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Assessment of groundwater quality in selected block of Madhya Pradesh

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Abstract
A study was carried out in selected blocks to assess the ground water quality in selected location in tribal districts of Madhya Pradesh. The various physical parameters (pH, EC, TSC), major constituents (calcium, magnesium), secondary constituents (carbonate, bicarbonate), minor constituents (iron, manganese and zinc) and other constituents like boron and phosphorous were analyzed in at ground water quality in open well. The results were compared with standard permissible limits of BIS, Royal Irrigation Department and FAO which show most of ground water samples of study area in 2013-14 were fall in “good to permissible limit” category and suitable for irrigation and tolerant. But, the study also indicates in few sampling ground water quality is deteriorating and found not suitable for any uses and it is because pollution.

Keywords: Ground water quality, pollution of water, irrigation water

Introduction
Groundwater is the major source of water for agricultural sector in many countries. The total water resource available in India is 1850 Km^3, which is roughly 4% of the world’s fresh water resources. Ground water quality plays an important role in groundwater protection and quality conservation. Water quality has become a major concern due to ever increasing human development activities that over exploit and pollute the water resources. Water resources in India have reached a point of crisis due to unplanned urbanization and Industrialization (EPA-PWD, 2001) [1]. Therefore, water quality issues and its management options need to be given greater attention in the developing countries. Intensive agricultural activities have increased the demand on groundwater resources in India. Water quality is influenced by natural and anthropogenic effects including local climate, geology and irrigation practices [2]. Since then there are lot of changes has occurred in pattern of ground water utilization, recharge, and land use and purpose of water uses [3]. Studies under this objective were concentrated on ground water quality in tribal belt of Madhya Pradesh [4]. Most human activities whether domestic, agricultural or industrial have an impact on water and the ecosystems. There are indication of water quality change in Jabalpur, Mandla, Dindori and Seoni districts due to various reasons [5]. The industrial development in the tribal belt of M.P. is lower as compared to other area. The objective of this study to assessment of groundwater quality in selected location in tribal districts of Madhya Pradesh.

Material and Methods
Water samples were collected as per standard method of sampling techniques, for the year 2013.There were seventy nine samples from selected location. Collection was made from nine blocks such as - Kundam, Bajag & Karanjia, Mohgaon&Bichhia, Chhappra,Kurai, Keolari & Ghansore from districts of Madhya Pradesh- Jabalpur Dindori, Mandla and Seoni [6]. Composite sample was stored in non-reactive plastic bottles. Plastic bottles of 1 liter capacity with stopper were used for collecting samples. Each bottle was washed with 2% Nitric acid and then rinsed three times with distilled water. The bottles were then preserved in a clean place. The bottles were filled leaving no air space, and then the bottle was sealed to prevent any leakage [7]. Each container was clearly marked with the name and date of sampling. Groundwater samples were collected between 8 am to 11.00 am [8]. Open well samples werecollected from selected location.

