STUDIES ON THE PHYSICO-CHEMICAL PARAMETERS OF WELL, BORE WELL, POND AND LAKE WATERS IN SENGILIKUPPAM VILLAGE OF VELLORE DISTRICT, TAMILNADU

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Abstract: The present study is aimed to see the water quality of pond water, lake water, bore well water and well water of Sengilikuppam village, Vellore district. For the present study, water samples collected from well, bore well, lake and pond in Sengilikuppam village of Vaniyambadi town of Vellore District were analyzed for the physical parameters such as Appearance, Odour, Turbidity, Total dissolved solids (TDS) and Electrical conductivity mic mho/cm and chemical parameters such as pH, alkalinity, total hardness, Mg, Fe,Na, K, Mn, NH3, No2, NO3, Cl, F, So_4, PO_4 and Tidy's test content using standard methods as given in APHA (2000) and their results are depicted in table 1. The acceptable limit mentioned in the text represents the standard for drinking water quality according to WHO (1984). In Sengilikuppam village, result indicated that the levels of physico - chemical parameters such as turbidity (12), TDS (2457), EC (3510) and total hardness (9950) were recorded to be higher values than the permissible limit for drinking purpose. Other physico-chemical parameters were found to be within the desirable limit. The water of the lake was shown to be yellowish in colour. It is concluded from the study that the water is found to be not suitable for drinking purpose as some of the vital physico - chemical parameters were seemed to be higher values. In pond water, the result indicated that the appearance of the water was yellowish in colour and the content of TDS, EC, pH and other chemical parameters were seemed to below the desirable limit.
The result of the bore well water indicated that TDS content (1111), EC (1587) and other chemical parameters were found to be within the permissible limit for drinking purpose. The result of the well water indicated that the contents of TDS (1666), EC (2380) and Total Hardness (640) were seemed to be higher than other water parameters. It is concluded from this study that the bore water of Sengilikuppam village was found to be more suitable for drinking purpose since the colour of the water was seemed to be clear and colourless. Other physico- chemical parameters were found to be within the permissible limit compared to well water, lake water and pond water of Sengilikuppam village. It is suggested from this study that the well water of Sengilikuppam area may be protected from the intrusion of tannery effluent discharges into the open water since the colour of brownish is a symptom of water getting polluted slowly.

Introduction: India is a vast country, where a large number of people live in villages. A large number of villages and cities still do not have adequate and safe drinking water. In order to essential needs of the people, water comes at the second position of air. During the last decade, it has been realized that the time has come to pay more and more attention to the ground water resources and their adequate management by utilizing modern technique (Tiwari, 1999). Numerous anthropogenic activities, like disposal of sewage and industrial water, recreational activities, excessive usage of fertilizers to land and use pesticides have threatened environmental health of both surface and ground water. Water pollution has however, threatened to reduce the quantity available in ponds, lakes, rivers and reservoirs due to other human activities (Trivedy and Chandrasekar, 1999).
Roa, *et al*. (1999) reported that due to increasing industrialization, urbanization and other developmental activities most of our water bodies such as ponds, lakes, streams and rivers have become polluted. Environmental effects of chromium (Cr) have been extensively reviewed (NAS, 1974; Steven, *et al.,* 1976; Synder, *et al.,* 1977; Towill, *et al.,* 1978; Taylor and Parr, 1978; Langard and Norseth, 1979; Post and Campbell, 1980; Hatherill, 1981; Ecological Analysts, 1981). Tamil Nadu is situated at the South Eastern Extremity of the Indian peninsula and it is the southernmost state of mainland India. It is located between 8°05 and 13°34 at North Latitude, 76014' and 8021' at East Longitude, Andhra Pradesh in the north, Karnataka in the North-West, Kerala on the West, Bay of Bengal in the east. Vellore district has become not only the hub of educational institution and also for the tannery industry, chemical industry, sugar mills etc., Vellore water is in an alarming condition as it has been receiving domestic and industrial wastes. Hence, the present study is centered around the water quality assessment in well, bore, pond and lake waters of Arcot town and its surrounded area of Vellore District.
Materials and Methods: Sampling area of Sengilikuppam village (Fig.1) is located 7 km away from Vaniyamabdi town and the Vaniyambadi area is known contain more than 300 tanneries. The total area of Vaniyambadi Firka is 72.39 sq.km and Vaniyambadi Firka lies between North latitudes 12°37' 00"to 12° 48' 00" and east longitudes 78° 33' 00"to 78° 42' 00". Water samples for present study were collected from lake (Fig.3), pond (Fig.4), well and

bore well waters (Fig.2). Well and bore waters are being utilized both for drinking and irrigation purposes. Lake water is used for fishing and irrigations purposes. Since the pond water contains lesser amount of water, it is not being utilized for any other purpose.

