

## Removal of Hardness from Ground Water Using Natural Coagulants

Hemalatha H.N<sup>1</sup>, Suresha R A<sup>2</sup>, Manojkumar K<sup>3</sup>, Manjunath Katrahalli<sup>4</sup>,  
Zubair Hamid Bhat<sup>5</sup>

<sup>1</sup> Assistant professor, Department of Civil Engineering, JSS Academy of Technical Education, Bangalore, India

<sup>2,3,4,5</sup> Undergraduate students, Department of Civil Engineering, JSS Academy of technical Education,  
Bangalore, India

Corresponding Author: Hemalatha H.N

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**Abstract:** Groundwater is one of the major sources of drinking water. But direct use of water for drinking is not suitable. Because drinking water parameters are not in standard range, developing countries facing problems in potable water because of inadequacy of economic support and technology. They are in need to adopted water treatment. Hardness is caused by the excess mineral soluble substances, which are generally calcium and magnesium. Hardness removal is one of the important steps in water treatment process and is achieved by the coagulation process using chemical based coagulants. But the effectiveness of chemical coagulants are high cost, detrimental effect on human health, large sludge production. So there is need to replace the chemical coagulants with cost effective natural coagulants. In the present study application of natural coagulants in removal of hardness has been attempted in the laboratory. This study deals with low cost water treatment i.e. water purification by using natural coagulants like MoringaOleifera, Okra and water melon seeds. The effectiveness of MoringaOleifera, Okra and water melon seeds powder for different ranges of hardness was determined. Moringaoleifera has the ability to remove the maximum hardness as the dosage is increased. After treatment of water sample with MoringaOleifera, the samples were analysed for different parameters like pH, turbidity, TDS, TS, Hardness, Chlorides, Alkalinity. All parameters were in the range of drinking water standards after treatment(chemical review , 2014)..

**Keywords:** MoringaOleifera, Okra and water melon seeds, hardness removal, Water Quality parameters.

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### I. Introduction

In many developing countries, access to clean and safe water is a major problem. Poor water quality is a key cause of poor livelihood and poor health. Surface water either from rivers or rain fed ponds and lakes has become one of the main sources of water supply. This water is vulnerable to various forms of pollution generated from different sources mainly households and agriculture. Many of the researchers from the world have done their studies on various naturally derived coagulants and flocculants. Natural coagulants of plant origin have been used for water purification for many centuries. Natural coagulants are biodegradable and cost effective for developing countries since they can be locally grown and have a wider range of effective dosage and they produce much lower sludge volume for flocculation of various colloidal suspensions. Deals with application of natural coagulants such as, MoringaOleifera, okra and water melon seeds in softening of hard water with an aim to provide safe drinking water(IJAT. Vol.2, No.1, 2013).

Groundwater is one of the major sources of drinking water. But direct use of water for drinking is not suitable. Because drinking water parameters are not in standard range, developing countries facing problems in potable water because of inadequacy of economic support and technology. They are in need to adopted water treatment. This study deals with low cost water treatment i.e. water purification by using natural coagulants like MoringaOleifera, Okra, and water melon seeds. After treatment of water sample with MoringaOleifera seeds powder were analysed for Hardness for before and after treatment. These parameters where comes in to the range of drinking water standards after treatment(higher Education Commission).

Hardness is caused by the presence of excess minerals soluble substance etc. Hardness removal is one of the important steps in water treatment process and is achieved by coagulation process using natural coagulants. The effectiveness of chemical coagulant are well noted yet the drawbacks associated with it can't be ruled out such as its high cost, detrimental effects on human health, large sludge production. There is thus need to replace the chemical coagulant with cost effective natural coagulants. In present study "Application of natural coagulants in removal of hardness" has been attempted in laboratory. The effectiveness of MoringaOleifera, Okra and water melon seeds for different ranges of hardness was determined. MoringaOleifera

has the ability to remove maximum hardness as the dosage is increased. The study indicated that with the application of above mentioned natural coagulants the hardness of water could be reduced with aim of providing safe drinking water(IJAERS, Vol.1, No.1, 2011)..

## II. Materials And Methodology

Materials used for testing parameter of water are glassware such as burette, pipette, conical flask, beakers, sample bottles for collection of water, hand gloves, glass rod. Instruments such as Jar test instrument. **Natural coagulants used:**For the present study moringaoleifera, okra, and water melon have been used.

### METHODOLOGY:

Samples were collected from ‘CHANNAPATNA’ ground water source. During sampling 20 lts of water was collected in a polythene container. Collected sample was brought to the laboratory immediately and analysed to know the physicochemical characteristics of water sample. Only one parameter analysed in laboratory i.e Total Hardness. The experimental works have been carried out:

- To test on analyzing the physical and chemical characteristics of the sample water taken.
- To check the parameters, whether they are present within the desirable limit according to BIS standards.
- Add suitable natural coagulants for removing of hardness.