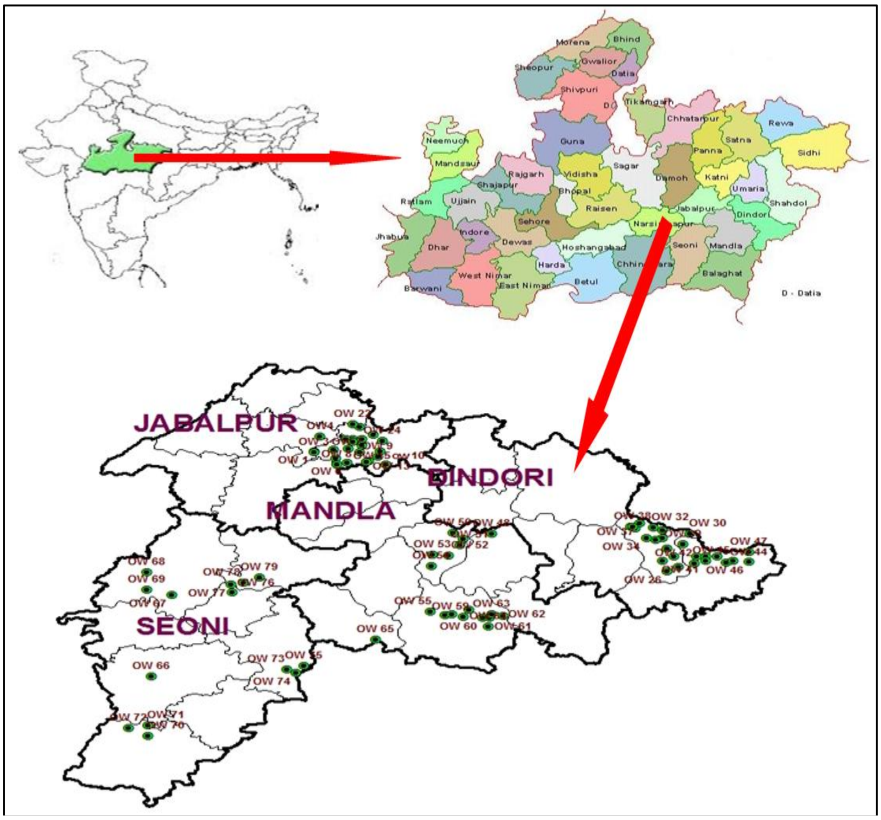

Fig 1: Location of ground water sampling

Result and Discussions

The major physico-chemical parameters, which decide the suitability of ground water for irrigation, are pH, EC, Alkalinity, Bicarbonate, Carbonate, Ca^{2+}+$Mg^{2+,}$ Cadmium, Chloride, Chromium, Copper, Iron, Lead, Manganese, Nickel, Nitrate, Phosphorus, Potassium, Sodium, zinc were determined by the standard methods. The groundwater qualities are affected by domestic waste, Urbanization and mismanagement of agriculture practices. Water quality for irrigation use depends upon the mineral constituent present in water.

Physical Parameters: pH, EC.

The acidity or basicity of irrigation water is expressed as pH (<7.0 acidic; >7.0 basic). It has been established that normal pH range for irrigation water is from 6.5 to 8.5 as per BIS.During year 2013, the pH value of ground water samples of all blocks under consideration fall within the permissible range of 6.5-8.5 (Fig.2). The maximum average value of pH have found 7.8 in Keolari block and 7.7 Ghansore block of Seoni district respectively, and minimum value was found 6.9 in Karanjiablock of Dindori district and 6.95 in Kurai block of Seoni district respectively.

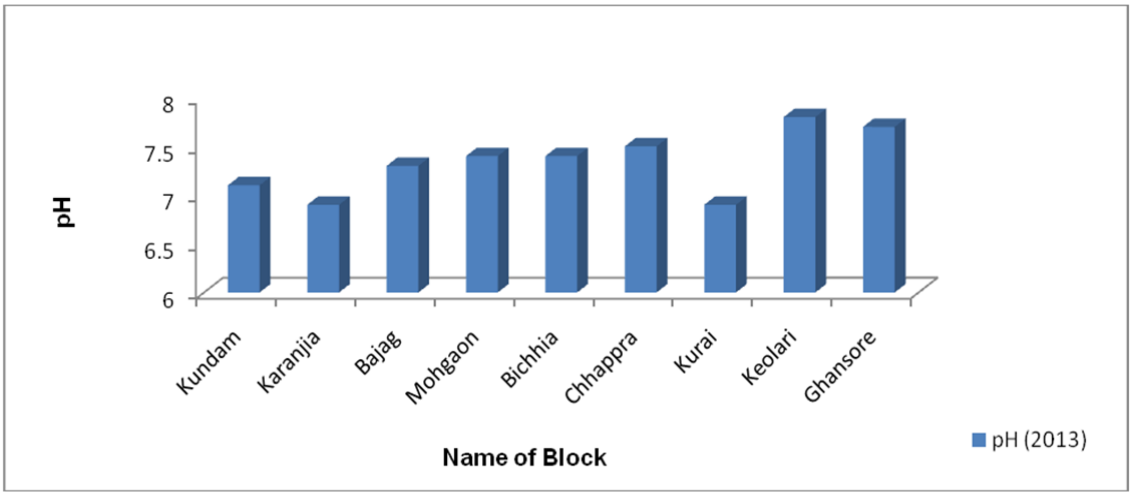

Fig 2: Block wise concentration of pH- present values.

