



Trade Science Inc.

Environmental Science

An Indian Journal

Current Research Paper

ESAIJ, 6(6), 2011 [351-354]

Co-relation of flouride with other parameter of physio chemical studies of daltonganj block area, Palamau district, Jharkhand to identify flurosis affected areas and its impact on environment

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Received: 6th September, 2011 ; Accepted: 6th October, 2011

ABSTRACT

Physico-chemical studies of ground water samples both from bore wells and dug wells of daltonganj block areas of Palamau district of Jharkhand have been carried out for various parameters in general and that of fluoride concentration in particular in pre-monsoon season of 2009. Though, generally ground water of both types of wells are of good quality but in certain areas it is confronted with slightly high concentration of fluoride causing dental fluorosis among children. In dug well fluoride concentration in 7 samples area bit higher side (TABLE-1) while in bore wells too, 7 samples are on higher and rest 7 within lower limit. (TABLE-2). The other variables so far analysed are within permissible limit of WHO for portable water in both types of wells samples (see TABLE 01 and 02). The variation observed in TABLE I and 2 in various parameters are due to its geogenic origin, of the various parameters and also of the nature of depth of wells of different places in the present area. © 2011 Trade Science Inc. - INDIA

INTRODUCTION

The physico-chemical composition of ground water of daltonganj area is related to the soluble products of rock weathering and decomposition and changes with respect of time and space. Some elements are essential in trace amounts for human consumption while higher concentration on the same element can cause toxic effect. The fluorine is such an element which falls under above category, and as such it is essential to know its concentration more so when water is used for drinking purpose. The concentration of fluoride between 0.06mg/l to 1.0mg/l is essential in portable water to protect tooth decay while concentration beyond 1.5mg/

l can cause tooth mottling (dental fluorosis) and still higher concentration leads to skeletal fluorosis.

Palamau district in Jharkhand state is prone to fluorosis disease^[2]. Whatever may be the primary source of fluorine. The element is ultimately dispersed in the environment and is found in atmosphere, soil and water^[3]. For the purpose of identifying the localized nature of fluorosis affected areas all the 12 blocks of Palamau district are being studied with help of physico-chemical analysis of ground water samples collected both from bore wells and dug wells.

The results obtained from 24 samples of daltonganj block during pre-monsoon season of 2009 are reported here. (TABLE 1 and 2)

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TABLE 1 : Results of Physico-Chemical Analysis of Ground water taken from, dug wells of daltonganj area

Sl.	Source and samples no	pH	EC ummhos/cm	TDS mg/1	Total hardness mg/1	Alkalinity mg/1	Nitrate ppm	Iron ppm	Fluoride ppm
1	DW1	6.9	610	751	190	180	18	.3	1.5
2	DW2	6.9	715	720	135	430	28	.14	1.7
3	DW3	6.31	610	520	100	400	15	.1	1.6
4	DW4	6.9	725	980	125	520	12	.	1.6
5	DW5	6.72	880	440	180	240	12	.1	1.4
6	DW6	6.7	910	810	150	190	20	.3	1.7
7	DW7	6.7	910	880	125	160	14	.4	1.5
8	DW8	5.9	710	780	150	190	20	.3	0.8
9	DW9	6.3	750	650	115	190	35	.1	0.8
10	DW10	6.2	670	975	120	245	16	.1	0.7

TABLE 2 : Results of Physico-Chemical Analysis of Ground water taken from, bore wells of daltonganj area

