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Cost Effective Technology on Water Purification

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Abstract: Water quality parameter analysis reports that the stored rain water in open tanks used for drinking purpose in the rural sector contains high turbidity and excess amount of iron and magnesium. To remove the turbidity, Moringa seeds are used as natural coagulant agent. This present study clearly explains the method of preparation of coagulant solutions from the moringa seeds and the amount of dosage which could be added with the impure water to remove its turbidity and the presence of excessive chemical content in the stored rain water used for drinking purpose.

Key words: Moringa Seeds · Coagulant Solution · Turbidity removal

INTRODUCTION

Providing potable drinking water to rural population is one of the primary issues for the developing country / nation. Ground water resources are not sufficiently enough to meet this demand. In most of the villages, the villagers stored the rain water in an open tank and use it for drinking purpose without making any pretreatment. Analyzing of water quality parameter on the stored rain water reports that, due to its high turbidity and the presence of excess amount of iron and magnesium it is found not suited for drinking purpose without pre treatment. Treatment with chemical components found economically higher and more over some kinds of unwanted effects are also there if it is added beyond the limit. As an alternate, naturally available Moringa seeds from the Moringa tree found suitable application on removal of turbidity in the stored rain water. Present work clearly explains how the moringa seeds are useful to treat the turbid water for drinking purpose.

Objectives

The Main Objectives of the Study Are:

- Examining the suitability of stored rain water for drinking purpose, by analyzing the water quality parameters.
- To make it suitability for drinking purpose, low cost purification technology using moringa seeds has to be adopted.

MATERIAL AND METHOD

To assess the suitability, stored rain water samples collected from different tanks were tested and reported in Table 1 and the results were compared with standard values in Table 2.

Drinking Water Quality Standard: Table2 explain the standard values to be present in the drinking water

Experimental Analysis

Preparation of Coagulant Solution: To prepare the coagulant solution from Moringa seeds the following steps were followed.

Step 1: Seed Pods are allowed to mature and dry naturally to a brown color on the tree.

Step 2: The seeds are removed from the harvested pods and shelled.

Step 3: The seed kernels are crushed and sieved (0.8 mm mesh or similar). Traditional techniques used to produce maize flour have been found to be satisfactory.

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Table 1: Analysis on water quality parameter before treatment

Parameters	Sample-1 Idampadal	Sample-2 Valantharavai	Sample-3 Ervadi	Sample-4 Michael Pattinam	Sample-5 Thiruppalaikudi	Sample-6 Panchanthangi
|Examination on Physical Parameters						
Appearance	Whitish	Whitish	Whitish	Brownish	Whitish	Whitish
Colour	-	-	-	-	-	-
Odour	None	None	None	None	None	None
Turbidity	150	70	120	120	80	260
Total Dissolved Solids	295	310	670	120	182	260
Electrical Conductivity	420	440	960	170	260	370
Examination on Chemical Parameters						
pH	7.7	7.4	7.8	7.0	6.8	7
Alkalinity pH	0	0	0	0	0	0
Alkalinity Total as Caco3	160	165	315	40	50	120
Total Hardness as Caco3	65	92	100	30	40	60
Calcium as Ca	16	21	24	8	8	16
Magnesium as Mg	6	10	10	2	5	5
Sodium as Na	70	60	160	25	35	50
Potassium as K	8	8	12	4	4	8
Iron as Fe	14	6	12	12	8	40
Manganese as Mn	0	0	0	0	0	0
Free Ammonia as NH3	0	0	0	0	0	0
Nitrite as NO2	0.04	0.06	0.08	0	0	0.08
Nitrate as No3	Nil	2	3	0	0	2
Chloride as Cl	35	35	100	35	40	25
Fluoride as F	0.4	0.6	0.6	0.2	0.2	0.4
Sulphate as SO4	10	13	15	4	0	15
Phosphate as PO4	0	0.12	0	0	0	0.08