### EXPERIMENTAL PROCEDURE.

#### 1. JAR TEST EXPERIMENT

- To determine the optimum coagulant type and dosage required for the sample.
- The dose of coagulant which gives the best flock is the optimum or least amount dose of coagulants.

#### 2. DETERMINATION OF TOTAL HARDNESS

- 25ml of sample in conical flask and add 2ml of buffer solution and a pinch of Erichrome Black-T Indicator.
- Titrate with standard EDTA solution till wine red colour changes to blue.
- Note down the volume of EDTA rundown in ml.

## III. Results And Discussions

### CONCENTRATION OF HARDNESS IN WATER AFTER COAGULATION TREATMENT

#### Coagulant Used: Okra Seeds

From the table A, the volume of sample 50ml is taken at different okra seeds powder dosage 2,4,6,8 and 10gms/l the percentage of hardness removal was found to be increase and decrease while varies the dosage level, the maximum amount of removal percentage obtained was 17.10% at 2gm/L, 36.60% at 4gm/L, 39.51% at 6gm/L, 36.60% at 8gm/L and 37.6% at 10gm/L. The permissible limit of hardness in ground water is 300-600mg/L

| SL. NO | NAME OF THE TEST      | METHOD OF TEST        | CHEMICALS USED                       | NAME OF THE COAGULANT | CONCENTRATION OF COAGULANTS ADDED IN gms |     |     |     |     | PERMISSIBLE LIMIT | RESULTS |
|--------|-----------------------|-----------------------|--------------------------------------|-----------------------|--|-----|-----|-----|-----|-------------------|---------|
|        |                       |                       |                                      |                       | 2  | 4   | 6   | 8   | 10  |                   |         |
| 01     | TOTAL HARDNESS (mg/L) | EDTA TITRATION METHOD | 1.BUFFER SOLUTION<br>2.EDTA SOLUTION | OKRA SEEDS            | 680                                      | 520 | 496 | 520 | 512 | 300-600           | 496     |

Table A

#### Coagulant Used : Water Melon Seeds

From the table B, the volume of sample 50ml is taken at different Water Melon Seeds powder dosage 2,4,6,8 and 10gms/litr the percentage of hardness removal was found to be increase and decrease while varies the dosage level, the maximum amount of removal percentage obtained was 54.15% at 2gm/L, 55.12% at 4gm/L, 54.15% at 6gm/L, 42.40% at 8gm/L and 60.97% at 10gm/L. The permissible limit of hardness in ground water is 300-600mg/

| SL.NO | NAME OF THE TEST      | METHOD OF TEST      | CHEMICALS USED                       | NAME OF THE COAGULANT | CONCENTRATION OF COAGULANTS ADDED IN gms |     |     |     |     | PERMISSIBLE LIMIT | RESULTS |
|-------|-----------------------|---------------------|--------------------------------------|-----------------------|--|-----|-----|-----|-----|-------------------|---------|
|       |                       |                     |                                      |                       | 2  | 4   | 6   | 8   | 10  |                   |         |
| 02    | TOTAL HARDNESS (mg/L) | EDTA TITRANT METHOD | 1.BUFFER SOLUTION<br>2.EDTA SOLUTION | WATER MELON SEEDS     | 376                                      | 368 | 376 | 472 | 320 | 300-600           | 320     |

Table B

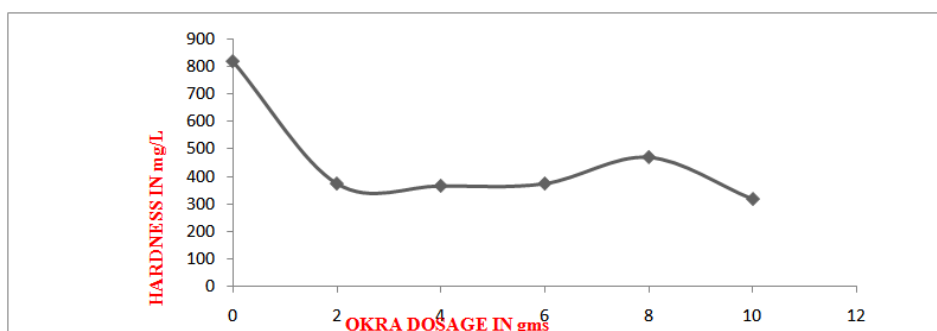
**Coagulant Used :MoringaOleifera Seeds**

From the table C, the volume of sample 50ml is taken at different Moringaoleifera Seeds powder dosage 2,4,6,8 and 10gms/litr the percentage of hardness removal was found to be increase and decrease while varies the dosage level,the maximum mount of removal percentage obtained was57.80% at 2gm/L, 55.12% at 4gm/L, 63.41% at 6gm/L, 53.66% at 8gm/L and 60.97% at 10gm/L. The permissible limit of hardness in ground water is 300-600mg/

