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A study of physico-chemical analysis of surface water of Darbhaga city

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Abstract
Due to human and industrial activities the ground water is contaminated. This is the serious problem now a day. Thus the analysis of the water quality is very important to preserve and prefect the natural eco system. The assessment of the ground water quality was carried out in the different wards of Darbhanga City. The ground water samples of all the selected stations from the wards were collected for a physiochemical analysis. For calculating present water quality status by statistical evaluation and water quality index, following parameters have been considered Viz. pH, colour, total dissolved solids, total alkalinity, total hardness, calcium, chromium, sodium, nickel. The study of physico-chemical and biological characteristics of this ground water sample suggests that the evaluation of water quality parameters as well as water quality management practices should be carried out periodically to product the water resources.

Keywords: Physico-chemical parameters, Water characteristics, Ground water analysis.

1. Introduction
Water is one of the five elements described in "SHASTRA" to form life. In the known planets, our earth (the blue planets) is only blessed by the existence of water hence the life survives here. Pure water means that the water collected from a properly protected sources and subjected to an adequate system of purification, which must be free from visible suspended matter, colour, odour and taste devoid of an objectionable bacteria and contain no dissolved matter of mineral or organic origin otherwise the water quality would be dangerous to health. Water pollution means when insoluble solid particles, soluble salts, sewage garbage, low level radioactive substances, industrial wastes, algae, bacteria, etc. go into water, water gets polluted. This type of pollution is called water pollution. Water fit for human consumption is called drinking water or "potable water". Water that is not specifically made for drinking, but not harmful for humans when used for food preparation are called safe water.

Darbhanga District is one of the thirty-seven districts of Bihar state with Darbhanga town as its administrative headquarter. It is situated between longitude 85 0 45'- 86 0 25' East and latitude 25 0 53' - 26 0 27' North and is bounded on the north by Madhubani district, on the south by Samastipur district, on the east by Saharsa district and on the west by Sitamarhi and Muzaffarpur districts. The district comprises of three civil sub-divisions, namely Darbhanga Sadar, Benipur and Biraul. There are 19 community development blocks, 329 panchayats, 1269 villages & 23 police stations in the district. The blocks of the district are Bahadurpur, Jale, Hayaghat, Singhwara, Benipur, Ghanshyampur, Baheri, Keoty, Manigachhi, Darbhanga, Biraul, Kusheswarsthan, Alinagar, Kusheswarsthan East, Gaura Vauram, Kiratpur, Hanuman Nagar, Tardih and Darbhanga Nagar Nigam (Figure 1). Total geographical area of the district is 2,279 sq. km. As per the 2011 census the total population of the district stands at 3921971 with the rural and urban populations of 3541846 and 380125 respectively.

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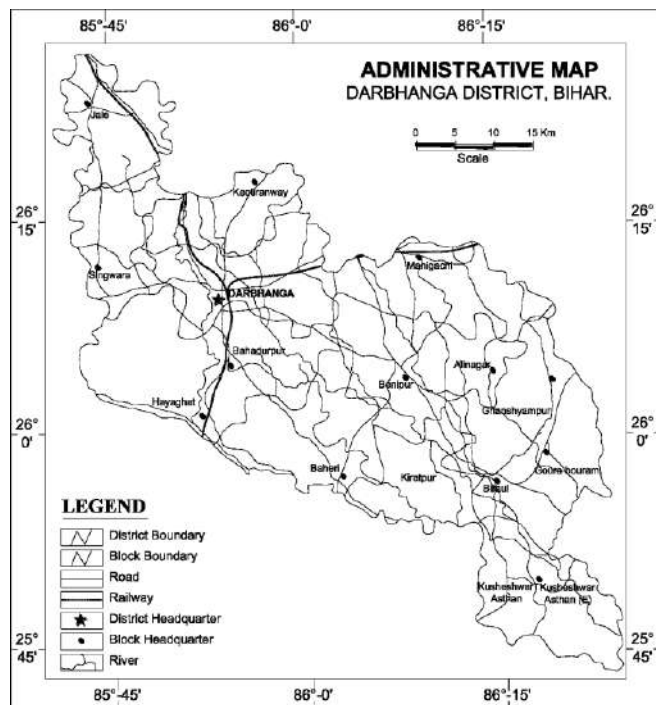Darbhanga, Bihar, India

Fig 1: Administrative map of Darbhanga district, Bihar with block boundaries road (rail) networks

Previous analysis concluded that it is the high rate of exploration then its recharging, inappropriate dumping of solid as well as liquid wastes, lack of strict enforcement of law and loose governance are the cause of deterioration of ground water quality. Municipal Corporation of Darbhanga facilitates the drinking water in limited area, in alternate to this people keeps option as hand pumps and jet pumps etc. from last few years it has been seen that the water quality of the alternative sources like hand pumps, wells has been deteriorating and its responses are in the form of yellowish and uncommon odour of the water people in this area using chlorine tablets for disinfect the drinking water. The objective of this work is to assess the quality of drinking water in Darbhanga city.