The methods followed for the physical parameters such as appearance, odour, turbidity NTU, Total Dissolved Solids and electrical conductivity and chemical parameters such as pH, alkalinity pH, alkalinity total, total hardness CaCo3, calcium, magnesium, sodium, potassium, iron total, manganese, free ammonia,, nitrite, nitrate chloride, fluoride, sulphate, tidy's test were done according to the procedures given in APHA (2000) and their units are represented as mg/l. The water samples were collected using 1 liter of polyethylene bottle from each month from December,2012 to March, 2013 for three months.

Fig 1: Showing the Colletion of Water Sample from the Bore Water in Sengili Kuppam Village

Fig 2: Showing the Colletion of Water Sample from the Pond in Sengili Kuppam Village

Results and Discussion: For the present study, water samples collected from well, bore well, lake and pond in Sengilikuppam village of Vaniyambadi town of Vellore District were analyzed for the physical parameters such as Appearance, Odour, Turbidity, Total dissolved solids (TDS) and Electrical conductivity mic mho/cm and chemical parameters such as pH, alkalinity, total hardness, Mg, Fe,Na, K, Mn, NH_3, No2, NO_3, Cl, F, So_4, PO_4 and Tidy's test content using standard methods as given in APHA (2000) and their results are depicted in table 1. The acceptable limit mentioned in the text represents the standard for drinking water quality according to WHO (1984). The present study is aimed to see the water quality of pond water, lake water, bore well water and well water of Sengilikuppam village, Vellore district.

In Sengilikuppam village, appearance of bore well water was clear and colourless and well water was slightly brownish in colour. Lake and pond waters were seemed to be yellowish in colour and this may be due to result from the presence of natural metallic ions like iron and manganese, human and peat material, plankton, Weeds and Industrial waste. The

colour is usually the first contaminant to be recognized in wastewaters that affects the aesthetics, water transparency and gas solubility of water bodies

Table 1. Result of the Physico-Chemical Parameters of the Well Water, Bore Well Water, Lake and Pond Water Samples Collected from Sengilikuppam Village of Vellore Disricts

S. No.	Parameters	Acceptable Limit WHO (1984)		Sengilikup pam (Bore well water)	Sengilikup pam (Well water)	Sengilikup pam (Lake)	Sengilikup pam (pond)
	PHYSICAL EXAMINATIONS						
1.	Appearance	A	B	C & C	C & C	Yellowish	Yellowish
2.	Odour	Unobjectionable		None	None	None	None
3.	Turbidity NTU	1	10	0±00	9±0.05	12±1.0	15±1.0
4.	Total Dissolved Solids mg/l	500	2000	1111±5.0	1666±4.0	2457±4.0	351±3.50
5.	Electrical Conductivity (Mic mho/cm)	-	-	1587±2.0	2380±3.0	3510±2.0	501±1.50
	CHEMICAL EXAMINATIONS						
6.	pH	6.5-8.5	6.5-9.2	7.02±0.09	7.23±1.0	7.33±1.0	7.25±1.50
7.	Alkalintiy pH as $CaCO_3$ mg/l	-	-	0	0	0	0
8.	Alkalintiy Total as $CaCO_3$ mg/l	200	600	288±2.00	440±2.00	320±2.50	124±3.00
9.	Total Hardness as $CaCO_3$ mg/l	200	600	548±2.00	640±2.00	950±3.0	160±2.0
10.	Calcium as Ca mg/l	75	200	184±1.50	204±2.00	264±2.00	50±1.00
11.	Magnesium as Mg mg/l	30	150	21±0.09	31±1.00	70±2.00	8±0.05
12.	Sodium as Na	-	-	-	-	-	-
13.	Potassium as K	-	-	-	-	-	-
14.	Iron Total as Fe mg/l	0.1	1.0	0.04±0.00	0.85±0.05	0.30±00	0.62±0.1
15.	Manganese Mn	30	150	0.00	0.00	0.00	0.00
16.	Free ammonia as NH_3 mg/l	-	-	0.00	0.00	0.08±0.01	0.60±00
17.	Nitrite as NO_2 mg/l	-	-	0.00	0.00	0.01±00	0.08±00
18.	Nitrate as NO_3 mg/l	45	100	40±1.00	41±1.25	58±2.00	26±2.00
19.	Chloride as Cl mg/l	200	1000	254±1.00	430±2.00	0.8±0.09	60±2.00
20.	Fluoride as F mg/l	1.0	1.5	1.2±00	1.2±00	334±2.0	1.4±2.0
21.	Sulphate as SO_4 mg/l	200	400	182±2.0	211±2.0	0.12±2.0	43±1.0
22.	Phosphate as PO_4 mg/l	-	-	0.00	0.00	0.4±1.00	0.28±0.09
23.	Tidy's Test	-	-	0.2±00	0.2±00	0.4±00	0.5±0.01
24.	RC	-	0.2	--	-	-	-
25.	BACTERIOLOGICAL EXAMINATION (M.F Technique)			-	-	-	-
26.	Fecal Coliform (100M)	0	0	--	-	-	-

Note: 1. A CPHEEO Std – Desirable Limit: B.CPHEEO/BIS Std – Permissible limit in the absence of alternative source. 2. Results of Chemical Examination expressed in mg/l except pH 3. C & C – Clear & Colourless .