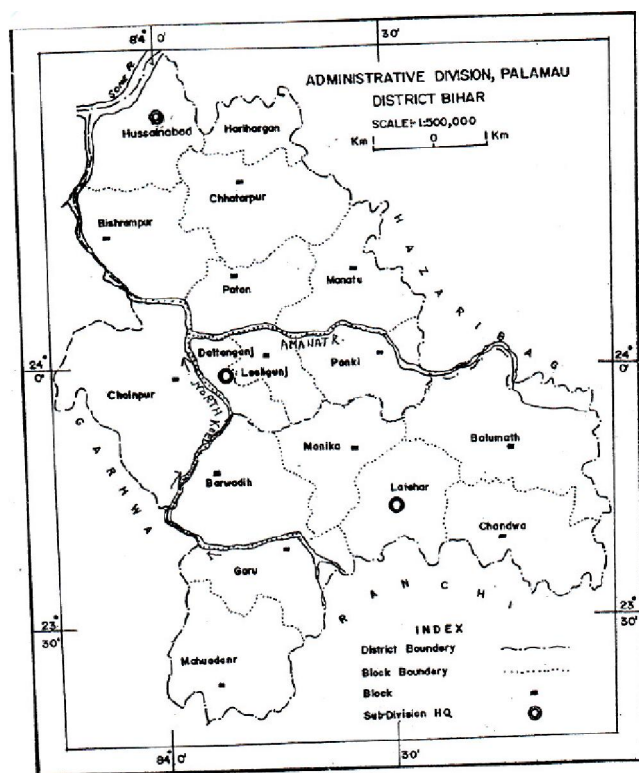
Sl.	Source and samples no	pH	EC ummhos/cm	TDS mg/1	Total hardness mg/1	Alkalinity mg/1	Nitrate ppm	Iron ppm	Fluoride ppm
1	BW1	6.18	580	856	100	320	15	.1	1.5
2	BW2	6.76	910	650	135	420	23	.1	1.8
3	BW3	6.57	810	660	75	310	25	.2	1.5
4	BW4	6.19	680	920	100	180	14	.1	1.6
5	BW5	6.22	720	880	110	280	16	.1	1.6
6	BW6	6.7	880	720	100	180	9	.15	1.6
7	BW7	6.8	725	789	135	240	16	.10	1.7
8	BW8	6.1	680	970	125	245	9	.10	0.7
9	BW9	6.7	900	810	150	180	16	.1	0.8
10	BW10	6.8	410	820	125	165	16	.2	0.7
11	BW11	6.8	825	750	135	180	17	.2	0.7
12	BW12	6.0	675	965	112	240	25	.2	0.9
13	BW13	5.9	810	980	110	320	17	.1	0.8
14	BW14	6.1	670	980	125	250	18	.1	0.5

LOCATION AND GENERAL FEATURES OF STUDY AREA

The daltonganj block administrative unit, is south western part of Palamau district bounded by the North Koel river in eastern and southern side and by area of Garhwa district on western and northern side (Figure 1).

The topography is characterized by hilly rugged landscape with green forest more in southern part. The slope of the area in general tends towards north and east. The climatic condition is characterized by three distinct seasons. The summer is usually between March to May, the Monsoon from June to September and the

winter stretches from October to February. The temperature varies from 5.6°C to 47°C so far recorded. The relative humidity varies from 21 to 83 per cent. Except during 1976-1978, the average rainfall recorded is far from normal i.e. 1279.9 mm per annum. As per record of the meteorological department, the rainfall in the month of June is 158.8 mm, in July 347.2 mm, in August 370.2 mm and in September 223.0 mm. Weathered and fractured gneiss and granite rocks of Pre Cambrian forms major aquifers in this area. Ground water occur under pheratic condition in the weathered zone of gneisses and granite rocks and alluvium. It also occurs in semi confined to confined condition in fractures and joints in unweathered deeper parts of these rocks^[4].



MATERIAL AND METHODS

To assess the fluoride content and nature of ground water quality, 10 samples from of dug wells (TABLE 1) and 14 samples from bore wells (TABLE 2) including hand pumps were collected from different localities (Figure 2). All samples were taken in sterilized bottles. The physic-chemical analysis was carried to determine pH value, electrical conductivity, total hardness, total dissolved substance, total alkalinity, along with nitrate, iron and fluoride content of all samples by using standard method^[1].

RESULTS AND DISCUSSIONS

Physico-chemical characteristics of 10 dug wells samples and 14 bore wells samples of daltonganj areas are presented in TABLE 1 and TABLE 2 respectively.

The pH value of dug well samples varies from 5.9 to 6.9 and almost same variation is recorded in bore well sample. It has been measured with the help of ELICO L1 120 pH meter. Since the value is below 7 as such it is weakly acidic in nature and not harmful for use.

Electrical conductive values varies from 610(DW1)-910(DW6) mm hos/cm in dug well samples and in bore

well samples it ranges from 410(BW10) to 910(BW2) mm hos/cm. It has been measured with help of Digital conductivity meter CENTURY CC 601 and the values are within range of good portable water.