Ground water salinity is usually measured by the TDS (total dissolved solids) or the EC. Permissible limit of EC for irrigation water is 3000 µS/cm. During the year 2013, the concentration of EC ranged between 247.5 to 1567.7 µS/cm (Fig. 3) i.e. under the safe limit. The concentration of EC was found maximum in Keolari block (1567.7 µS/cm) and minimum in Bichhia block (247.5 µS/cm).

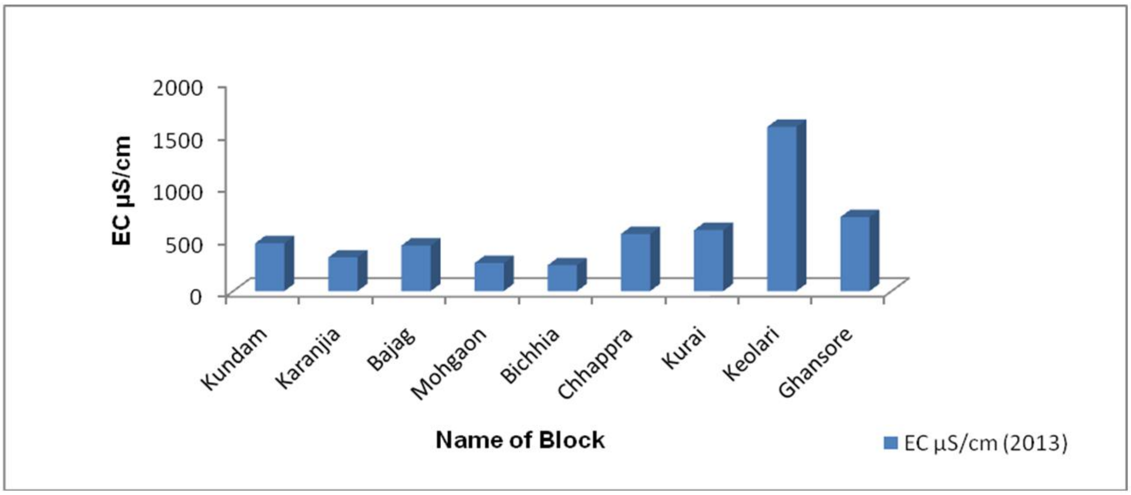

Fig 3: Block wise concentration of EC- present values

Major Constituents; Calcium, Magnesium:

Calcium is a major constituent of igneous rocks. The range of calcium content in ground water is largely dependent on the solubility of calcium carbonate, sulphide and rarely chloride. Magnesium content of water is considered as one of the most important qualitative criteria in determining the quality of water for irrigation. Generally, calcium and magnesium maintain a state of equilibrium in most waters. More magnesium in water will adversely affect crop yields as the soil become more alkaline. Magnesium is an important constituent of basalt. It's solubility in water is around five times that of calcium. Calcium and Magnesium together cause the hardness of water. EDTA titration was used to determine the magnesium concentration in the samples. Calcium and magnesium ions in irrigation water tend to keep soil permeable and in good tilth and Magnesium are essential to normal plant growth. The recommended safe limit for total hardness Ca+Mg according to BIS for irrigation water is 2000 ppm respectively. During the observation period 2013 the concentration Ca+Mg was found under the permissible limit in ground water sample obtained from different location. The maximum Ca+Mg value was found in Kundam block (837.8 ppm) and Keolari block (784.9 ppm) andminimum concentration of Ca+Mg was found in Bajag block (379.68 ppm) respectively (Fig.4).

