



GIS Mapping and Determination of Heavy Metals (Ca, Cr, Fe, Pb) in (Pre-Monsoon) Surface and Ground Water Samples in Abhanpur Block, Distt.- Raipur (C.G.)

Dr. (Mrs.) Pramisha Sharma

Associate Professor at M M College of Technology, Raipur (C.G.)

Dr. Som Kumar Chatterjee

Ex-Principal Govt. College Mahasamund (C.G.)

Abstract

Determination of heavy metals (Ca, Cr, Fe, Pb) and GIS mapping in Ground and Surface water samples (Pre-Monsoon) in Abhanpur Block, Distt.-Raipur of Chhattisgarh, India. GIS maps are used to examine and visualize the different locations of water samples in the study area. Abhanpur Block situated in 21°3'N to 21°35'4'' an altitude and 81°43'E to 81°49'5''E Longitude. The four Heavy metals (Ca, Cr, Fe, Pb) are examined by using UV-VIS-NIR Spectrophotometer is almost all modern techniques for the determination of heavy metals. The World Health Organization (WHO) 4th Edition in 2011 is given drinking water standard limits is compared with the concentration of heavy metals in surface and groundwater samples in the study area.

Keyword – Groundwater, Surface water, GIS Mapping (Pre-Monsoon), UV-VIS-NIR Spectrophotometer, WHO, Abhanpur Block, Raipur District.

Introduction

For maintaining the ecosystem and human health from much of current Scenarios with observe to environmental superiority is focused on water because of its consequence.¹ For agriculture, industry, and even human existence freshwater is a limited origin, without freshwater of an adequate standard and standard sustainable development will not be possible.¹ For corrosion of water standard there is extensive literature available that underscores.²⁻⁵ The addition of various kinds of adulterate and nutrients through urban sewage, industrial discharges, agricultural runoff, etc. A global problem is freshwater origin is becoming day by day at the foster rate of weakening of the water standard.⁶ Discharge of poisonous chemical, over-pumping of qualifier and defilement of water bodies with the substance that assists algae growth are some of today's major causes for water standard Humiliation. Organic guano, municipal squander and fungicides often accommodate a fairly high concentration of heavy metals. Soils sustain pesticides that have manifested high concentrations of determinable heavy metals and that thereby increase their concentration in runoff while falling as rainwater picks up small amounts of gases, ions, dust, and particulate matter from the atmosphere⁷⁻⁸. This added material may be anyhow classified as biological, chemical, physical, and radiological adulteration.⁹

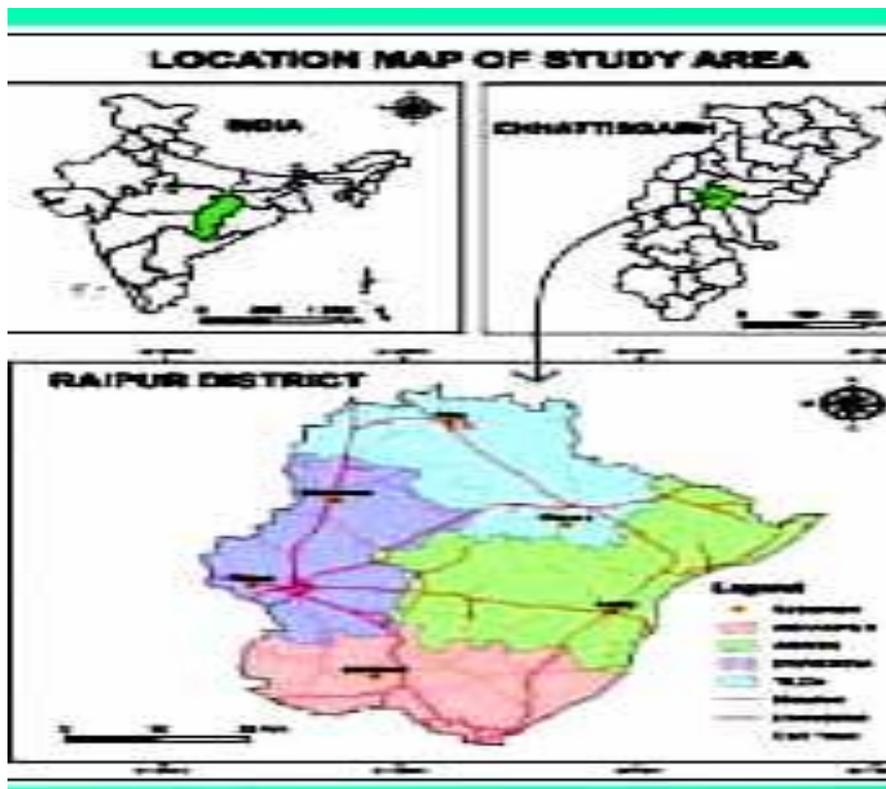
This adulteration may give water a bad taste, color, odor, muddy and cause hardness, causticity, staining, or frothing¹⁰. The constitution of surface and groundwater depends on natural components (geological, topographical, metrological, hydrological, and biological) in the drainage basin and be dissimilar with the seasonal difference in run-off capacity, weather circumstances, and water levels.¹¹

