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Groundwater quality in Tirupur, Tamilnadu, India: A pilot-assessment

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Abstract: Tirupur is a well known town of south India for its garments and dyeing industries. There is a growing concern that the potable water sources are getting deteriorated day by day. Therefore, in order to assess the groundwater quality, water samples were taken from six bore wells (Gandhi Nagar, Odakkadu, Kongu Nagar, Old bus stand, Periyar colony and Thennampalayam) and six open wells (Velliyangadu, College road, Kangayam road, Karuvampalayam, Rakiyapalayam and Sevanthampalayam) for a period of six months from October, 2007 to March, 2008. These water samples were tested for water quality parameters, such as temperature (T), pH, total alkalinity (TA), total hardness (TH), calcium (Ca), total dissolved solids (TDS), nitrate (NO_3), chloride (Cl), silica (Si) and phosphate (PO_4). Among these parameters TA, TH, Ca, TDS, NO_3 and Cl were found to exceeded from prescribed desirable Indian standards (200, 300, 75, 500, 45 and 250 mg L^{-1} respectively, BIS, IS: 10500: 1991). Therefore, these parameters are considered as most polluted. Analyses of regression revealed that TA, TH, Ca and NO_3 showed negatively correlated between stations, where as TDS and Cl showed positively correlated. Among twelve stations tested samples of eight stations (Odakkadu, Kongu Nagar, Old bus stand, Periyar colony, Thennampalayam, Velliyangadu, College road and Karuvampalayam) were found to exceed from the desirable limits. There were three sampling stations (Gandhi Nagar, Kangayam road and Sevanthampalayam) where five of the above said water quality parameters were found to exceed from the desirable limits. There was only one sampling station, Rakiyapalayam which exceeds the desirable limits with four of the above said water quality parameters. Moreover, TH, TDS and Cl were recorded to above the desirable limit of Indian standard in all the sampling stations. Ca and NO_3 were found to above the desirable limit in eleven sampling stations. TA was recorded to above the desirable limit in nine sampling stations. However, the pH recorded was within desirable limits (6.5-8.5) in all the sampling stations. The overall observation suggests that the ground water quality was less desirable for consumption in these places of Tirupur town. It is suggested that the deterioration of ground water quality was mainly due to contamination by man-made sources, like household let-outs and effluents from dyeing industries. Therefore, steps need to be taken urgently to ensure effective water resource management in Tirupur.

Key words: Tirupur, Potable water quality, Bore wells, Open wells, Dyeing

Introduction

Generally, the groundwater is used for domestic, agriculture and industrial purposes in almost all parts of the world. The groundwater in wells and bore wells are the source of drinking water for about 90% of the human population (Rao, 2002; Karunakaran *et al.,* 2009). Now a days, the groundwater quality is getting degraded due to various anthropogenic activities (Rao and Mamatha, 2004; Subramani *et al.,* 2005; Jinwal and Dixit, 2008). It has been reported that at least 1% of ground water source is polluted (Davis and Cornwell, 1991). The quality of water depends on individual hydrological, physical, chemical and biological factors. Generally higher proportions of dissolved constituents are found in ground water than in surface water because of greater interaction of ground water with various materials in geologic strata. There are voluminous literature is available on studies regarding ground water quality (Gupta and Gupta, 1999; Adak and Purohit, 2003; Rajasekarapandian *et al.,* 2005; Rajan and Paneerselvam, 2005; Thakare *et al.,* 2005; Shikha *et al.,* 2007; Joarder *et al*., 2008; Antony *et al*., 2008; Shyamala *et al.*, 2008). The following are the some of the recent case studies of ground water quality assessment reported in India. Prakash and Somashekar (2006) studied the ground water quality of Anekal (Bangalore) and reported the unacceptable quality not suitable for drinking purpose at several locations. Bishnoi and Arora (2007) studied the ground water quality in rural area of Rohtak district and concluded that most of the samples did not comply with WHO standards. Mishra *et al.* (2008) has studied the ground water quality of Lucknow city and suggested deterioration day by day. Agarwal *et al.* (2009) assessed the potable ground water quality of Chinhat, Lucknow and suggested that the contamination problems not alarming at present but groundwater quality may deteriorate with time. Mishra *et al.* (2009) studied the impact of urbanization on drinking water quality in Lucknow and suggested that the water received at the users end was severely contaminated, especially regarding total alkalinity (240-410 mg L^{-1}) and total hardness (310-430 mg L^{-1}). These values are above desirable limits of respective parameters as per Indian standard (BIS, 1991). The periodic monitoring of ground water quality is necessary to safe guard its long term sustainability. Reddy (2009) studied the groundwater quality in Patancheru mandal of Medak district, Andhra Pradesh and found that the quality was deteriorated mainly due to the industrial activity. The reported value of total dissolved solids was ranged between 516-1613 mg L^{-1} and the content of chloride was ranged between 276-417 mg L^{-1}. These values are above desirable limits of respective parameters as per Indian standard (BIS, 1991).