2. Materials and methods
The experiment was conducted at Dept. of Chemistry Mahatma Gandhi College, Darbhanga. The coldest months here are December-January and the hottest months are May-June. The Temperature varies from 5° to 17° centigrade in winters and 30° to 42° in summers. But sometimes winter temperature ebbs to 3° C and summer temperature shoots up to 450C. In the summers, which begin from March and last till Mid June the temperature starts rising and sometimes it reaches 450 C. The annual rainfall in the district was between 800 mm. and 1200 mm and in 2011 the rainfall was 1034 mm. On the average there are 49-55 rainy days (days with rain fall of 2.5 mm or more) in a year in the district July and September the relative humidity are high being over 70 %. During the Post-Mansoon and winter season the humidity is high in the morning. By summer, the relative humidity become very low i.e. less than 25 %.Anonymous. It having 42 wards with some extension areas of the city five sites are selected for the study as mentioned in Fig.:-1 Map View. The average boring depth of the city is 45-60 meter.

2.1. Sampling and sampling sites
A fluorinated plastic bottle of capacity 2 litre has been used to collect the sample, before sampling evacuation of the stored water in the pipelines has been made to take the fresh ground water sample the selected sampling sites are populated and urban areas of the city depicted in the Fig.: 1 A map view of Darbhanga city as site I to V. The sampling has been carried out in the month of April year 2016.

2.2. Methodology
The samples were analysed for following physic-chemical parameters viz., Temperature (by mercury thermometer), pH (by using pH meter), Turbidity (Nephelornetric Method), Calcium (FDTA Titrimetric), Iron (Phenanthroline spectrophotometric), Dissolved oxygen (Winkler method with acidic modification), Total dissolved solids (Gravimetric after filtration). Most of the physicochemical parameters were determined by standard methods prescribed by APHA (2005).

3. Result

Table 1: Reading of water quality parameters at different sites in Darbhanga city

Parameters	S1	S2	S3	S4	S5	ICMR
pH	7	7.2	6.9	8.1	8.3	7.0–8.5
TDS	200	186	149	220	245	500
T.H.	256	240	248	265	301	300
Cal. Hard	110	099	105	135	008	–
D.O.	3.4	4.1	3.7	4.0	5.0	4–6
Cl	078	101	085	094	106	200
Alk.	118	140	110	135	149	200
CO_2	7.4	7.6	7.9	7.1	7.67	–
Na	23	26	40	42	49	–
K	4	5	6	8	10	75

S1-Laxmisagar, S2-Dighi, S3-Sundarpur, S4-Bhatiyarisarai, S5-Subhankarpur.

4. Discussion
The value of pH range among 6.8 to 8.3. It is in the prescribed limit of ICMR. A little bit increase in pH level may depress the effectiveness of the disinfectants like chiorination's thereby requiring the additional chiorines. Total hardness ranges from 235-304 mg/I, total hardness is within the prescribed limit of ICMR except the site-S which is 304 it fall in hard water category it means it contains appreciable amount of Calcium and Magnesium ions. Calcium hardness ranges from 99-158 mg/I. The value of total dissolved solid ranges from 145-245 mg/I all the values of total dissolved solid is in the prescribed limit of ICMR it is due to high dissolved salts of Ca, Mg and Fe it requires specification and anion analysis. Dissolved Oxygen ranges from 3.4-5 mg/I, D.O. indicating the nearly pure symptoms. Chloride content is 78-106. Chloride content is also in the limit of ICMR. Alkalinity ranges from 110-149 mg/I. Alkalinity is the cause of carbonate and bicarbonate ion and its salts. It is in the prescribed limit of ICMR. Cabon dioxide content is from 7.02-7.92 ppm. According to Henry's law the gaseous dissolution has been determined by partial pressure of gases, soluble salt content and ambient temperature. Increase in CO_2 content may be by high dissolved salt contents. One more possibility is there that is the degradation of DOC (dissolved organic carbon).

Higher DOC on post disinfectant application causes some DBPs (Disinfection byproducts) like THM (Trihalomethanes), HAA (Haloaceticacids) etc. Some of them are potential carcinogens, and a shortterm exposure can lead to dizziness, headaches, as well as to problems associated with the central nervous system. So it is more relevant for those areas where OM contaminations are high with high use of disinfectants. Quality of ground water under study is nearly fit for drinking purpose, but it is recommended that ground water analysis should be carried out from time to time to monitor the rate and kind of contamination along with analysis of DBPs to corroborate the present study.

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