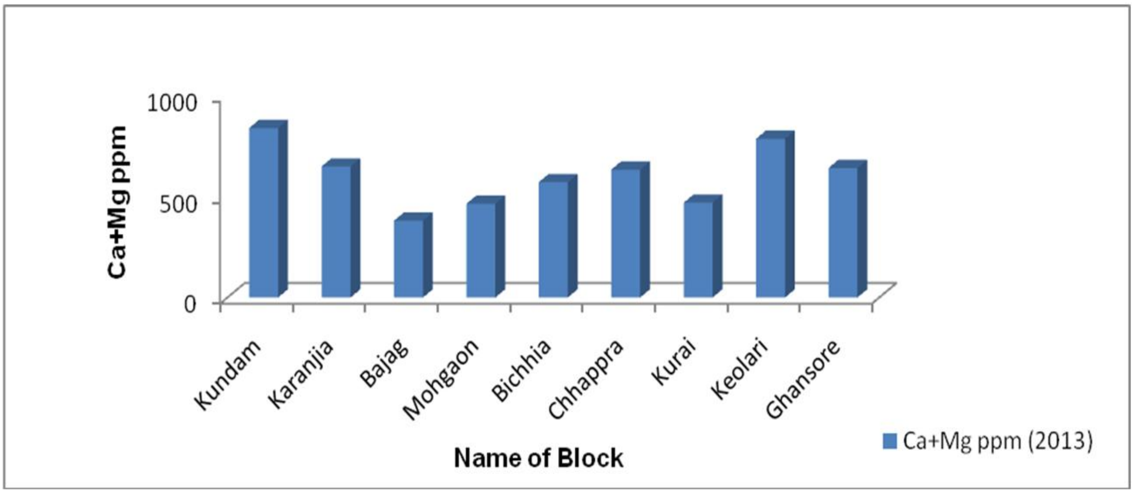

Fig 4: Block wise concentration of Ca + Mg – present values

Secondary Constituents; Carbonate, Bicarbonate:

The Concentration of carbonate and bicarbonate also influence the suitability of water for irrigation purpose. Concentration of CO_3 and HCO_3 represent the total alkalinity. The permissible limit for both carbonate and bicarbonate for irrigation water is 600 ppm. Generally CO_3 is not present in good quality of water. During the observation, CO_3 was found in two blocks Keolari (382.2 ppm) and Ghansore (22.5 ppm) (Fig.5), and in rest of the blocks carbonate was not present or present with minimum concentration. Concentration of bicarbonate was found under safelimit in all blocks the maximum concentration of HCO_3 was found in Keolari block (345.7 ppm) followed by Ghansoar 280.7 ppm (Fig. 6) and minimum concentration was found in Bichhia 139.08 ppm and Mohagoan 156.86 ppm (Fig. 6). An increased value of CO_3 and HCO_3 increases RSC which increases pH and land irrigated with such water becomes infertile owing to deposition of sodium carbonate as indicated by black color of the soil.