Tirupur (11° 7' N and 77°15'E), located on the banks of the river Noyyal, a tributary of the river Cauvery (60 km away from Coimbatore city, Tamilnadu, south India), It is a well known centre of hosiery manufacture in India. This is popularly known as "Baniyan city" serves as one of the major exporters of textiles to the world market. Process of dyeing and bleaching of fabrics produces a lot of organic and inorganic pollutants. Thus, there is a growing concern that the industrial pollution at Tirupur has affected not only the surface water but also the soils and ground water. Literature indicates that Tirupur is facing the problem of groundwater pollution more because of the primitive processing methods of dyeing (Manivasakam, 1997; Jacob and Azariah, 1998; Senthilnathan and Azeez, 1999). There are many reports which indicate the status of groundwater pollution in Tirupur. According to a report of Public Works Department, before the 1990s, ground water in and around Tirupur was potable. Open wells and bore wells in and around Tirupur exhibit high levels of TDS (most areas >3000 mg L^{-1} and some places even up to 11,000 mg L^{-1}) and chloride (generally > 2000 mg L^{-1} and certain areas up to 5000 mg L^{-1}) due to industrial pollution (Report of the PWD, Govt. of Tamilnadu, India, 2002 "Study on Implementation of Cleaner Production in Textile Industries at Tirupur." Organizations involved in Project: PWD Water Resources Organization, Coimbatore; ASQ Engineers, Kuruvikkaranpalayam; School of Energy, PSG College of Technology, Coimbatore, India). One of the most significant challenges for Tirupur textile industry today is water requirement. Textile dyeing and bleaching industries are water intensive and generate large quantity of effluents with toxic chemicals. The current values of pollution concentration are very much higher than the background levels at this region. The present work was undertaken to analyze the ground water quality parameters, such as temperature, pH, total alkalinity, total hardness, calcium, total dissolved solids, nitrate, chloride, silica and phosphate in selected bore wells and open wells at Tirupur town in order to evaluate the potable quality of ground water.

Materials and Methods

Ground water samples were collected from twelve point locations indicated bellow in the corporation of Tirupur for a period of six months from October, 2007 to March, 2008. Of which six bore wells situated at Gandhi Nagar, Odakkadu, Kongu Nagar, Old bus stand, Periyar colony and Thennampalayam and six open wells situated at Velliyangadu, College road, Kangayam road, Karuvampalayam, Rakiyapalayam and Sevanthampalayam. The sampling stations are situated approximately 3-8 km away from Old bus stand. The groundwater samples were collected from each sampling station uniformly with a gap of ten days between sampling. Therefore, sampling was done for three times a month and each sampling was taken in triplicate. Therefore, every month each parameter was estimated at least nine times (3 x 3 = 9) and thus, fifty four times during the study period (9 x 6 months = 54) with eighteen average values (3 mean values per month for 6 months = 18). Actually, every time a mean of triplicate values was considered as an individual observation. Thus fifty four replicate values are equated to eighteen mean values.