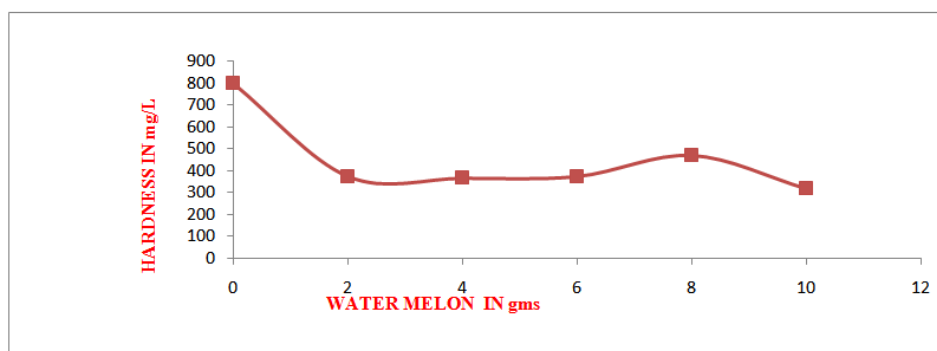
| SL.NO | NAME OF THE TEST      | METHOD OF TEST      | CHEMICALS USED                       | NAME OF THE COAGULANT | CONCENTRATION OF COAGULANTS ADDED INgms |     |     |     |     | PERMISSIBLE LIMIT | RESULTS |
|-------|-----------------------|---------------------|--------------------------------------|-----------------------|---|-----|-----|-----|-----|-------------------|---------|
|       |                       |                     |                                      |                       | 2                                       | 4   | 6   | 8   | 10  |                   |         |
| 02    | TOTAL HARDNESS (mg/L) | EDTA TITRANT METHOD | 1.BUFFER SOLUTION<br>2.EDTA SOLUTION | MORINGA OLEIFERA      | 346                                     | 368 | 300 | 380 | 320 | 300-600           | 300     |

Table C

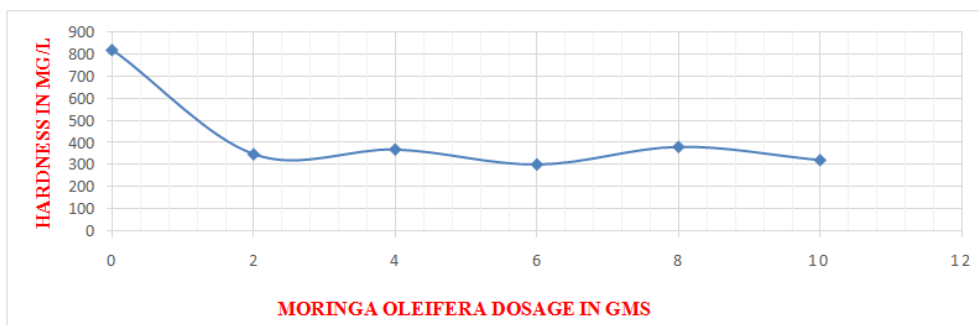
**GRAPHS FOR REMOVAL OF HARDNESS**



Performance of okra with varying dosage (Graph1)



Performance of water melon seeds with varying dosage(Graph 2)



Performance of moringaoleifera with varying dosage (Graph 3)

Optimum dosage experimental results

| Name of the coagulants | Dosage in gms |   |   |   |    | Performance in terms of % removal |       |       |       |       |
|------------------------|---------------|---|---|---|----|-----------------------------------|-------|-------|-------|-------|
|                        | 2             | 4 | 6 | 8 | 10 | 57.80                             | 55.12 | 63.41 | 53.66 | 60.97 |
| Moringaoleifera        | 2             | 4 | 6 | 8 | 10 | 57.80                             | 55.12 | 63.41 | 53.66 | 60.97 |
| Water melon seeds      | 2             | 4 | 6 | 8 | 10 | 54.15                             | 55.12 | 54.15 | 42.4  | 60.97 |
| Okra                   | 2             | 4 | 6 | 8 | 10 | 17.1                              | 36.6  | 39.51 | 36.6  | 37.6  |

Table D

The permissible limit of hardness in ground water is 300-600mg/L. As per the above results (Table D) obtained the best suitable seed which effectively removes the hardness from the ground water is Moringaoleifera.

#### IV. Conclusion

- The seeds used in the experimental tests are Moringaoleifera, Okra seeds and Water melon seeds. As per the results obtained the best suitable seed which effectively removes the hardness from the ground water is Moringaoleifera.
- Increased hardness removal efficiency was obtained for moringaoleifera.
- Moringaoleifera seeds can be effectively used for hardness removal.
- It is easily available and cost effective.

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