Groundwater is one is the major origin all over the world. The term groundwater is usually restrained for the subsurface water that occurs under the water table in soils and geological formations that are fully wet through.¹²It assists drinking water supply; livestock requires irrigation industrial and many commercial pursuits.¹³ Groundwater is generally less inclined to contaminant and adulterate when differentiated to surface water bodies.¹⁴Also the natural adulteration in rainwater. Which recharges the groundwater system gets eliminated it while delicate through soil strata. But, in India, where groundwater is used determinedly for irrigation and industrial motive, a variation of land and water-based human venture are causing adulterate of this precious origin.¹⁵ Essentially groundwater can also be accommodated by naturally occurring origins. Soil and geologic formation carrying a high amount of heavy metals can purify those metals into groundwater. This can be compulsory by over-pumping well, especially for agriculture adulterate bring about by fertilizers and pesticides used in agriculture, often separate over large areas, is a great ultimatum to fresh groundwater ecosystems.¹⁶

Adulterate of groundwater due to industrial discharges and municipal squander in water bodies is another major cover in many cities and industrial clumps in India. Groundwater is very strenuous to perfect, except in small defined areas and therefore the consequence has to be on obstruction. Owing to the human venture, the ponds have become discard grounds of domestic squanders and other reduction of the society.¹⁷ so, the knowledge of the scope of adulterate and the costly origins of water for successors. Water standard

guidelines origins of water for successors. Water standard guidelines come up with a basic scientific fact about water standard parameters and ecological applicable toxicological threshold values to safeguard specific water uses.

The main aim of this work has to examine GIS Mapping and Determination of Heavy Metals (Ca, Cr, Fe, Pb) in (Pre-Monsoon) Surface and Ground Water Samples in Abhanpur Block, Distt.- Raipur (C.G.).



Material and Methods

Sampling and Preservation:- The water sample were warm during pre-monsoon (May to June). The ground and surface water were collected from the different wards of Abhanpur Block in Raipur District (C.G.).Sample collected were examined within two days in avoiding special preservation required.

These samples were subjected to analysis by using UV-VIS-NIR Spectrophotometer based on Beer-Lambert's Law.

$$\text{Log}_{10} I_0/I_t = abc$$

RESULTS AND DISCUSSION

GIS Mapping and Determination of Heavy Metals (Ca, Cr, Fe, Pb) in (Pre – Monsoon) Surface and Ground Water Samples in Abhanpur Block, Distt.- Raipur (C.G.)