Sampling was done in sterile, wide-mouth, screw capped glass bottle during the morning hours between 7-9 AM. The samples were taken to the laboratory in appropriate temperature and immediately processed for analysis. The water samples were subjected to analyses following standard methods for the examination of water and wastewater (APHA, 2005). Water temperature (T) was measured by using a thermo probe at the sample collection site and recorded in a Celsius scale. The pH was measured by using portable digital pH meter (Eutech Instruments, India). Total alkalinity (TA) was estimated by titration of the samples against strong H_2SO_4 as described by Trivedi and Goel (1986) and methyl orange was used as an indicator. Total hardness (TH) was estimated by EDTA method using Eriochrome Black T as an indicator as described by Trivedi and Goel (1986). Calcium (Ca) was estimated by EDTA titrimetric method using ammonium purpurate as an indicator as described by Manivasakam (1997). The total dissolved solid (TDS) was estimated by gravimetric method. Nitrate was estimated spectrophotometrically by adopting brucine sulphate method as described by Manivasakam (1997). Chloride was estimated by silver nitrate titrimetric method using potassium chromate as an indicator as described by Manivasakam (1997). Silica was estimated spectrophotometrically by adopting heteropoly blue method in the presence of stannous chloride. For the estimation of total phosphate (PO_4) the water samples were digested by adopting H_2SO_4-K_2SO_4 method. The acid in the digest was neutralized by titrating against NaOH in the presence of phenolphthalein indicator and the phosphate thus released was estimated spectrophotometrically as described by Manivasakam (1997). The data obtained were compared with desirable and permissible limits of Indian standard as well as WHO standard. The water quality data obtained in all twelve stations were subjected to correlation analysis using Microsoft EXCEL to determine their linear relationship. The 'y' value and R^2 were considered to determine the correlation/ linear type.

Results and Discussion

Table 1 presents the values of various physico-chemical parameters of the groundwater samples. This table also represents the correlation and regression values obtained for each parameter when water quality parameters of different stations were plotted and correlated. In order to compare and to understand the desirable and permissible limits of Indian standard (BIS, 1991) as well as WHO standard were also given in Table 1. The parameter wise and station wise deviations from these limits are also indicated in the Table. The temperature was recorded to be in the range between 27.0 to 28.3^{o}C, which is said to be normal. Generally, water temperature is an important factor to influence the biological reactions. Higher water temperature accelerates chemical reactions and reduces solubility of gases and dissolved oxygen. This point is applicable to the present study, since ground water samples were taken from open wells also. Temperature is also very important in determination of other parameters like pH, conductivity, saturation level of gases and various forms of alkalinity (Shyamala *et al.,* 2008).

The pH is one of the important water quality parameters since most of the aquatic organisms are adapted to an average pH range. The limit of pH value for drinking water is specified as 6.5-

