method for water treatment for drinking purpose is Coagulation-flocculation followed by sedimentation, filtration and disinfection, often by chlorine, is used worldwide in the water treatment industry before distribution of treated water to consumers (Ndabigengesere, A. and Narasiah, K. S. 1998).

Many coagulants are widely used in conventional water treatment processes for potable water production for drinking purpose. Coagulants are classified into inorganic coagulant, synthetic organic polymer, and naturally occurring coagulant. Synthetic polyelectrolytes are used as primary coagulant as well as coagulant aid to improve the strength of particle aggregates, enhance coagulation and deposition (filtration) (Muyibi, S. A., et al 2001).

Natural coagulants are usually presumed to be safe for human health. Using aluminum salts have a fear of inducing Alzheimer's disease (Martyn et al., 1989). Some studies on natural coagulants have been carried out and various natural coagulants were produced or extracted from microorganisms, animals or plants (Ganjidoust, H., et al 1997; Kawamura, S. 1991; Lee, S.H., et al 1995).

Moringa oleifera is one of the most wide spread plant species that grows quickly at low altitudes in the whole tropical belt, including arid zones. It can grow on medium soils having relatively low humidity (Ndabigengesere, A., et al 1995). Moringa oleifera seeds are an organic natural polymer.

II. METHODOLOGY

A. *Materials*

Fig. 1: Moringa oleifera Tree

Fig. 2: Moringa oleifera Pods and Seeds

Dry Moringa oleifera seeds used in this study were collected from store. (Figure 1, 2, shows the tree and pods with seeds). The extraction of oil carried out by electro thermal Soxhlet using hexane. The bioactive constituents were extracted from Moringa oleifera using phosphate buffer (0.1M), jar test for measuring coagulation activity, turbid meter for turbidity measurements, and the river water samples (low, medium, and high turbidity were collected to apply jar test. Moringa Oleifera seeds can be used in different ways .The crushed seeds are soaked in water overnight then ,strained water of

soaked seeds is also used for dosing raw drinking water to make it safe for drinking purpose.

B. Oil Extraction

Moring Oliefera seeds oil extraction is carried out by electro thermal Soxhlet using hexane. The oil percentage was 35% w/w. The dried cake was used in this study while the oil kept for other research work.

C. Extraction of Bioactive Constituents

Weighing of 10gm of Moringa oleifera cake, adding of 100ml of phosphate buffer (0.1M) with pH 7.3, mix with gentle stirring at 4ºC for 2hours to extract the bioactive constituents, then centrifuge the contents at 6000 rpm for 25-30 min, the supernatant was injected to the Ion Exchange column to separate the bioactive constituents (Gassenschmidt, U., et al, 1995).

D. Jar Test

Jar test is a test for measuring optimum dosage of coagulant and its coagulation activity, turbid meter for turbidity measurements, and the river water samples (low, medium, and high turbidity) were used to apply jar test. The turbidity for river water samples were 43.9, 91, and 333 for low, medium and high turbidity, respectively.

Fig. 3: Jar test for high turbidity river water

III. Results and Discussion

Coagulation property of Moringa oleifera was improved by isolation of bioactive constituents from the seeds as a coagulant/flocculant which gave turbidity removal of 94%, 96.5%, and 97.3% for the treatment of river water with low, medium and high turbidity, respectively and by using the dosage tabulated in Table 1 safe for drinking purpose

The results showed that the dosage of coagulant to be added was decreased which means decreasing of sludge volume produced (which consider as one of the main problems associated with using Aluminum salts and as a sequence need to be treated with more chemicals).

The residual turbidity for all samples was lower than 5NTU, which is the standard set by WHO for drinking water.

Initial turbidity	Dosage of processed	Residual turbidity	Turbidity
NTU	Moringa oleifera (mg/l)	NTU	removal %
Low (43.9)	0.05	1.78	94
Medium(91)	0.15	1.10	96.5
High (333)	0.30	2.10	97.3

Table 1: Jar test results

IV. Conclusion

Moringa oleifera can be considered as one of the best approaches for Water Treatment. It is as a natural coagulant/flocculants alternative to the Aluminum and other metallic salt which is environmental friendly and more sustainable approach.

References

[1] Ganjidoust, H., Tatsumi, K., Yamagishi, T., and Gholian, R.N. (1997). "Effect of Synthetic and natural coagulant on lignin removal from pulp and paper wastewater". Water Science Technol. Vol. 35, pp. 286-291.
[2] Gassenschmidt, U., Jany, K. D., Tauscher, B., and Niebergall, H. (1995). "Isolation and Characterization of a flocculating protein from Moringa oleifera Lam". Biochemica et. Biophysica Acta Vol. 1243, pp. 477-481.
[3] Jahn, S.A.A. (1984). "Effectiveness of Traditional Flocculants as Primary Coagulants and Coagulant aids for the Treatment of Tropical Waters with more than a Thousand Fold Flocculation in Turbidity". Water Supply. Vol. 2 (3/4) Special Subject, No. 6, pp. 8-10.
[4] Jahn, S.A.A. (1988). "Using Moringa oleifera seeds as coagulant in developing countries". J. Am. Wat. Wks Ass. Vol. 6, pp. 43-50.
[5] Kalbamatten, J.M., and Burns, M.J. (1983). "Water supply and sanitation in developing countries - introduction". Water supply and sanitation in developing countries, B.J. Dangerfield, IWES, London, England.
[6] Kawamura, S. (1991). "Effectiveness of natural polyelectrolytes in water treatment". JAWWA Vol.83, No. 10, pp. 88-91.
[7] Lee, S.H., Lee, S.O., Jang, K.L., and Lee, T. H. (1995). "Microbial flocculant from arcuadendron SP-49". Biotechnol. Lett. Vol. 17, No. 1, pp. 95-100.
[8] Martyn, C.N., Barker, D.J. P., Osmond, C., Harris, E.C., Edwardson, J.A. and Lacey, R.F. (1989). "Geographical relation between Alzheimer's disease and aluminum in drinking water". The Lancet, Vol. 1, pp. 59-62.
[9] McConnachie, G.L., Folkard, G.K., Mtawali, M.A., and Sutherland, J.P. (1999). "Field Trials of Appropriate Hydraulic Flocculation Processes". Wat. Res. Vol. 33, No. 6, pp. 1425-1434.
[10] Muyibi, S. A. and Evison L.M. (1995). "Optimizing Physical Parameters affecting coagulation of turbid water with Moringa oleifera seeds". Wat. Res. Vol. 29, No. 12, pp. 2689-2695.
[11] Muyibi, S. A., (1998). "Moringa oleifera seed extract in water treatment". Journal-Institution of Engineering, Malaysia. Vol. 59, No. 3, pp. 37-50.
[12] Muyibi, S. A., Noor, M.J.M.M, Ding Tai Ong, and Khor Woon Kai. (2001). "Moringa oleifera seeds as A flocculant in Waste Sludge Treatment".
[13] Ndabigengesere, A., Narasiah, K.S. and B.G. Talbot (1995). "Active agents and mechanism of coagulant of turbid waters using Moringa oleifera" Water Research Vol. 29, No. 2, pp. 703-710.
[14] Ndabigengesere, A. and Narasiah, K. S. (1998). "Quality of water treated by coagulation using Moringa oleifera seeds". Wat. Res. Vol. 32, No. 3, pp. 781-791

