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Research article

STATUS OF GROUND WATER AND MUNICIPAL WATER SUPPLY OF LUCKNOW REGION-U.P.

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ABSTRACT: The extent of deterioration of water quality is directly proportional to industrialization and urbanization in a modern society. In this study an attempt was made to compare the groundwater (Handpump/Borewell water) and the municipal water of various localities of Lucknow for which grab samples from eight spots namely Vidya-Vihar, South City, ELDECO, Telibagh, Charbagh, Nishatganj, Kailashpuri and Chinhat were collected and analyzed for pH, total hardness, chloride content, total alkalinity and nitrate. The results showed that on an average the hand pump water proved better in terms of pH and total hardness and municipal water proved better in terms of alkalinity and chloride content. The values of nitrate were lower for hand pump as compared to supply water in some areas but most areas showed higher nitrate concentration in hand pump water.

Keywords: Municipal water, hand pump water, water quality analysis, Lucknow

INTRODUCTION

Clean water has become one of the most precious and inaccessible resources for the common man. The surface water gets polluted due to discharge of industrial effluents, agricultural runoff, discharge of partially treated domestic sewage, washing of animals and fecal discharge [3, 10]. The result is an over nutrition of water [11] and ultimately eutrophication [7]. The water from hand pumps available in Lucknow are derived from the first layer of aquifer at a depth of about 60 feet. The ground water gets polluted mainly due to leaching of chemical species e.g., nitrate, phosphate, pesticides and toxicants through drains, septic tanks, sulabh shauchalayas and agricultural fields [11]. The flow of the pollutants is in the direction of ground water flow. Water for drinking is made available to the Lucknowites from both surface water source i.e. Gomti river and subsurface water sources. Subsurface water is made available through two sources. The first source is deep bore well through which water is extracted from about 200 feet and sent to overhead tanks where it is chlorinated and supplied to the colonies. Another source of groundwater is hand pumps dug approximately 60 feet deep. The surface water from the river Gomti is pretreated at the intake and subsequently before the supply using slow sand filters and rapid gravity filters and finally supplied to the colonies [12]. The present study is an attempt to compare the quality of municipal water with hand pump water and to determine the potability in terms of pH, total hardness, chloride, total alkalinity and nitrate; which was conducted by analyzing grab water samples from eight different spots selected randomly during the winter season (December-January).

MATERIALS AND METHODS

All the samples were collected in the months of December –January 2009-2010. The study was conducted in Lucknow city (26^o 55'N, 80^o59'E) [1]. The locations selected for investigation were Vidya Vihar (B.B.A.U.), South City, ELDECO, Telibagh, Nishatgang, Charbagh, Kailashpuri, and Chinhat. The samples were collected in sterilized and phosphate free bottles. The collected samples were analyzed for various physico-chemical parameters following, "Standard Methods of Analysis of Water and Waste water" [6]. The chemicals used were of analytical grade and instruments were to limit of precise accuracy.

RESULTS AND DISCUSSION

The physico chemical parameters exhibited substantial variation from sample to sample. All the measurements were carried out in the vicinity of 20°C. The observations are summarized in Table 1.

Table 1. Comparison of Physico-chemical characteristics of ground water and municipal water quality of various sites of Lucknow

