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Drumstick seed as a coagulant

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ABSTRACT

The results of investigation using drumstick seed powder as a natural coagulant are reported. The raw waters used for experimental work encompassed turbidity values ranging from 32 to 210 NTU, and, PH values ranging from 6.5 to 9.1. The results of the work clearly indicate the effectiveness of the drumstick seed as a coagulant and compares well with alum for treatment of turbid waters. The findings of the work will be of immediate application in rural water supplies in the developing countries.

DESCRIPTION OF DRUMSTICK PLANTS AND SEEDS

The scientific name for drumstick plant is Moringaceae. It has several species. Most of them are grown in India, Africa, S. America and, many Asian countries. The author has investigated two species which are common in India and Ethiopia.

Moringa stenopetala is found in many parts of Ethiopia. The seeds for the experimental work were collected from Arba Minch, Konso and, Omoratte. *Moringa oleifera* is found in Errer Gota near Dire Dawa in N.E. Ethiopia. This is the species which is commonly grown in the backyards of dwellings and gardens in South India. The fruit of this is commonly known as "drumstick", and is popular as a vegetable in S. India. The leaves are also used for making green-leaf curry, both in S. India and in Ethiopia. Both fruits and leaves are supposed to be good for heart and against diabetes.

The name "Moringa", is derived from the Dravidian (S. India) word "Morunga", which probably indicates the original home of the plant. The seeds of *M. oleifera* for the experimental work were collected from Error

Gota (Ethiopia) and Bangalore and, Tirupati (S. India).

The trees of both species of *Moringa* reported in the paper grow to height of about 4 meters in 12 months from seeds and start giving fruits for seeds in 13 to 15 months. The height of the trees when fully grown may be 5 to 6 meters. Only the ripe fruits are suitable for removing seeds, for coagulation. If plants are manured and watered regularly, yield from each plant can reach 1000 fruits per year. The author has grown *M. oleifera* several times in the last 30 years and, *M. stenopetala* has been observed for about 2 years. Each fruit on average gives 8 good and useful seeds. The powder for coagulation is to be obtained from the kernels by removing the shell of the seed. The details regarding the weights of seeds and kernels are given in Table I. The useful life of *Moringa* trees of the above two species is expected to be 8 to 10 years.

EXPERIMENTAL SAMPLES

The water samples were collected both in dry and wet seasons from the river Kulfo, lake Abbaya and, lake Chamo; all within 10 km radius from the Institute. The raw water characteristics are given in Table II.

The drumstick fruits were plucked when fully matured and when showing symptoms of drying. Fruits were either dried in the sun or in shade. Table I gives the places, from where the fruits were gathered for testing. The seeds were removed from the fruits and dried in the shade for several days before using. Kernels from seeds were separated by ripping off the husk, just before powdering for use in the experiments.

TABLE I

MORINGA SEEDS, THEIR AVERAGE WEIGHTS AND USEFUL KERNAL WEIGHTS

Species	Sample from	Wt. Per seed	Wt. of Kernal	Wt. of Kernal as % of seed
M.stenopetala	Arba Minch (E)	590	500	84.57
M.stenopetala	Konso (E)	480	430	89.58
M.stenopetala	Omoratte (E)	380	320	84.21
M.oleifera	Errer Gota (E)	240	180	75.00
M.oleifera	Bangalore (I)	330	290	87.88
M.oleifera	Tirupati (I)	340	300	88.24