Table - 1: Physico-chemical parameters of ground water samples

Type	Station	T (°C)	pH	TA (mg L^{-1})	TH (mg L^{-1})	Ca (mg L^{-1})	TDS (mg L^{-1})	NO_3 (mg L^{-1})	Cl (mg L^{-1})	Si (mg L^{-1})	PO_4 (mg L^{-1})	No. of Parameters Above DL	No. of Parameters Above PL
Bore well	Gandhi Nagar	27.0±1.09	7.16±0.36	100±8.46	1300±181.54	338±14.84	3200±192.35	146±9.35	3526±79.94	280±13.97	ND	5	5
	Odakkadu	27.0±1.78	7.65±0.37	350±23.66	975±136.49	125±12.52	4800±214.84	325±8.41	2540±129.61	670±16.73	ND	6	4
	Kongu Nagar	27.0±1.89	7.90±0.24	375±18.70	1125±235.94	333±18.27	1900±121.81	473±11.62	3380±245.27	836±13.91	0.429±0.003	6	4
	Old bus stand	27.6±1.37	8.10±0.47	425±17.32	700±72.59	428±19.18	3200±192.35	528±7.50	535±102.32	188±9.31	ND	6	4
	Periyar colony	27.3±1.21	7.50±0.55	675±72.93	600±77.93	112±9.20	900±57.96	55±4.47	2478±94.23	100±8.0	ND	6	2
	Thennampalayam	27.3±1.36	8.13±0.44	725±81.67	950±88.54	96±6.41	1600±297.99	78±4.73	525±24.49	148±10.65	ND	6	2
Open well	Velliyangadu	27.5±0.54	8.03±0.73	235±13.13	875±72.93	160±10.35	4200±191.41	99±6.60	628±23.45	198±7.48	ND	6	2
	College road	27.5±1.37	8.28±0.59	220±17.33	825±81.67	99±6.69	4300±219.08	330±14.28	3200±192.35	625±14.01	ND	6	4
	Kangayam road	28.3±0.81	8.40±0.47	400±14.15	1125±235.94	55±4.47	1100±89.44	97±5.65	436±23.59	1100±89.44	ND	5	1
	Karuvampalayam	27.8±1.06	7.81±0.29	410±26.48	325±17.32	343±9.69	5700±130.38	110±7.79	4928±77.20	220±9.87	ND	6	4
	Rakiyapalayam	28.0±0.89	7.58±0.66	175±25.91	1375±208.30	110±12.52	4800±214.84	42±4.33	2478±94.23	80±9.20	ND	4	3
	Sevanthampalayam	27.1±1.60	8.03±0.73	200±7.45	950±88.54	224±6.06	2100±89.44	124±5.24	3400±259.30	330±16.34	ND	5	5
Correlation & Regression	Y - value	0.0695x + 26.99	0.042x + 7.607	-11.22x +447.1	-10.92x +998.1	-13.14x +304.0	60.14x +2725	-23.21x +351.4	37.29x +2095	-10.09x +463.5	-0.010x +0.0104	—	—
	R^2	0.358	0.181	0.038	0.017	0.140	0.017	0.246	0.008	0.012	0.093	—	—
	Linear type	Positive	Positive	Negative	Negative	Negative	Positive	Negative	Positive	Negative	Negative	—	—
No. of stations above DL		—	—	9	All stations	11	All stations	11	All stations	—	—	—	—
No. of stations above PL		—	—	2	10	5	8	7	8	—	—	—	—
Desirable limit (BIS, Indian)		NP	6.5-8.5	200	300	75	500	45	250	NP	NP	—	—
Permissible limit (BIS, Indian)		NP	No Relaxation	600	600	200	2000	100	1000	NP	NP	—	—
WHO standard		NP	6.5-8.5	NP	500	NP	1000	10	250	NP	NP	—	—

Each value is mean ± SD of 54 individual observations (3x3=9x6=54); a mean of 3 values is considered as individual observation, *i.e.*, each value is 3x6=18 individual means).
ND, Not deducted. NP, Not prescribed. DL, Desirable limit. PL, Permissible limit.
T, Temperature; TH, Total hardness; TDS, Total dissolve dolids; Cl, Chloride; TA, Total alkalinity; NO_3, Nitrate, Ca, Calcium; Si, Silica; PO_4, Phosphate.