Sites	Temperature		PH		Total hardness		Total suspended solids		Chloride		Total Alkalinity		Nitrate	
	G.W.	M.W.S.	G.W.	M.W.S.	(mg/l)				(mg/l)		(mg/l)		(mg/l)	
					G.W.	M.W.S.	G.W.	M.W.S.	G.W.	M.W.S.	G.W.	M.W.S.	G.W.	M.W.S.
Vidya Vihar	293.15	294.15	7.77	8.25	180	60	0.035	0.02	42.5	14.18	190	110	33.4	20.36
South City	294.15	295.15	7.76	8.1	180	216	0.032	0.043	28.4	14.18	200	196	16.4	25.17
ELDECO	294.55	295.35	7.70	7.98	200	200	0.035	0.036	85.1	21.27	214	192	18.1	25.17
Telibagh	294.95	295.55	7.0	7.53	180	200	0.03	0.032	28.4	21.27	192	180	53.2	24.6
Charbagh	295.15	296.65	7.05	7.10	220	180	0.035	0.03	70.9	70.94	234	212	37.9	23.19
Kailashpuri	295.15	296.65	7.30	7.30	140	180	0.28	0.3	121	121.4	198	210	26.6	27.9
Chinhatt	294.15	295.15	7.60	7.99	180	200	0.36	0.39	21.3	21.27	228	196	12.7	14.9
Nishatganj	294.15	295.15	7.50	8.09	160	160	0.34	0.32	35.5	21.27	180	204	31.1	17.81
Average	294.438	295.425	7.46	7.7925	180	174.5	0.1434	0.1464	54.2	38.223	205	184.5	28.7	22.388
S.D.	0.679154	0.724568 837	0.31	0.4239	23.9	49.359	0.1534	0.1597	35.2	38.349	19.1	32.333	13.3	4.3513

G.W. = Ground Water M.S.W. = Municipal Water Supply

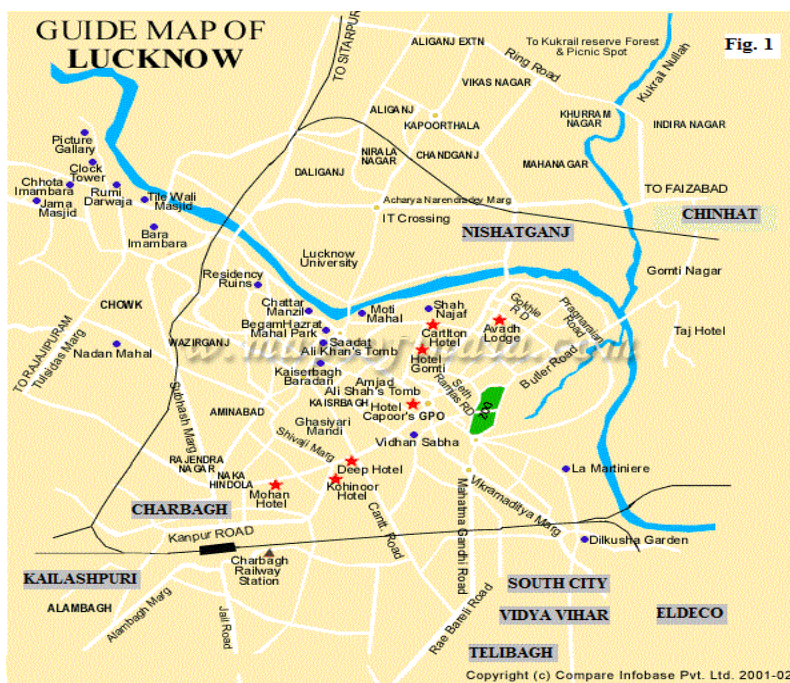


Figure 1: Map of Lucknow showing the sites selected for the study

All the water samples were tested for their pH values. The pH value of water was recorded minimum (7.0) in the hand pump of Telibagh while the pH value was the maximum (8.25) in the water supply of Vidya Vihar. The pH of ground water was observed to be lower than that of municipal water. All the pH values were within the limits prescribed by World Health Organization (W.H.O.) [8] i.e. 6-8 and Bureau of Indian Standards [4] i.e. 6.5-8.5 for drinking water.

The total hardness of samples varied from a minimum of 60 mg/l at Vidya Vihar to a maximum of 220 mg/l in the ground water of Charbagh. Except for Vidya Vihar and Charbagh the total hardness of ground water was recorded to be less or equal to that of municipal water supply. The limit of 500 mg/l prescribed by W.H.O. and B.I.S. was not crossed by either of the sample sets.

The ground water sample of Charbagh showed maximum alkalinity (234 mg/l) followed by the ground water sample from ELDECO (214 mg/l), water supply sample of Charbagh (212 mg/l) and Nishatganj (204 mg/l) which was beyond the limit of 200 mg/l as prescribed by the B.I.S. The water supply of Vidya Vihar had the least alkalinity of 110 mg/l. The alkalinities of rest of the samples were within the limit of 200 mg/l as per the B.I.S. standards [4].