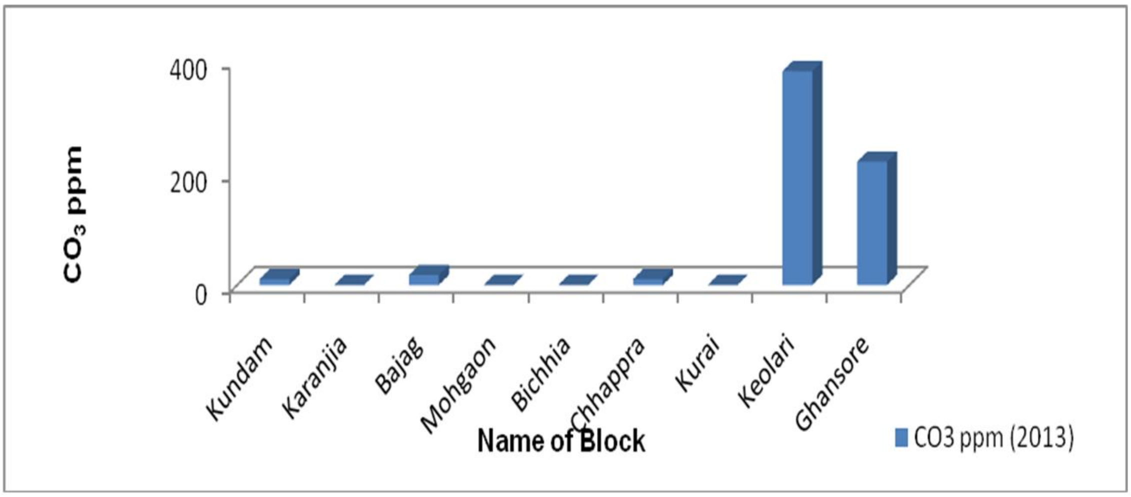

Fig 5: Block wise concentration of CO_3 - present values

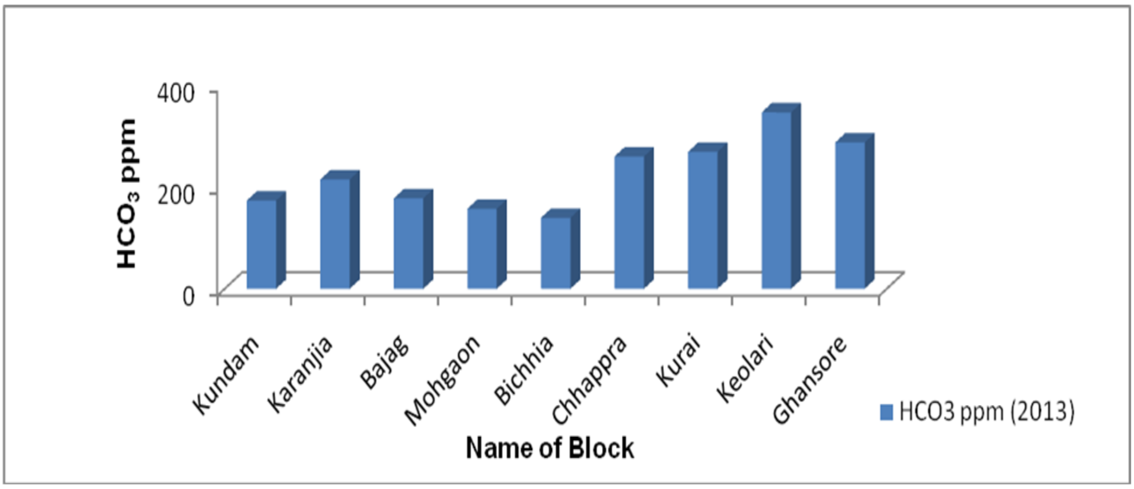

Fig 6: Block wise concentration of HCO_3 - present values

Minor Constituents; Fe, Zn, Mn:

Iron occurs in water either as ferrous iron or Ferric iron. The Iron content in small quantity is desirable for plant growth especially for vegetable. The permissible limit of Iron content in irrigation water is 5 ppm according to FAO and Royal irrigation department and 1 ppm by BIS. Large quantities cause unpleasant, metallic, bitter taste and favour the slimy growth of iron bacteria. The maximum concentration of Iron (0.018 ppm and 0.0172 ppm) (Fig.7) was recorded in Kurai and Mohgaon block respectively. The minimum concentration of Iron (0.0008 ppm and 0.003 ppm) was recorded in the ground water sample obtained from Karanjia block and the rest of the sample concentration of Iron was observed under the desirable limit.