8.5 (BIS, 1991). A lower pH (< 4) and higher pH (> 8.5) produce sour and alkaline tastes respectively to the water (Trivedi and Goel, 1986). In the present study, the recorded pH values were ranged from 7.17 to 8.40. The maximum pH value of 8.40 was observed in Kangayam road and minimum values of 7.17 in Gandhi Nagar. Therefore, the obtained pH value was slightly alkaline in nature and this parameter was not adversely affected. However, it alters the taste of water. Similar alkaline pH (7.4-8.0) has been reported in the groundwater samples taken from open wells at either side of the Noyyal river, Tirupur (Senthilnathan and Azeez, 1999), in the groundwater samples at Chithar river basin, Tamilnadu (Subramani *et al.,* 2005) and in groundwater samples (7.8-9.7) of villages at Ambala district, Haryana (Gupta *et al*., 2009).

The alkalinity of water is due to presence of minerals. The various ionic species that contribute to alkalinity include bicarbonate, hydroxide, phosphate, borate and organic acid. The maximum (725 mg L^{-1}) and minimum (100 mg L^{-1}) values of total alkalinity was observed in Thennampalayam and Gandhi Nagar respectively. As per Indian standard (BIS, 1991) the desirable limit of total alkalinity in drinking water is 200 mg L^{-1}, and the permissible level is 600 mg L^{-1}. In this study, the total alkalinity was above the desirable limit in nine stations (Odakkadu, Kongu Nagar, Old bus stand, Periyar colony, Thennampalayam, Velliyangadu, College road, Kangayam road and Karuvampalayam) and above the permissible limit in two stations, Thennampalayam (725 mg L^{-1}) and Periyar colony (675 mg L^{-1}). Therefore, these stations have more alkaline groundwater. In the present study, it is suggested that the discharge of dyeing effluents into the land surface may lead to an increased alkalinity of ground water due to leaching effect (Shyamala *et al*., 2008). Total alkalinity above desirable limit (250-650 mg L^{-1}) has been reported by Senthilnathan and Azeez (1999) in the groundwater samples of open wells at either side of the Noyyal river, Tirupur, by Antony *et al*. (2008) in ground water samples of Manali Pertroleum Industrial region in Tamilnadu (225-1015 mg L^{-1}), by Alam *et al*. (2009) in groundwater samples at Delhi (260-860 mg L^{-1}) and by Gupta *et al*. (2009) in groundwater samples of villages at Ambala district, Haryana (600-1500 mg L^{-1}).

In this study, the TH was higher in all sampling stations when compared with the desirable limit of Indian standard. Total hardness was found to maximum in Rakiyapalayam (1375 mg L^{-1}) and minimum in Karuvampalayam (325 mg L^{-1}). Among twelve sampling stations tested, ten stations were TH value with above the permissible limit (600 mg L^{-1}). The stations with TH values of below or within the permissible limit are Karuvampalayam (325 mg L^{-1}) and Periyar colony (600 mg L^{-1}). Total hardness above desirable limit (390-4700 mg L^{-1}) has been reported by Senthilnathan and Azeez (1999) in the groundwater samples of open wells situated at either side of the Noyyal river, Tirupur. Higher TH value (400-845 mg L^{-1}) has also been reported by Tatawat and Chandel (2007) in groundwater samples of Jaipur city, Rajasthan and by Gupta *et al*. (2009) in groundwater samples of villages at Ambala District, Haryana (308-856 mg L^{-1}). Generally, total hardness is caused by presence of $Ca^{2+}$and Mg^{2+}. Calcium is one of the most abundant substances in the natural water. Calcium is a component of water hardness and can combine with bicarbonate and carbonate results in deposition of lime (Shyamala *et al.*, 2008). The level of calcium in natural water generally vary from 10 to 100 mg L^{-1} depending upon the types of the rocks. Calcium level is the best indicator of water hardness. In this study, calcium level was exceeded the desirable limit of 75 mg L^{-1} in all sampling stations except Kangayam road where calcium level was 55 mg L^{-1}. There were five stations with their calcium levels above the permissible limit (200 mg L^{-1}). Calcium level was maximum (428 mg L^{-1}) in Old bus stand. The recorded higher level of calcium and total hardness was mainly may be due to disposal of sewage and industrial wastes. Calcium level above desirable limit (140-2800 mg L^{-1}) has been reported by Senthilnathan and Azeez (1999) in the groundwater samples taken from open wells at either side of the Noyyal river, Tirupur. Similar higher level of calcium (113-200 mg L^{-1}) has been reported by Mishra and Bhatt (2008) in groundwater samples of Anand district, Gujarat, by Antony *et al*. (2008) in ground water samples of Manali pertroleum industrial region in Tamilnadu (129-451 mg L^{-1}), by Alam *et al*. (2009) in groundwater samples of Delhi (92-200 mg L^{-1}) and by Gupta *et al*. (2009) in groundwater samples taken from the villages at Ambala district, Haryana (76-136 mg L^{-1}). In this study, the content of calcium was lower (55 mg L^{-1}) at higher pH (8.4). Similar finding in calcium (880 mg L^{-1} at pH 8.6 and 176 mg L^{-1} at pH 9.2) has been reported by Subramani *et al.* (2005) in the groundwater at Chithar river basin, Tamilnadu.