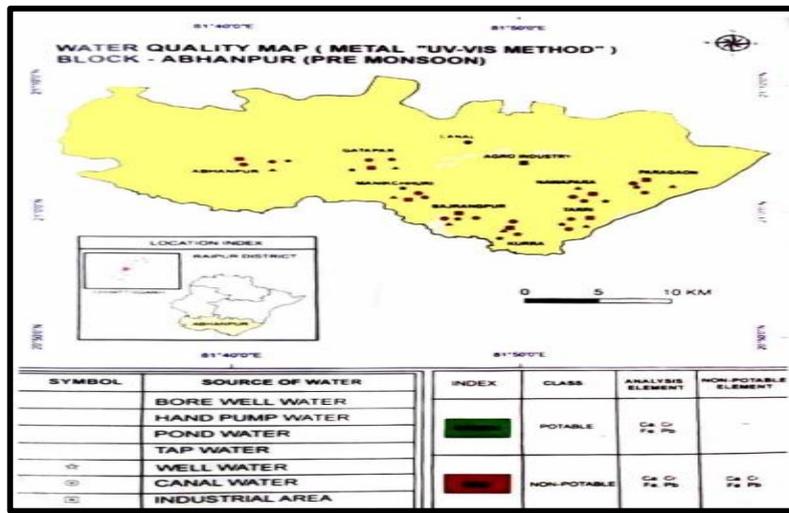


Figure: Abhanpur Block (Pre-Monsoon) Water Standard Map by UV-VIS



Table 1: Pre-Monsoon data of heavy metals of ABHANPUR (Surface water)

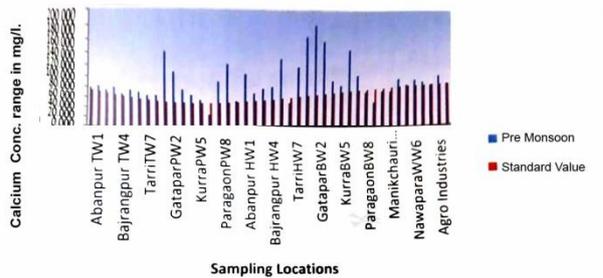
Metal →	Ca	Cr	Pb	Fe
WHO (Standard Value)	75mg/l	0.05mg/l	0.01mg/l	3mg/l
Abhanpur TW1	79.525	0.012	0.059	0.005
Gatapar TW2	85.074	0.028	0.042	0.031
Manikchauri TW3	80.474	0.058	0.037	0.016
Bajrangpur TW4	89.129	0.028	0.037	0.026
Kurra TW5	78.833	0.023	0.048	0.047
Nawapara TW6	88.477	0.047	0.014	0.020
Tarri TW7	87.836	0.013	0.037	0.018
Paragaon TW8	83.746	0.012	0.045	0.072
Abhanpur PW1	85.650	0.049	0.029	0.285
Gatapar PW2	153.937	0.010	0.046	0.016
Manikchauri PW3	126.562	0.013	0.026	0.325
Bajrangpur PW4	98.810	0.042	0.053	0.059
Kurra PW5	90.550	0.028	0.018	0.278
Nawapara PW6	81.081	0.010	0.032	0.116
Tarri PW7	51.770	0.022	0.047	0.087
Paragaon PW8	112.957	0.021	0.042	0.078
Mahandi	137.749	0.052	0.032	0.182
Canal	77.432	0.030	0.057	0.038

Note: TW= Tap Water, PW = Pond Water

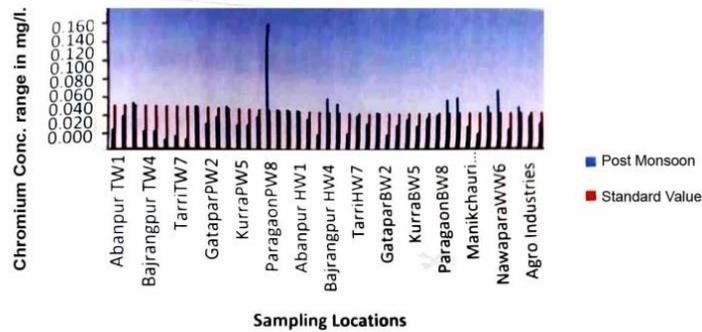
Table 2: Pre – Monsoon data of heavy metals of ABHANPUR (Ground water)