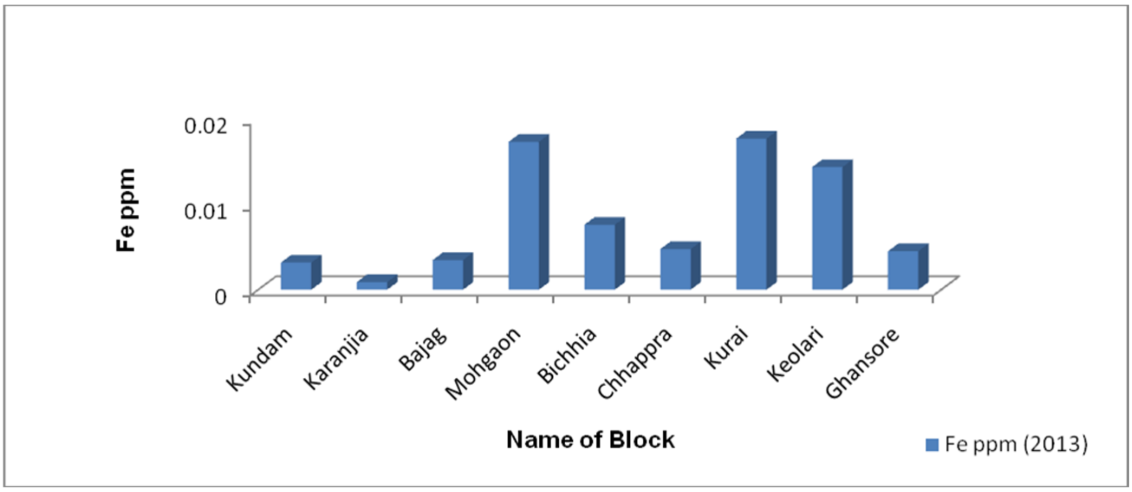

Fig 7: Block wise concentration of Fe - present values

Manganese is essential plant nutrient but is toxic when its concentration is exceeding 0.2 ppm [3]. The desirable limit for manganese is 0.1 ppm and the permissible limit in the absence of alternate source is 0.4 ppm. Beyond this limit taste and appearance are affected and has the adverse effect on domestic uses and water supply structures. Toxic to a number of crops at a few tenths to a few ppm in acid soils [24]. During the observation period concentration of manganese was found below the desirable limit, even very low amount of manganese was observed in all blocks of ground water samples.

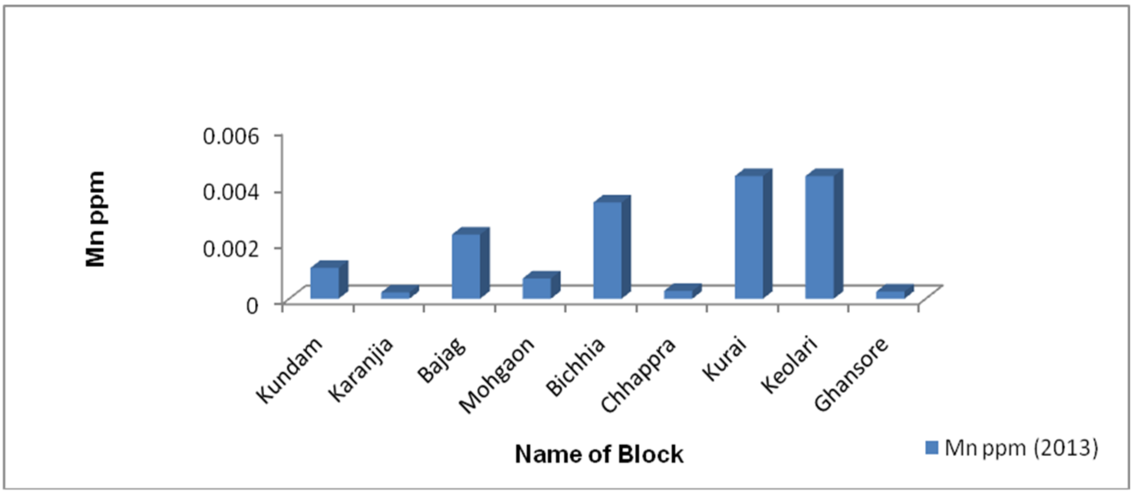

Fig 8: Block wise concentration of Mn- present values

Zinc is an important micronutrient for the crop production. Concentration of Zinc in small quantity in irrigation water is beneficial to the crop.The concentration of Zinc was found in ground water samples obtained from Mohgaon, Keolari, Bichhia and Kundam blocks was (0.0086, 0.0066, 0.006 and 0.0032 ppm) respectively (Fig 9). The standard for irrigation water approved by BIS (Bureau of Indian Standards) for Zn is 5.0 ppm. These results show that Zinc deficiency in ground water but Zinc toxic to many plants at widely varying concentration, reduced toxicity at increased pH (6 or above) and in fine textured or organic soils (Ayers and Westcot 1985).The contamination of all ground water samples of Zinc concentration fall under permissible limit.