Ground water usually contains higher TDS concentration than surface water, because of the mineral pick-up from the soil rocks. The specified limit of TDS for drinking water is between 500-2000 mg L^{-1} (BIS, 1991). In the present study, TDS was found to maximum (5700 mg L^{-1}) in Karuvampalayam and minimum (900 mg L^{-1}) in Odakkadu samples. TDS was exceed the desirable limit of Indian standard in all sampling stations. TDS above desirable limit (1510-8000 mg L^{-1}) has been reported by Senthilnathan and Azeez (1999) in the groundwater samples taken from open wells at either side of the Noyyal river, Tirupur. Similar higher value of TDS has also been reported by Subramani *et al.* (2005) in the groundwater at Chithar river basin, Tamilnadu (543-5051 mg L^{-1}), by Tatawat and Chandel (2007) in groundwater samples of Jaipur city, Rajasthan (645-1435 mg L^{-1}), by Antony *et al*. (2008) in ground water samples of Manali pertroleum industrial region in Tamilnadu (1228-5875 mg L^{-1}), by Alam *et al*. (2009) in groundwater samples at Delhi (642-1430 mg L^{-1}) and by Gupta *et al*. (2009) in groundwater samples taken from Ambala district, Haryana (569-1753 mg L^{-1}). In the present study, TDS was observed to above the permissible limit in eight sampling stations. The higher TDS values observed in ground water samples may be due to the impact of effluents and sludge discharged from dyeing units as suggested by Shyamala *et al.* (2008).

Water nitrate level above 25 mg L^{-1} is an indication of direct contamination (European Community, 1988), and above 50 mg L^{-1} is categorized as unsuitable for drinking (WHO, 1993). In the present study, the nitrate value was found to maximum in Old bus stand, 528 mg L^{-1} and minimum in Rakiyapalayam, 42 mg L^{-1}. Further, the level of nitrate was found to exceed the desirable limit (45 mg L^{-1}) in all sampling stations except Rakiyapalayam samples (42 mg L^{-1}). The nitrate level was alarming in seven sampling stations where the values recorded were above the permissible limit (100 mg L^{-1}). Similar result in nitrate levels (59-196 mg L^{-1}) has been reported by Shikha *et al*. (2007) in drinking waters at Delhi, India. The higher concentration of nitrate recorded may be attributed to leaching of organic materials and biodegradation products (Shikha *et al*., 2007).