Metal	Ca	Cr	Pb	Fe
WHO (Standard Value)	75mg/l	0.05mg/l	0.01mg/l	3mg/l
Abhanpur HW1	122.792	0.012	0.036	0.036
Gatapar HW2	89.764	0.240	0.042	0.044
Manikchauri HW3	96.310	0.023	0.042	0.008
Bajrangpur HW4	98.572	0.031	0.041	0.014
Kurra HW5	140.460	0.024	0.021	0.690
Nawapara HW6	65.596	0.013	0.014	0.026
Tarri HW7	126.234	0.013	0.050	0.014
Paragaon HW8	168.105	0.021	0.059	0.270
Abhanpur BW1	182.293	0.038	0.024	0.023
GataparBW2	160.381	0.011	0.016	0.026
Manikchauri BW3	97.249	0.048	0.017	0.041
Bajrangpur BW4	87.280	0.018	0.016	0.020
Kurra BW5	144.612	0.034	0.043	0.016
Nawapara BW6	101.807	0.031	0.056	0.017
Tarri BW7	70.816	0.017	0.056	0.009
Paragaon BW8	50.761	0.031	0.052	0.282
Abhanpur WW1	70.102	0.016	0.042	0.288
GataparWW2	68.469	0.022	0.043	0.103
Manikchauri WW3	88.869	0.010	0.023	0.038
Bajrangpur WW4	77.450	0.014	0.025	0.005
Kurra WW5	85.122	0.016	0.025	0.044
Nawapara WW6	80.992	0.027	0.026	0.057
Tarri WW7	74.762	0.022	0.022	0.038
Paragaon WW8	89.698	0.027	0.038	0.063
Agro Industries	75.83	0.037	0.052	0.388

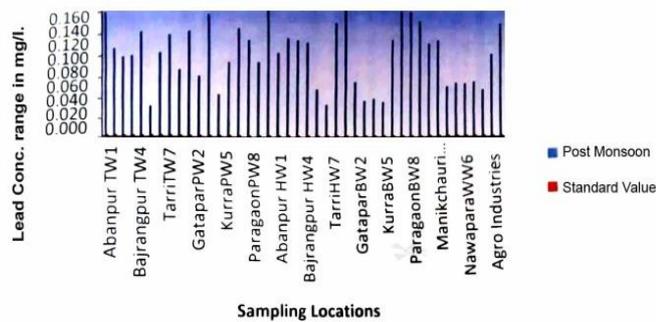
Note: HW = Hand Pump Water, BW = Borewell Water, WW = Well Water



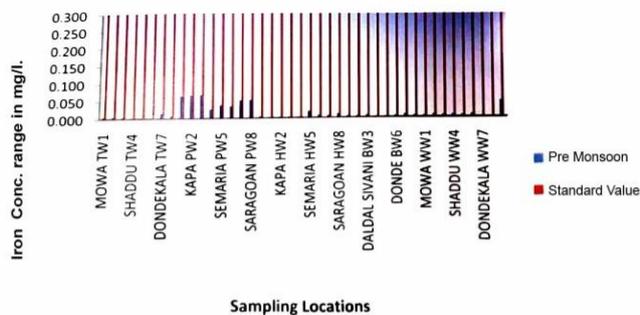
Graph 5.2.4 (a) : Graph Showing the Calcium in gm/l among the different Sampling Location during the Pre Monsoon Season.



Graph 5.2.1 (b) : Graph Showing the Chromium in gm/l among the Sampling Location during the Post Monsoon Season.



Graph 5.2.2 (a) : Graph Showing the Lead in gm/l among the different Sampling Location during the Pre Monsoon Season.



