

Calcium Concentration in Ground Water of Punjab Satluj Floodplain (India): Spatio-temporal Analysis from 1970-2011

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Abstract: Maximum permissible limit of calcium ion concentration is 75 mg/L. In study area, range of calcium concentration in groundwater was varied with time. Calcium concentration in groundwater exceeds permissible consumption limit with time as it ranged between 33 to 110 mg/L in 1970 and reached to 206 mg/L during 1980 with 69.42 and 76.74 mean respectively; in 1990, 2000 and 2011 calcium concentration existed between 14 to 140 mg/L, 17 to 68 mg/L and 8 to 78 mg/L respectively. Concentration of calcium is effected by the nature of hydrogen ion concentration, carbon dioxide and carbonate minerals.

Keywords: Groundwater, Floodplain, Calcium, Contamination, Spline

Introduction

Spatial-temporal variation in concentration of calcium ion in groundwater of Punjab Satluj floodplain has been analyzed from 1970 to 2011. Punjab Satluj floodplain covered parts of Phillaur Block of Jalandhar District; Aur, Nawanshahr and Balachaur Block of Shahid Bhagat Singh Nagar District; Chamkaur Sahib Block of Rupnagar District and Machhiwara, Ludhiana II and Ludhiana I Block of Ludhiana District of State Punjab Country India. This part is stretched between 30°32" N to 31°35" N and 75°05" E to 76°44" E latitudes and longitudes respectively and covers 1042.75 square kilometers area of Indian Punjab.

Fifty wells have been selected for understanding the changing pattern of calcium concentration in groundwater of Punjab Satluj floodplain. Secondary data provided by Department of Soil and Conservation, Punjab and Central Groundwater Board, India has been used and spline interpolation technique has been applied to that analyzed, processed point data for displaying it in isolines form.

Discussion and Analysis

Maximum permissible limit of calcium ion concentration in water for consumption is 75 mg/L [1]. This value is affected by the pH, carbon dioxide and carbonate minerals [2-3]. Excessive concentration of calcium in water increased the risk of cardiovascular diseases in humans [4] and also increased the hardness of water [5]. In study area, range of calcium concentration in groundwater was varied with time (table 1). For 1970, it ranged between 33 to 110 mg/L with 69.42 mean and 23.92 standard deviation (table 1). Areas characterized with beyond permissible calcium ions include western and southern Balachaur Block and eastern Nawanshahr Block of Shahid Bhagat Singh Nagar District. It also incorporates whole Chamkaur Sahib Block of Rupnagar District and eastern part of Ludhiana District. In the western part of study area, unfit groundwater was observed in north western part of Aur Block of Shahid Bhagat Singh Nagar District, central part of Phillaur Block of Jalandhar District

and western part of Ludhiana District (figure 1 (a)). For 1980, calcium concentration in groundwater of study area was increased and reached at 206 mg/L for some areas. This high range i.e. 187.5 to 206 mg/L calcium contaminated groundwater was covered two distinctive areas, one was observed in north western Nawanshahr Block of Shahid Bhagat Singh Nagar District and other include a circular patch consisting south western part of Nawanshahr Block (Shahid Bhagat Singh Nagar District), south eastern part of Aur Block of Shahid Bhagat Singh Nagar District and north eastern Ludhiana II Block of Ludhiana District (figure 1 (b)).

Table 1: Calcium Concentration in Punjab Satluj Floodplain: Variability Analysis from 1970 to 2011

Parameters	Maximum Permissible Limit for Consumption (WHO, 2011)	1970	1980	1990	2000	2011
Calcium (mg/L) (Range Variability)	75	33-110	30-206	14-140	17-68	8-78
Mean		69.42	76.74	56.45	35.81	36.33
Standard Deviation		23.92	32.33	32.6	12.94	17.63

Source: Central Groundwater Board, India

During 1990, maximum value of calcium concentrated groundwater for study area was decreased and it ranged between 14 to 140 mg/L. Areas consisted in highest calculated range during this period incorporates south western Aur Block of Shahid Bhagat Singh Nagar District, south eastern and north western Phillaur Block of Jalandhar District and western part of Ludhiana II Block of Ludhiana District (figure 1 (c)). For 2000, whole study area was covered under the WHO stated maximum permissible limit of calcium concentration in groundwater (figure 1 (d)). During 2011, it again exceeds its maximum acceptable limit and ranged between 8 to 78 mg/L. This unfit groundwater observed in two patches. One consist a small patch covered

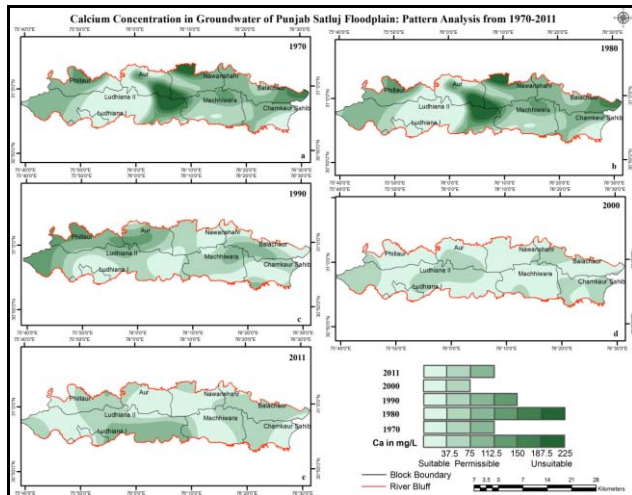
the north eastern part of Phillaur Block of Jalandhar District. Second patch was found in Ludhiana District containing south western part of machhiwara Block, southern part of Ludhiana II Block and south eastern part of Ludhiana I Block (figure 1 (e)).

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Author Profile



Ms. Harsimrat Kaur Gill is conducting research on „Land use and Land cover Change in Part of Satluj Floodplain, Punjab“, a theme of regional relevance having global implications from Centre of Advanced Study in Geography, Panjab University, Chandigarh, India. She qualified National Eligibility Test (NET) for lectureship in the subject of Geography conducted by University Grants Commission, New Delhi, India. She is also a recipient of UGC Research Fellowship Award in Science for Meritorious Students for pursuing her Doctorate Degree. In the course of her research she has augmented her research abilities through learning and adopting the state-of-the-art in research techniques within the discipline. She learned varied aspects of Geospatial technology that included Remote Sensing & GIS-Technology and Applications; Hyperspectral Remote Sensing and Microwave remote Sensing for Natural Resources from National Remote Sensing Centre, Hyderabad and Indian Institute of Remote Sensing, Dehradun, Department of Space, ISRO, Govt. of India.



Source: Interpreted from data provided by Central Groundwater Board, India

Figure 1

Conclusion

Variation has been noticed in the concentration of calcium ion in groundwater of Punjab Satluj floodplain. Maximum concentration beyond acceptable consumption limit has been observed in 1980. High concentration of calcium in water when consumed increased the incidence of cardiovascular diseases in humans and also affects the hardness of water.

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