Chloride is the best indicator of water pollution (Rai, 1974). When combines with sodium it gives a salty taste to drinking water. The specified desirable and permissible limit of chloride in drinking water is 250 and 1000 mg L^{-1} respectively. In the present study, chloride was found to maximum in Karuvampalayam, 4928 mg L^{-1} and minimum in Kangayam road, 436 mg L^{-1} water samples. The level of chloride was found to above the desirable limit (250 mg L^{-1}) in all sampling stations and above the permissible limit (1000 mg L^{-1}) in eight sampling stations. In this study, the presence of higher chloride level may be due to the effect of industrial effluents and domestic let outs as suggested by Leung and Jiao (2005). Chloride level above desirable limit (886-3545 mg L^{-1}) has been reported by Senthilnathan and Azeez (1999) in the groundwater samples taken from open wells at either side of the Noyyal river, Tirupur. Similar higher chloride level (259-2482 mg L^{-1}) has also been reported by Subramani *et al*. (2005) in the groundwater at Chithar river basin, Tamilnadu, by Shikha *et al*. (2007) in drinking water samples at Delhi (258-418 mg L^{-1}), by Antony *et al*. (2008) in ground water samples of Manali pertroleum industrial region in Tamilnadu (427-2372 mg L^{-1}) and by Alam *et al*. (2009) in groundwater samples of Delhi (257-931 mg L^{-1}).

Silicon is the most abundant element in the earth after oxygen. Despite it's over abundance in nature, it occurs in meager quantity in ground water. This is because of its resistance to chemical weathering process. It has been reported that solubility of silica was more at higher pH and temperature (Gupta and Gupta, 1999). In the present study, at higher pH (8.4) and temperature (28.3) the level of silica was found to maximum (1100 mg L^{-1}) in Kangayam road water sample. This may be due to the influence of effluents generated through dyeing industries. A minimum level of silica, 80 mg L^{-1} was recorded in Rakiyapalayam water sample. Besides chloride, phosphate is also an indicator of water pollution. It originates from the earth's crusts, and addition of fertilizer and organic matter from agriculture and industrial run-off. In the present study, the level of phosphate was found to below the deductable limit in all sampling stations except Kongu Nagar where also only a trace quantity of phosphate was recorded (0.429 mg L^{-1}). Therefore, in this study, phosphate was the least affected/ unpolluted parameter despites other parameters were somehow polluted because of the anthropogenic activities operated.

In conclusion, the groundwater is the only source of drinking and other domestic purposes in Tirupur. It is very difficult to treat groundwater after getting polluted. Therefore, protection of its potable quality is the major environmental priority. In the present study, among twelve sampling stations studied for their water quality parameters, TA, TH, Ca, TDS, NO_3 and Cl were found to exceeded the desirable limits in eight sampling stations (Odakkadu, Kongu Nagar, Old bus stand, Periyar colony, Thennampalayam, Velliyangadu, College road and Karuvampalayam). There were three sampling stations (Gandhi Nagar, Kangayam road and Sevanthampalayam) where five of the above said water quality parameters exceeded the desirable limits. In this study, only one sampling station, Rakiyapalayam was found to least polluted. Its water quality was found to exceed the desirable limits of four parameters (TH, Ca, TDS and Cl). However, two sampling stations were found to most polluted (Gandhi Nagar and Sevanthampalayam), where five of the above said water quality parameters were exceeded the permissible limits. Moreover, five sampling stations (Odakkadu, Kongu Nagar, Old bus stand, College raod and Kuruvampalayam) were exceeded the permissible limits of four water quality parameters. One sampling station (Rakiyapalayam) was exceeded the permissible limits of three parameters. Three sampling stations (Periyar colony, Thennampalayam and Velliyangadu) were exceeded permissible limits of two water quality parameters. Only one sampling station (Kankgayam road) was exceeded the permissible limit of only one water quality parameter (TH). Analyses of correlation and regression revealed that TA, TH, Ca and NO_3 were negatively correlated between sampling stations, whereas TDS and Cl showed positive correlation. The data obtained indicated a fast deterioration of ground water quality due to the discharge of effluent from dyeing and bleaching industries. Thus, a large urban population may be at risk of consuming groundwater with less desirable potable quality. Therefore, urgent steps need to be taken to ensure effective water resource management in Tirupur.

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