Note: E = Ethiopia; I = India
 weight in milligrams and rounded to nearest 10

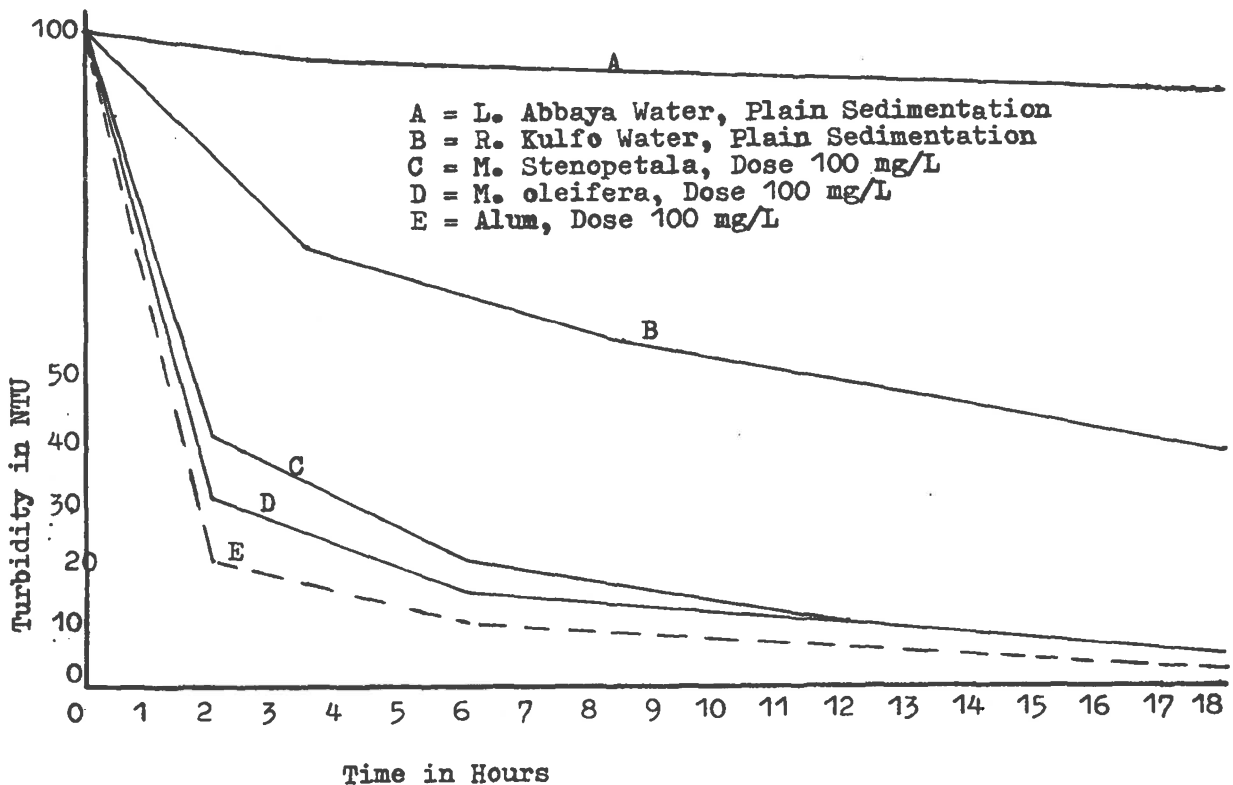


FIGURE I

RELATIONSHIP BETWEEN DOSE, TURBIDITY & SEDIMENTATION TIME

TABLE II
PARTICULARS OF RAW WATERS

Source	Turbidity range	PH range
River water (Kulfo)	32 - 210*	7.5 - 8.5
Lake water (Abbaya)	80 - 110	8.1 - 9.1
Lake (Chamo)	20 - 40	8.8 - 9.2

Note: Turbidity units are in NTU

* High turbidity values after rainy days

EXPERIMENTAL WORK

The Laboratory analysis was carried out in the Water Treatment Laboratory of the Department of Sanitary Engineering (Env. Engg.) of the Institute. The kernels removed from the seeds were powdered by using pestle and mortar of hard porcelain. Exact quantities of the powder required were weighed using glass weighing-boats on digital Electronic precision balance. Solution of the powder was made in volumetric flasks with distilled water partly filled. After thorough shaking for a few minutes, the balance of water up to the mark was added and shaken. This stock solution was used in the jar test experiments using Hach Floc-Tester. Hach Turbidity meter (Model 2100+) was used for measuring turbidities. Mixing was done manually for one minute and flocculation (slow-mixing) was done for 15 minutes by adjusting the time switch. Flocculation time of 10-15 minutes was found to be satisfactory through initial experiments by varying the times from 5 minutes to 45 minutes. The dose of the solution (containing powder) was added by pipettes and was varied from 20 mg/l to 300 mg/l. The PH adjustment when required was done by adding HCl. Observations were made at intervals to get detention periods from 2 hours to 20 hours. Samples for turbidity measurement were withdrawn by using pipettes fitted with suction bulbs.

RESULTS

The results of the experiments showing the relationship between Turbidity, Dose and Detention period, for powders of seed from *Moringa stenopetala* and

Moringa oleifera, Alum are shown in Fig. 1. Blank samples (plain sedimentation) are also plotted. No significant differences were observed between samples obtained from different places of the same species. Seeds of *M. stenopetala* are bigger and yield more powder. However, *M. oleifera* fruits are more tasty as a vegetable, and hence are recommended in places where they are used as a vegetable. The PH values of water in the range of 6.5 to 9.2 does not significantly affect the dose requirement of seed powder.

CONCLUSION

Drumstick plants can grow in most of the developing countries in tropics. The seeds can be harvested from the plants within a period of 12 to 15 months after showing the seeds. Two or three plants in the backyard will be adequate to supply enough seeds required for treating the waters. The seed powder is quite effective in removing the turbidities up to 300 NTU and up to a PH values of 9.2. A dose of 100 mg/l and overnight clarification are considered adequate for most of the waters to bring down the turbidity values to about 5 NTU. The drumstick seed powder is comparable to Alum up to PH value 7 and is superior at higher values and at lower values.

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