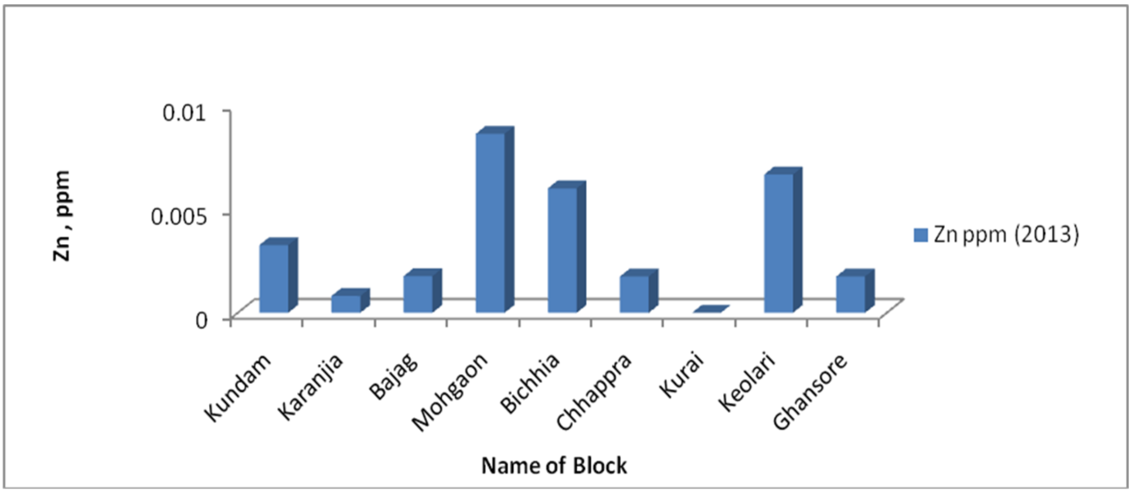

Fig 9: Block wise concentration of Zn - present values

Conclusion

During year 2013, the pH value of ground water samples of all blocks under consideration fall wittghin the permissible range of 6.5-8.5. The maximum value (7.8) of pH have found in Keolari block of Seoni district while the minimum value of 6.9 was found in Karanjiablock of Dindori. The concentration of EC ranged between 247.5 to 1567.7 µS/cm which is under the safe limit.

Ca+Mg were found under the permissible limit in ground water sample obtained from different location. The maximum Ca+Mg value was found in Kundam block (837.8 ppm) and Keolari block (784.9 ppm) respectively.Calcium and magnesium ions in irrigation water tend to keep soil permeable and in good tilth and Magnesium are essential to normal plant growth.

During the observation, CO_3 was found in two blocks Keolari (382.2 ppm) and Ghansore (22.5 ppm), and in rest of the blocks carbonate was not present or present as traces.Concentration of bicarbonate was found under safelimit in all blocks with the maximum concentration of HCO_3 in Keolari block (345.7 ppm) followed by Ghansore 280.7 ppm.

Trace element like Fe, Mn and Zn are micro plant nutrients these are beneficial for crops. In this study, these entire elements were found within desirable limit.