Graph 5.2.11 (e) : Graph Showing the Iron in gm/l among the different Sampling Location during the Pre Monsoon Season.

UV-VIS-NIR spectrophotometers are almost all convenient techniques for the determination of heavy metals up to part per million. Therefore suspect that there may be metals adulterate in the selected sample of groundwater and surface water.

SURFACE WATER

1. CALCIUM (Ca)

The value of Ca concentration determined by the present study area Abhanpur block surface water (Pre-monsoon season) sample ranges from 79.525 to 77.432mg/l. maximum and minimum concentration of calcium were Tap water samples no. 4 & 5, 89.129 to 78.833mg/l. And Pond water samples no. 2 & 7, 153.937 to 51.770 gm/l. respectively. All the selected sample concentration is higher of the maximum (75mg/l) WHO standards. Measurable concentrations values are shown in Table -1 the comparison level of calcium in the study area is shown in Graph – 1.

2. CHROMIUM (Cr)

The value of Cr concentration determined by the present study area Abhanpur block surface water (Pre-monsoon season) sample ranges from 0.012 to 0.30mg/l. Maximum & minimum Chromium were between Tap water sample no. 6 & 1,8, 0.047 to 0.012, 0.012 mg/l. and Pond water sample no. 4 & 6, 0.042 to 0.010 mg/l. All the selected sample concentration is higher of the maximum (0.05mg/l) WHO standards. Measurable concentrations values are shown in Table -1 the comparison level of chromium in the study area is shown in Graph – 2.

3. LEAD (Pb)

The value of Pb concentration determined by the present study area Abhanpur block surface water (Pre-monsoon season) sample ranges from 0.059 to 0.057mg/l. Maximum & minimum Lead concentration were between Tap water sample no.1 & 6, 0.059 to 0.014 mg/l. and Pond water sample no. 4 & 5, 0.053 to 0.018mg/l. . All the selected sample concentration is higher of the maximum (0.01mg/l) WHO standards. Measurable concentrations values are shown in Table -1 the comparison level of lead in the study area is shown in Graph – 3.

4. IRON (Fe)

The value of Fe concentration determined by the present study area Abhanpur block surface water (Pre-monsoon season) sample ranges from 0.059 to 0.057mg/l. Maximum & minimum Iron concentration was between Tab water sample no. 8 &1, 0.005 to 0.072mg/l. and Pond water sample no. 1 & 5, 0.285 to 0.059mg/l. . All the selected sample concentration is lower of the minimum (3mg/l) WHO standards. Measurable concentrations values are shown in Table -1 the comparison level of iron in the study area is shown in Graph – 4.

GROUNDWATER:**1. CALCIUM (Ca)**

The value of Ca concentration determined by the present study area Abhanpur block surface water (Pre-monsoon season) sample ranges from 122.792 to 75.83mg/l. Maximum & minimum Calcium concentration varied between Hand pump water samples no. 8 & 6, 168.105 to 65.596mg/l. Borewell water samples no. 1 & 8, 182.293 to 50.761mg/l. and Well water samples no. 8 & 2, 89.698 to 68.469mg/l. Calcium concentration levels in all studied except in Hand pump water sample no. 6. Borewell water sample no. 8. And Well water sample no.2. Hand pumps water sample no.8. Borewell water sample no.1. And Well water sample no.8 are exceeding then compared WHO Standards. Measurable concentrations values are shown in Table -2 the comparison level of Calcium in the study area is shown in Graph –1.

2. CHROMIUM (Cr)

The value of Cr concentration determined by the present study area Abhanpur block surface water (Pre-monsoon season) sample ranges from 0.012 to 0.037mg/l. Maximum & minimum Chromium concentration varied between Hand pump water sample no. 2 & 1, 0.240 to 0.012mg/l. Borewell water samples no.3& 2, 0.048 & 0.01mg/l. Well water samples no.6,8 & 3, 0.027, 0.027 to 0.010. All the selected sample concentration is higher of the maximum (0.05mg/l) WHO standards. Measurable concentrations values are shown in Table -2 the comparison level of chromium in the study area is shown in Graph – 2.