TDS values in dug well samples varies between 440 (DW5) - 980 mg/1 (DW4) and in bore hole samples between 650 mg/1 (BW.2) - 980 mg/1 (BW13). All samples are analysed by gravimetric method. Total dissolved solids denote the various type of minerals present in water in dissolved form. The concentration on dissolved solid is an important parameter to judge the quality of water. The values recorded both from dug well and bore well samples are within permissible limit as prescribed for portable water.

Total hardness of types of samples are analysed by titrimetric method. Total hardness in dg well samples varies between 100 mg/i (DW3) - 190 mg/1 (DW1). Likewise in bore well samples it varies 75 mg/1 (BW3) to 150 mg/1 (BW9). The lower concentration in bore well samples are due to more depth of water and lesser degree of evaporation than dug well samples having lesser depth and more evaporation due to larger diameter of wells. Dug well water is hard whereas of bore well water sample are moderately hard.

Total alkalinity of both type of water samples are determined by tetrimetric method. The total alkalinity in dug well samples varies between 160 mg/1 (DW7) to 520 mg/1 (DW4), TABLE 1. But in bore well samples it varies between 165 mg/1 (BW10) to 420 mg/i (BW2) in TABLE 2. From persusal of concentration found in TABLE 1 and TABLE 2 it is clear that the water sample both type of wells is alkaline in nature. It is within permissible limit and hence harmless.

The nitrate, iron and fluoride concentration of both type of samples are determined with help of UV-VIS spectrophotometer Systronics 118.

The nitrates present in Dug well sample (TABLE 1) varies between 12 ppm (DW4) to 35 ppm (DW9). Likewise it show variation in bore hole sample from 9 ppm (DW6) to 25 ppm(BW3). The lower concentration of nitrate in bore hole samples is due to lesser degree of evapotranspiration due to greater depth and lesser diameter than dug wells. All samples analysed are within permissible limit as per WHO standard.

Iron is almost always found in significant concentration because of its abundance in the earth crust. The

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primary concern about iron in drinking water is its objectionable taste. The iron content of dug well sample varies .1 ppm (DW3). to .4ppm (DW7) and in bore well sample it is between .1 ppm to .2 ppm. The slightly greater concentration in sample (DW7) is due to geogenic nature of bed rock of that particular area. It is within permissible limit in Daltonganj area.

Fluoride concentration of daltonganj block area varies between 0.7 ppm (DW10) to 1.7 ppm (DW2, DW6). Two sample DW3 and DW4 show its concentration 1.6 ppm. Out of 10 dug well sample 4 shows its value more than permissible limit. It shows matter of concern. Likewise out of 14 bore well samples 5 samples (BW2, 8W4, BW5, BW6 and BW7) shows higher concentration than permissible limit of 1.5 ppm.

Fluoride problem in daltonganj Area

Fluoride is one such element whose presence in drinking water is needed in small concentration for general development of human body but if concentration is above 1.5 ppm (as per drinking water standard) can cause dental fluorosis and skeletal deformation. In India for the first time the high fluoride problem was detected in Naglonda district of Andhra Pradesh in 1930's. Later short (1937) published his first report on endemic fluorosis in India. This diseases is now reported from more than 15 states and Jharkhand is one among them. The Geochemistry of genesis of high fluoride concentration in ground water have been studied by^[5]. According to him the high concentration is developed due to

(I) semi arid climate of the area which leads to high intensity of evapotranspiration or exceeds precipitation for major part of the year

(ii) bed rock is composed of crystalline rocks mainly gneisses and granite rocks of Pre Cambrian age.

(iii) Weathering and erosion has been effective for a very long time in that area and due to this, landscape becomes in general flat with low gradient which makes the movement of ground water slow.

(iv) Low amount calcium in ground water generally contains high level of fluoride and it has positive correlation with bicarbonate.

The concentration of fluoride in some parts of daltonganj area above permissible limit fulfill all above mentioned condition as suggested by^[5]. The area needs in depth study for remedial measures as higher fluoride

concentration of more than 1.5 ppm is hazardous for health and leads to dental and skeletal fluorosis in that area in future.

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