Treatment of Underground Water by Using Natural Zeolites

Dr. Sami Taha Ahmed Aladimy[1] Dr. M. B. Mule[2]

[1,2]Department of Environmental Science

[1,2]Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (MS), India

Abstract— The treatment of groundwater became necessary to improve the quality of drinking water and to reduce contaminates from groundwater resources. Because of the high cost of treatment technique, most of the studies turned to decrease the cost of treatment technique of water to find out the cheap and available technique to anyone and anywhere. In this investigation, the natural zeolites was used as an absorbent to reduce the dissolved salts from groundwater and at the same time increasing the quality of drink water. The zeolites was grand and mixed with groundwater sample, the physicochemical parameters such as hardness, Cl-, Na+, K++, Mg+ and Ca+ ions of groundwater sample was analyzed before and after mixing with zeolites. The results recorded and the conclusion was that zeolites have good results to reduce the total hardness and ions of dissolved salts from groundwater and the extra amount of zeolites in the underground water leads to increasing of the reducing of hardness and dissolved ions in the underground water.

Key words: Groundwater, Natural Zeolites, Dissolved Salts, Treatment

I. INTRODUCTION

Water is a main natural resource and is considered as a valuable national asset. It is a major compound of all living beings and is one of the fundamental requirements in the world. Water is the most important need for human existence and for the development of any ecological balance and for society. The different purposes of Water are ranging from domestic, industrial, agriculture, and other purposes. Water is one of the basic needs of human being, animal and plant life (Mariappan et. al, 2000).

Groundwater is the primary source of water supply for domestic, industrial and agriculture uses in Maharashtra state; it represents almost eight percent of the drinking water requirements in rural areas, fifty percent of urban water requirements and more than fifty percent of the irrigation requirements of the nation. Ground water occurs in weathered portion, along with the joints and fractures of the rocks.

In nature, groundwater contains mineral ions. These ions dissolve slowly from sediments, soil particle and rock. The water travel along minerals surface in the holes or fracture of the aquifer and the unsaturated zone, this referred to as dissolved solids. The quality of ground water depends on various chemical quantities and their concentration in the water. The pollution of ground water is causing by human activities like industrial and domestic activities. The water pollution is causing many diseases like hair, skin and eye diseases and other severe diseases (Chakroborty, 1999).

II. STUDY AREA

The samples have been collected from Jaisingpura area as Site1 (S1), and the another sample was taken from Rauza baug area Site2 (S2) both of sites in Aurangabad city of Maharashtra state of India
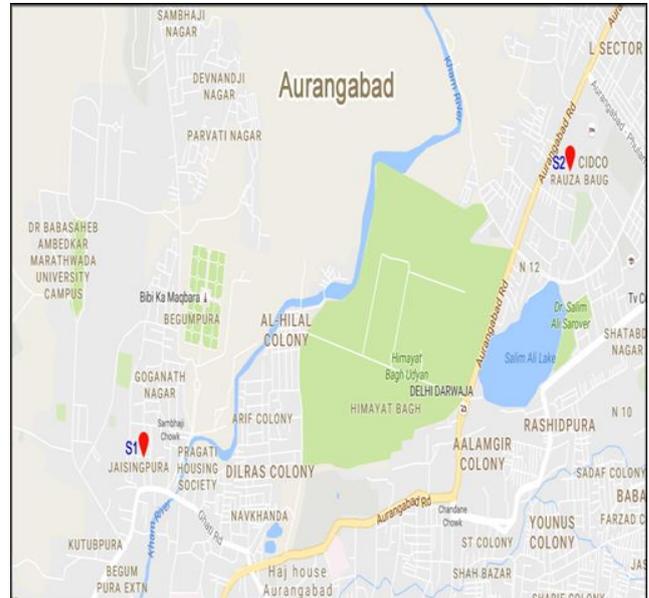

Fig. 1: Map of Aurangabad showing the sampling sites

III. MATERIAL AND METHODOLOGY

In this study, natural zeolites collected from the different sites in Aurangabad, one of these sites was Dr. Babasaheb Ambedkar Marathwada University. After collection, the stones cracked and grand by and converted it into powder. The water sample mixed with the powder of zeolites and left it for 30 minutes. The mixture filtered and the filtered sample analyzed for determines the efficiency of zeolites for reducing the hardness and dissolved salts in groundwater samples.

The chemical materials, procedures, methods were prepared and achieved as per of APHA (2000), Trivedy and Goel (1986), NEERI (2007).