3. LEAD (Pb)

The value of Pb concentration determined by the present study area Abhanpur block surface water (Pre-monsoon season) sample ranges from 0.036 to 0.052mg/l. Maximum & minimum Lead concentration varied between Hand pump water samples no. 8 & 6, 0.059 to 0.014mg/l. Borewell water samples no. 6,7 & 2, 0.056,0.056 & 0.016mg/l. Well water samples no. 8 & 7, 0.038 to 0.022mg/l. All the selected sample concentration is higher of the maximum (0.01mg/l) WHO standards. Measurable concentrations values are shown in Table -2 the comparison level of lead in the study area is shown in Graph – 3.

4. IRON (Fe)

The value of Fe concentration determined by the present study area Abhanpur block surface water (Pre-monsoon season) sample ranges from 0.036 to 0.388mg/l. Maximum & minimum Iron concentration varied between Hand pump water samples no. 5 & 6, 0.690 to 0.008mg/l. Borewell water samples no. 8 & 5, 0.282 to 0.016mg/l. Well water sample no. 1 & 4, 0.288 to 0.005mg/l. All the selected sample concentration is lower of the minimum (3mg/l) WHO standards. Measurable concentrations values are shown in Table -2 the comparison level of iron in the study area is shown in Graph – 4.

Conclusions and Outcomes

In the present study, GIS maps are used to analyzed and visualized the standard of water origins (Surface and Groundwater). Portable and Non-portable due to the presence of Heavy Metals in Abhanpur Block. This study comes up with the baseline data for the assessment of various Heavy Metals adulterate in Abhanpur Block. Hence the monitoring result should be carried out to check the rise in water adulterates for sustainable development to the study area. The Groundwater and surface water samples were collected from various locations of Abhanpur Block, Raipur dist., Chhattisgarh. In pre-monsoon May-Jun. 2013 for the determination of (Ca, Cr, Pb, and Fe). by spectrophotometer concentration of the above-listed element were found to be ranged between surface water Ca in Tap water 79.525-83.746mg/l. and Pond water 85.650-112.957mg/l. Cr in Tap water 0.012-0.012mg/l. and Pond water 0.049 -0.021mg/l. Pb in Tab water 0.059-0.045mg/l. and Pond water 0.029-0.042mg/l. Fe in Tab water 0.005-0.072mg/l. and Pond water 0.285-0.078mg/l. Groundwater Ca in Hand Pump water 122.792-168.105mg/l. Borewell water 182.293-50.761mg/l. Well, water 70.102-89.698mg/l. Cr in Hand Pump water 0.012-0.021mg/l. Borewell water 0.038-0.031mg/l. Well water 0.016-0.027mg/l. Pb in Hand Pump water 0.036-0.059mg/l. Borewell water 0.024-0.052mg/l. Well water 0.042-0.038mg/l. Fe in Hand Pump water 0.036-0.270mg/l. Borewell water 0.023-0.282mg/l. Well water 0.288-0.063mg/l. Surface water Calcium, Chromium, Lead & Iron concentration levels in all studied samples exceeding then compared WHO standards. Groundwater Ca except in Hand pump water sample no. 6, Borewell water sample no.8, And Well water sample no.2. Fe All the selected samples concentration is lower than the compared WHO standards. Ca, Cr, Pb, heavy metal in all the samples are exceeded WHO limits for drinking water. The excess presence of Calcium causes Hypercalcemia disease, hardness of water & adverse effect on domestic use. Chromium presence excess amount may be Encrustation in water supply structure and adverse effect on domestic use. The excess presence of lead causes damages the nervous system and causes brain disorder. From the results of the present study, we can suggest that the Government should be adopted some treatment technologies in the following study areas to minimize these heavy metals in ground and surface water for safe drinking water to the public.

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