



Evaluation of *Moringa oleifera* seed as coagulant for water treatment

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Abstract

Water is used for several purposes by humans but the level of purity of the water being consumed is very crucial since it has a direct effect on health. In the present study efficacy of *Moringa oleifera* seed extract as a natural coagulant in water treatment was investigated. Highly turbid water was collected from a river. Collected water samples were treated with varying concentrations of *Moringa oleifera* seed extract: 50 mg/l, 100 mg/l, 150 mg/l, 200 mg/l and 250 mg/l. The collected water samples from the river were analyzed before and after treatment with *Moringa oleifera* seed extracts at varying concentrations for different parameters – pH, conductivity, turbidity and total solids – to evaluate the suitability and effectiveness of moringa oleifera seed extract in treating highly turbid water. Significant reduction in all parameters analyzed with increased doses of *Moringa oleifera* seed extract was observed, with the exception of the pH, which remained fairly constant at all doses. It was therefore concluded that *Moringa oleifera* seed extract acts as a natural coagulant for the treatment of highly turbid water. This should be an encouragement for developing countries.

Keywords: *moringa oleifera* seed, water treatment, coagulant

Introduction

Water is a renewable natural resource. Due to ever increasing industrialization, urbanization, this precious resource is continuously under stress. There are multiple dimensions to water quality and its deterioration. Water pollution is rendering much of the available water unsafe for consumption. The pressure of increasing population, loss of forest cover, untreated effluent discharge from industries and municipalities, use of non-biodegradable pesticides/fungicides/herbicides/insecticides, use of chemical fertilizers instead of organic manures, etc. are causing water pollution (Folkard *et al.*, 1999; Bhuptawat *et al.*, 2007) ^[4, 7]. Moreover, there are numerous water borne diseases like cholera, diarrhoea, dysentery etc. which are transmitted by drinking contaminated water. There are various new water purification techniques which have come up to purify water for example by using rechargeable polymer beads, using the seeds of *Moringa oleifera* tree, purifying water by using aerobic granular sludge technology etc. (Madsen *et al.*, 1987) ^[6]. Research is being conducted all over the world to develop more and more techniques which can generate pure water at low cost. All these techniques are being developed to ensure that in near future everyone will have access to clean and pure water and that too at an affordable cost (Wright *et al.*, 2004) ^[4].

Moringa is one of the most useful trees in the world; with a huge amount of benefits. The plant possesses many valuable properties which make it of great scientific interest. *Moringa oleifera* is a tropical multipurpose tree that naturally grows in India, South-Saharan Africa and South-America (Jahn, 1988) ^[5]. Almost every part of the plant (leaves, flowers, seeds, roots and bark) can be used as food or with medicinal and therapeutic Purposses (Anwar *et al.*, 2007) ^[2], specially in

developing countries. *Moringa oleifera* seeds also contain between 30-35 % (w/w) of vegetable oil (Sengupta and Gupta, 1970), known as "Behen" or "Ben" oil. *Moringa oleifera* seeds are also used as a primary coagulant in drinking water clarification and wastewater treatment due to the presence of a water-soluble cationic coagulant protein able to reduce turbidity of the water treated. Seeds are powdered and added to the water straight or after preparing crude extract. In the present study Seed powder of *Moringa oleifera* were used to remove the turbidity.

Materials and method

Plant Material

Moringa Oleifera seeds were collected from surroundings of Mumbai and Nashik districts of Maharashtra. *Moringa oleifera* (good quality dried drumstick were selected and) wings and coat from seeds were removed. Fine powder was prepared by using mortar and pestle and this powder was directly used as coagulant. Turbid water sample was collected from Mithi River, Mumbai City for the study purpose. Treatment to water was given by directly using seed powder. The water quality parameters were checked before and after treatment. Doses of seed powder i.e. 50, 100 and 150 mg/l were selected for treatment. The coagulant was mixed with drinking water sample and kept on the shaker for 45 min at 110 - 120 rpm. The settling time was 1 - 2 hours (depending on the water turbidity) (Ndabigengesere and Narasiah, 1998) ^[7]. After sedimentation, supernatant of treated water was used for test. The water quality parameters were checked for physicochemical and bacteriological parameters as per standard methods (APHA, 1998) ^[1] before and after the treatment. The efficiency dose of *Moringa oleifera* seed powder was determined.

Results and discussion

The water samples were collected from Mithi River, following drinking water quality parameters were analyzed before and

after the treatment of various doses of *Moringa oleifera* seed powder.

Table 1: Physico-chemical characters of river water before and after treatment with various doses of *M. oleifera* seed powder

No	Parameter	Before Treatment	After Treatment			WHO Standards
			50 mg/l	100 mg/l	150 mg/l	
1.			Colorless	Colorless	Colorless	Colorless
2.	Colour	Faint Broun	Colorless	Colorless	Colorless	Colorless
3.	pH	8.40	7.77	7.20	6.87	6.5-8.5
4.	Turbidity (NTU)	15.4	11.2	8.84	4.44	5
5.	TDS (mg/l)	650.7	422.3	342.6	112.5	500
6.	Total alkalinity (mg/l)	150	89	78	72	200
7.	Total hardness (mg/l)	256.3	166.3	126.3	96.3	500
8.	Chloride (mg/l)	11.7	9.6	7.3	6.2	250
9.	MPN (100/ml)	2400	1100	460	210	Nil

The initial brown colour of the river water sample was completely removed after the treatment of *M. oleifera* seed powder. This suggests that the *M. oleifera* seeds show absorbent properties. Good clarification is obtained if a small cloth bag filled with the powdered seeds of the moringa is swirled round in the turbid water. During the present study, treatment of *Moringa oleifera* seed powder was given to river water in different doses. During the analysis, it was observed that after treatment with Moringa seed powder; pH was decreased at 50 and 100 mg/l dose, but at 150 mg/l dose, it was partially increased. It was observed that the initial turbidity was 15.4 NTU in the river water sample which was beyond the limit as per WHO standards in surface water. In the present study it was observed that the use of *Moringa oleifera* seed powder showed decreased turbidity with increased dose from 50, 100 and 150 mg/l respectively. In case of TDS, initial range was above 600-700 mg/l and is within permissible limits of WHO (WHO, 2006) [9]. After the treatment of *M. oleifera* seed powder, the total solids and total dissolved solids were reduced from the river water. The range of total solids was found between 350-500 mg/l and for total dissolved solids range was 200 - 350 mg/l, and these were present within the limits. Alkalinity during the present study was observed to be 150 mg/l. At various doses of *Moringa oleifera* seed powder, it was observed that the alkalinity reduced after the treatment at 50 mg/l dose but at higher doses i.e. 100 and 150 mg/l, the alkalinity was increased. MPN means total coli forms which are calculated quantitatively. The presence of coli forms indicates that the water is feacally contaminated and not safe for drinking purpose. Due to coli forms various waterborne diseases occur and therefore, MPN should be nil for drinking water. In the present study, it was observed that the initial MPN was present beyond the limits of WHO standards (WHO, 2004). After the treatment, MPN / 100 ml coli form was decreased from low dose to high level dose of *M. oleifera* seed powder. The MPN was present in the range 200-250 coliforms/ml in all samples after the treatment which indicates that it is above the limits of WHO standards.

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.

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