IV. RESULTS AND DISCUSSION

The results of samples analysis were recorded in the table (1) and table (2) for Site 1 and site 2 respectively.

In the site1 the zeolites reduced the pH from 8.4 to 8.2, chloride ions from 213 mg/L to 146.26 mg/L, total hardness from 540 mg/l to 380 mg/l, calcium from 101.8 mg/L to 76.152 mg/L, magnesium from 106.9 to 74.138 mg/L, sodium from 95 mg/L to 91mg/L and potassium ions has still without any changes.

In the site2 the zeolites also reduced the pH from 8.5 to 8.3, chloride ions from 276.9 mg/L to 234.3 mg/L, total hardness from 360 mg/l to 220 mg/l, calcium ions from 12.02 mg/L to 8.420 mg/L, magnesium ions from 84.9 to 75.53 mg/L, sodium ions from 111 mg/L to 104mg/L and potassium ions has still without any changes. The obtained results compared with the standard value for water quality of WHO, BIS and ICMR.

In this study, zeolites have the good efficiency to reduce hardness and dissolved salts in the underground water, and zeolites are useful absorbent for reducing the water with high hardness because of the high quantity of calcium and magnesium content.

There are many researchers have mentioned that natural zeolites were used for the treatment of contaminated water. There are two types of naturally occurring zeolites minerals used in treatments: clinoptilolite and modernite. Natural zeolites are used for water treatment in households and industrial sector (Margeta et al., 2011).

(Widiastuti et. al., 2008; Wang and Peng, 2010; Widiastuti et. al., 2011) they are indicating that the zeolites can be used for removal of some selective parameters.

The Natural and modified zeolites have shown good results used for water purification and they have the best performance with up to 97% for removal ammonium and this depending on contact time, pH, zeolites loading, initial ammonium, concentration value. The studies showed that the desorption of ammonium on the zeolite is high sufficiently (Widiastuti et al., 2008).

Sr. No.	Parameters	Before Mean ±SD	After Mean ±SD
1	pH	8.4±1.5	8.2±1.4
2	Chloride (Cl⁻) mg/L	213±2.0	146.26±4.6
3	Total Hardness (TH) mg/L	540±3.2	380±5.2
4	Calcium (Ca⁺⁺) mg/L	101.8±1.2	76.152±1.8
5	Magnesium (Mg⁺⁺) mg/L	106.9±2.4	74.138±1.2
6	Sodium (Na⁺) mg/L	95±1.8	91±1.9
7	Potassium (K⁺) mg/L	1±0	1±0

Table 1: Results of selected chemical parameters of the underground water sample collected from Jaisingpura area (Site1) at Aurangabad before and after treating with zeolites

Sr. No.	Parameters	Before Mean ±SD	After Mean ±SD
1	pH	8.5±1.8	8.3±1.5
2	Chloride (Cl⁻) mg/L	276.9±2.1	234.3±3.8
3	Total Hardness (TH) mg/L	360±3.0	220±5.2
4	Calcium (Ca⁺⁺) mg/L	12.02±2.2	8.420±1.05
5	Magnesium (Mg⁺⁺) mg/L	84.9±1.6	75.537±1.4
6	Sodium (Na⁺) mg/L	111±1.9	104±2.4
7	Potassium (K⁺) mg/L	1±0	1±0

Table 2: Selected chemical parameters as control parameters of the underground water sample collected from Roza bagh area (Site2) at Aurangabad.
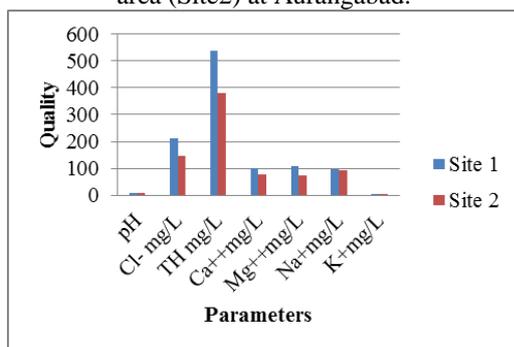

Fig. 2: Graph showing the Quality of water samples of Site 1 and Site 2

V. SUMMARY AND CONCLUSION

In this study the natural zeolites was used for the treatment of underground water samples that collected from two sites in Aurangabad city of Maharashtra state. The sodium was changed slightly and potassium was not changed in this treatment. Zeolites was reduced the total hardness and calcium significantly. The natural zeolites can be used for the removal of calcium content and hardness selectively.

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