Reference

1. Anonymous. Total hardness assessment of Kharghab river water surround the Dooshkhamat town from Iran Khonsar city at 4 stations. Asian Journal of Development Matters. 2013, 7(1).
2. APHA. Standards methods for the examination of water and waste-water, 16^{th} edn. Ayers, R.S and West D.W. Cot. Water quality for agriculture, FAO irrigation and Drainage Paper 29.FAO Rome, (1985).
3. Ayers RS, West DW. Cot. Water quality for agriculture, FAO irrigation and Drainage Paper 29.FAO Rome, 1985.
4. Behera B, Mira Das, Ajaya Chanda. Assessment of ground water quality in and around Bacheli and Kirandulaarea, Dantewada district, Chhattisgarh, India.Siksha "O" Anusandhan University, ITER, Dept of Chemistry, Bhubaneswar, Odisha. International Journal of Environmental L Sciences. Volume 3, No 6, 2013.
5. Burow KR, Jennifer Shelton L, Neil Dubrovsky M. Regional Nitrate and Pesticide Trends in Ground Water in the Eastern San Joaquin Valley, California. Journal of Environmental Quality 2008; 37(5):S-249-S-263.
6. Chaudhary V. Assessment of TDS, Total Hardness and Nitrate in Groundwater of North-West Rajasthan India. Department of Chemistry CSSS, PG College Machhra, Meerut, U.P. India. VEGETOS 2013; 26(2):127-137.
7. Davithuraj J, Manjunatha S. Hydrochemical Analysis of Ground water of Upper Bennihalla Basin, Karnataka (India). Journal of Applied Geochemistry. 2014; 16(2):148-160.
8. Das R, Das M, Goswami S. Groundwater Quality Assessment for Irrigation Uses of Banki Sub-Division, Athgarh Basin, Orissa, India. Journal of Applied Geochemistry. 2013; 15(1):88-97.
9. Deshpande SM, Aher KR, Bhatpude AA. Heavy Metal Concentrations in Ground waters of Chikhalthana Area of Aurangabad, India. Journal of applied Geochemistry, 2013; 15(2):201-212.
10. Dixit A, Shrivastava S. Assessment of Parameters of Water Quality Analysis of Hanumantal and Robertson Lake at Jabalpur (M.P.).Asian J Research Chem. 2013; 6(8):0974-4169.
11. Doneen LD. The influence of crop and soil on percolating water. Proc. 11961 Biennial conference on Groundwater Recharge, 1962, 156-163.
12. Dubey S. Sewage water quality of Motinala and its effect on nearby Ground water sources in Jabalpur. Unpublished M.Tech Thesis. College of Agricultural Engineering, Jabalpur, 2012.
13. Environmental Planning Frame Work for Water Resources Management in Tamil Nadu, Final Draft, Public Works Department, Government of Tamil Nadu, 2001.
14. Gajbhiye S. Assessment of groundwater quality at some selected waste water irrigated sites in Jabalpur. Unpublished M.Tech. Thesis. College of Agricultural Engineering, Jabalpur, 2009.
15. Hilding-Rydevik T, Johansson I. (eds) How to Cope with Degrading Groundwater Quality in Europe. Swedish. Council for Planning and Coordination of Research, Stockholm, Sweden, 1998.
16. Honda BK. Geochemistry and genesis of fluoride containing ground water in India. Ground water 1975; 13:275-281.
17. Honisch AMC, Hellmeier BK, Weiss C. Response of surface and subsurface water quality to land use changes. Geoderma 2002; 105(Ž2002):277–298.
18. Islam SR, Gyananath G. Contamination of chemical fertilizer in groundwater. J Ecotoxico Environ Monit. 2002: 12(4):285-290.
19. Khan K, M Naseen, Rehman S, Labal J. Environmental assessment of ground water quality of Lahore area, Pakistan. Journal of applied science. 2007; 7:41-46.
20. Kumar KS, Rammohan V, Sahayam JD, Jeevanandam M. Assessment of groundwater quality and hydro geochemistry of Manimuktha River basin, Tamil Nadu, India. Environ Monit Assess, 2008. DOI 10.1007/s10661-008-06337.
21. Kumar K, Carl Rosen J, Satish Gupta C, Matthew Mc Nearney. Land Application of Sugar Beet By-products: Effects on Runoff and Percolating Water Quality. Journal of Environmental Quality 2009; 38(1):329-336.
22. Kumar Sunitha J, Ramakrishna Reddy. Determination of an optimal interpolation technique to represent the spatial distribution of groundwater quality at urban and peri-urban areas of Proddatur, Y.S.R district, Andhra Pradesh, India. International Journal of Geomatics, 2013.
23. Matini L, François A, Marie MJ. Assessment of groundwater quality during dry season in southeastern Brazzaville, Congo. International Journal of Applied Biology and Pharmaceutical Technology, 2010, I(3).
24. Rowe RD, Abdel- Magid. Handbook of Wastewater Reclamation and Reuse by Donald R. Rowe and Isam Mohamed Abdel Magid, 1995.