The chloride content of hand pump as well municipal water was maximum (approximately 121.40 mg/l) in Kailashpuri. This may be because of the problem of sanitation and waste disposal as well accumulation of solid waste in the area which is the likely reason for increased alkalinity. The water sample of Vidya Vihar showed least chloride content (14.18 mg/l). This area also happens to be relatively less polluted. The chloride content of ground water may be higher because of high concentration of salts in it as a result of mineral dissolution and leaching of salts. The chloride content of all the samples were far below the limits set by W.H.O. and B.I.S [8, 4]. The ground water of Telibagh was the most polluted in terms of nitrate (53.2 mg/l). Here the nitrate value exceeded the permissible limit of 45mg/l prescribed by the B.I.S. This may be because of lack of proper sanitation and release of faecal matter in the open by the local population which is the main problem in that area.

Faecal matter happens to contain nitrate which gets dissolved with rainwater to join the water table. This water is withdrawn for drinking purposes and the nitrate dissolved in it enters the human body. It causes methaemoglobinemia in infants also called the blue baby syndrome in which the body of children goes blue due to lack of oxygen in the blood. Long term chronic exposure may even lead to diuresis [13]. Nitrate has also been associated with cancers of the digestive tract and non-hodgkin's lymphoma [9, 5]. Chinhat is the safest in this respect having about 12.7 mg/l of nitrate in its ground water.

CONCLUSION

The present investigation has led us to the conclusion that the qualities of a majority of water samples subjected to study were acceptable according to the BIS and WHO guidelines for domestic purposes except for the ground water of Telibagh and the ground water of Charbagh and Chinhat. The pH values were found to be negatively correlated to temperature indicating that an increase in temperature leads to a decrease in pH thus making it more acidic.

Overall the deep bore well water of Vidya Vihar was found to be safest for drinking purpose.

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REFERENCES

- [1] Abdul Jameel A. 1998. Physico-chemical studies in Uyyakondan Channel water of river Cauvery. *Pollution Research*, 17 (2): 111-114.
- [2] Agone National Laboratory, EVS Human Health fact sheet. 2005. Available at <http://www.ead.anl.gov/pub/doc/nitrate-ite.pdf>.

- [3] Barua A K. 2001. Water Technology Management Challenges and Choices in Sustainability of Water use, Dominant Publishers and distributors, New Delhi, 2: 2-3.
- [4] BIS. 1991. Indian Standard Specifications of drinking water. B.S. 10500.
- [5] Camargo J A and Alonso A. 2006. Ecological and toxicological effects of inorganic nitrogen pollution in aquatic ecosystems: a global assessment. *Environ. Int.*, 32: 831-849.
- [6] Clesceri L S, Greenberg A E and Trassel R R (Editors). 1998. Standard Methods for the Examination of Water and Wastewater, American Public Health Association, Washington DC, U.S.A. Vol 19.
- [7] De A K. 2001. Environmental Chemistry, New Age International Publishers, New Delhi, 4: 230-231.
- [8] Guidelines for drinking water quality (World Health Organization), Geneva, 2: 97-100.
- [9] Gulis G, Czompolyova M and Cerhaned J R. 2002. An ecological study of nitrate in municipal drinking water and cancer incidence in Trnava District, Slovakia. *Environmental Research*, 88: 182-187.
- [10] Prihandrijanti M and Firdayati M. 2011. Current Situation and Considerations of Domestic Wastewater Treatment Systems for Big Cities in Indonesia, *Journal of Water Sustainability*, Volume 1, Issue 2, PP 249-256.
- [11] Sharma P D. 2003. Ecology and Environment, Rastogi Publications, Meerut. 7: 461.
- [12] The World Bank, Global Water Partnership Associate Program. 2009. Lucknow City – India: Groundwater Resource Use & Strategic Planning Needs. Sustainable Ground Water Management, Lessons from Practice.
- [13] US EPA. (2007). Water Quality Trading Toolkit for Permit Writers (No. EPA 833-R-07-004).