Table 2: Drinking water quality standards

	Bureau Indian IS Standards 10500-1983(ISI)		World Health Organization (WHO)		Indian Council of Medical Research (ICMR)		Central Public Health Environmental Engineering and Research Organization (CPHEERO)	
	P	E	P	E	P	E	P	E
Turbidity	2.5	10	5	25	5	25	2.5	10
Total Dissolved Solids	-	-	500	1500	-	-	500	2000
Electrical Conductivity	-	-	1400µS/cm	-	-	-	-	-
Chemical Examination								
pH	6.5-8.5	6.5-9.2	7- 8.5	6.5-9.2	7-8.5	6.5-9.2	7-8.5	6.5-9.2
Alkalinity pH	-	-	-	-	-		-	-
Alkalinity Total as $CaCO_3$	200	600	200	600	50	450	200	600
Total Hardness as $CaCO_3$	300	600	100	500	300	600	200	600
Calcium as Ca	75	200	75	200	75	200	75	200
Magnesium as Mg	50	150	30	150	50	150	30	150
Sodium as Na	-	-	200	-	-	-	-	-
Iron as Fe	0.3	1	-	-	-	-	0.1	1
Manganese as Mn	0.1	0.3	-	-	-	-	0.05	0.5
Nitrite as NO_2	-	-	-	-	-	-	0.02	0.22
Nitrate as NO_3	-	-	-	-	-	-	45	100
Chloride as Cl	250	1000	200	600	250	1000	200	1000
Fluoride as F	0.5	1.5	-	-	-	-	1	1.5
Sulphate as SO_4	150	400	200	400	200	400	200	400

Step 4: The finely crushed seed powder is mixed with clean water to form a paste and is then diluted to the required strength. Dosing solutions can be prepared from 0.5 to 5% concentration (i.e.0.5 to 5g/l)

Step 5: Insoluble material is filtered out using either a fine mesh screen or muslin cloth.

Step 6: The solution is ready for use.

Dosage Calculation: Jar Test method clearly indicates that the amount of dosage to be added with the impure water to remove its turbidity.

Dosage calculations for Water Treatment

Level of Turbidity in NTU	Dosage Range (mg/l)
Below 50 NTU	10-25
Between 50 to 150 NTU	25-75
Above 150 NTU	75-150

RESULT AND DISCUSSION

After treatment with natural coagulant solution prepared from moringa seeds the results on water quality parameters were reported in Table 3.

Reports on water quality parameter shows that the stored rain water contains high level of turbidity and excess amount of iron and magnesium. To remove the turbidity and the excess amount of chemical content moringa seeds are used as natural coagulant to purify the turbid water.

After treatment with moringa oleifera the results on water quality parameters of turbidity and iron concentration were compared with the values of the same parameter before treatment. The level of turbidity and the variation of iron concentration in the selected samples before and after treatment were given in Figure 1.1.

From the above bar chart 1.1.(a) it was observed that the turbidity level varies from 150 NTU to 8 NTU in sample-1. Similarly the variation levels were differed from 70 to 6, 120 to 10, 170 to 6, 80 to 8 and 260 to 10 NTUs for all other respective samples. After treatment the turbidity levels were found within the permissible limit and it is suitable for drinking purpose.

Presence of excess amount of iron concentration is another parameter which affects the portability of water. From the above bar chart 1.1.(b) it was observed that after treatment the level of iron were found below one unit in all the samples. It shows the best performance on water treatment. On removal of turbidity and excess iron concentration the collected samples were found suitability for drinking purpose.

Table 3: Results on Water quality parameters after treatment

	Sample-1 Idampadal	Sample-2 Valantharavai	Sample-3 Ervadi	Sample-4 Michael Pattinam	Sample-5 Thiruppalaikudi	Sample-6 Panchanthangi
Physical Examination	---	---	---	---	---	---
Appearance	Salty Whitish	Sallty Whitish	Salty Whitish	Salty Whitish	Salty Whitish	Salty Whitish
Colour	-	-	-	-	-	-
Odour	None	None	None	None	None	None
Turbidity	8	6	10	6	8	10
Total Dissolved Solids	320	320	685	250	245	245
Electrical Conductivity	460	460	950	360	350	350
Chemical Examination						
PH	7.2	7.6	8.1	6.9	7.3	7.1
Alkalinity PH	0	0	0	0	0	0
Alkalinity Total as $CaCO_3$	150	160	280	140	170	110
Total Hardness as $CaCO_3$	70	72	100	80	90	40
Calcium as Ca	16	16	24	16	20	8
Magnesium as Mg	8	8	10	10	10	5
Sodium as Na	65	65	170	45	30	65
Potassium as K	6	6	12	4	4	6
Iron as Fe	0.8	0.6	1	0.6	0.8	1
Manganese as Mn	0	0	0	0	0	0
Free Ammonia as NH_3	0	0	0	0	0	0
Nitrite as NO_2	0.04	0.06	0.06	0	0	0.06
Nitrate as NO_3	Nil	2	3	2	0	2
Chloride as Cl	35	40	170	25	30	30
Fluoride as F	0.4	0.6	0.8	0.4	0.4	0.4
Sulphate as SO_4	5	13	18	13	13	15
Phosphate as PO_4	0	0.12	0	0	0	0.08

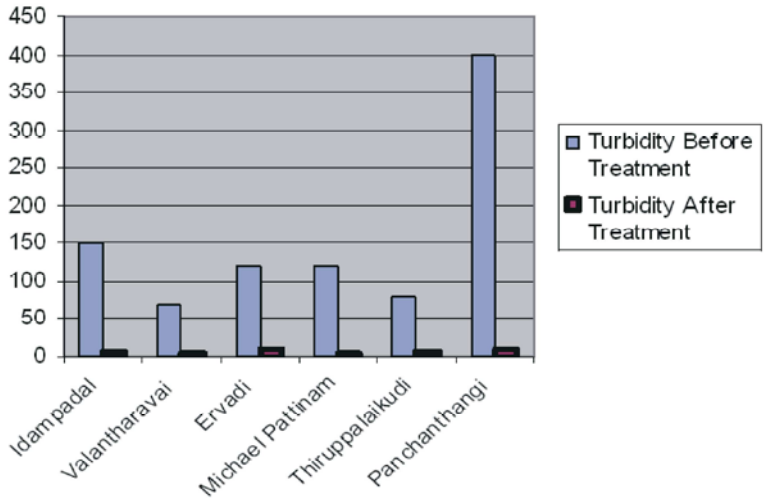

Fig. 1.1.(a): Variation of Turbidity before and After Treatment

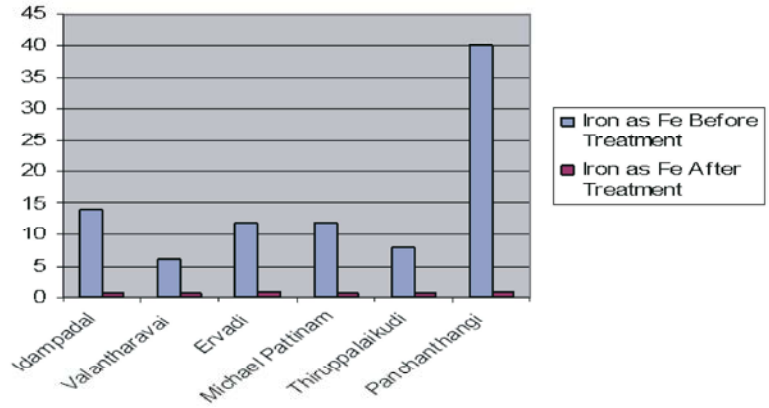

Fig. 1.1.(b): Variation of Iron Concentration before and After Treatment

CONCLUSION

Providing safe drinking water to rural population is the major challenge for a district administration. It could be possible by having the water treatment technology using moringa oleifera coagulant solution. The low cost water treatment using Moringa Oleifera (drumstick) seeds in the form of water soluble extract is suspension resulting an effective clarification agent for highly turbid and untreated pathogenic water. Efficient reduction on high turbidity produces an aesthetically clear supernatant. In addition the presence of excess iron concentration were also be reduced by the same technology. Applications of this low cost treatment technology at rural and urban people living in extreme poverty are leads to provide solution for drinking the highly turbid and micro biologically contaminated water.

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