(Yuxing and Jian 1999). The odour was none in lake, pond, well and bore well waters. When odour is objectionable it indicates that the water has become deteriorated. Turbidity was within the limit in bore well water (0) and well water (9), Whereas, the turbidity level was found to be within the acceptable limit in lake water (12) and pond water (15). When the turbidity is increased it is indicated that the water is under deteriorative condition and this may be due to the intrusion of tannery effluent discharge from the tannery industries. This increase of turbidity content in the water may cause lack of productivity, reduction of O_2 and increase of CO_2 and thereby reduction of biomass including fish and other aquatic organisms will occur (Akan, et al., 2009).

Total dissolved solids (TDS) content was found to be 111 in bore well water, 1666 in well water and 351 in pond water. TDS content of lake water was seemed to be 2457. Among these four waters compared, the lake water was found above the acceptable limit. The TDS content of well water, bore well water and pond water was found to be within the acceptable limit. It is

predicted that TDS content was noticed to be high in all the water bodies except the pond water (351). Total dissolved solids are one of the important measures of water quality. Waters with high solid content are of inferior palatability and may induce an unfavourable physiological reaction in the transient consumer. The desirable limit of TDS is 500 (WHO, 1984). The hike level of TDS may cause harmful effects for the purpose of irrigation and drinking and this may be due to the release of tannery effluents into the water body with uncontrolled levels.

For most of the natural water, the main contributors for total dissolved solids are calcium, Magnesium, Sodium, Potassium, Chloride, Sulphates and bicarbonates. TDS reflect the increasing extent of industrial and domestic discharge in aquatic habitats (Welcomme, 1985). High value of TDS were found to affect the survival and growth of fish (Dicketson and Vingard, 1999). High levels of TDS in the effluent renders it unsuitable for irrigation and drinking purpose. According to Manivasakam (1984) high amount of TDS recorded in tannery effluent could be attributed to processes like soaking, liming, dehairing, defleshing and deliming. Electrical conductivity content was found to be around 1587 in bore well water, 2380 in well water, 3510 in lake water and 501 in pond water. Among these four waters compared the electrical conductivity content was found to be more only at lake water. Electrical conductivity is a useful tool to evaluate the purity of water. It is the property of water caused by the presence of various ionic species.

The acceptable limit of Electrical Conductivity is 600 (WHO, 1984). It is significantly noticed that the Electrical Conductivity content was likely to be increased only in the lake water carrying the sludge of tannery effluent discharge. The high level of conductivity may be due to the presence of inorganic substances and salts which show good conductivity (Robinson and Stokes, 1959). The electrical conductivity is a useful parameter of water quality for indicating salinity hazards. Among the physical parameters of the water compared in four different water body like bore well water, well water, lake water and pond water, their levels were seemed to be higher than the acceptable limit. It is indicated that the hike values of physical parameters in lake water may cause a harmful effects for drinking and irrigation purpose and also fisheries resources are likely to be affected and this may be due to the release of tannery effluents or by its seepage into the water bodies of well, bore well and lake by direct or indirect means.

The pH value of the water is an important indication of its quality and it is dependent on the carbon dioxide, carbonate and bicarbonate equilibrium. The pH of the present study was ranged between 7.02-7.33 in bore well water, well water, lake water and pond water. The result of pH showed that there is no harmful effect due to its presence varied between 7.02-7.33. The discharge of waste water into water bodies may cause a drop or increase their pH affecting size and activities of microbial populations therein. Other workers also reported acidic (Pathe, et al., 1995; Dikshit and Shukla, 1989; Mbuthia, et al., 1989; Saravanan, et al., 1999) and alkaline tannery waste waters (Shukla and Shukla, 1994; Kadam, 1990; Sastry, 1986; Sakthivel and Sampath, 1990). The factors like photosynthesis, exposure to air, disposal of industrial wastes and domestic sewage affect pH (Saxena, 1987). WHO (1984) prescribed beyond pH 8.5, the water can affect the mucous membrane.

Total Alkalinity content was 288 in bore well water, 204 in well water, 320 in lake water and these values were found to be within the permissible limit. Whereas, slightly low values (124) could be noticed only in pond waters. It is predicted that this water showed suitable for drinking purpose. Alkalinity is important for fish and aquatic life because it protects or buffers against pH changes (keep the pH fairly constant) and makes water less vulnerable to acid rain. High alkalinity values are indicative of the eutrophic nature of the water body. Total alkalinity values of water are important in calculating the dose of alum and biocides in water (Trivedy and Goel, 1988). Total hardness content was 950 in lake water, 160 in pond water, 548 in bore well water and 640 in well water and these levels were higher than permissible limit in lake and well waters. Optimum contents of total hardness was noticed only in bore well water and its minimum quantity was noticed in pond water. Among the results of four water body compared, the bore well water was seemed to be good for drinking purpose.

Hardness is advantageous in certain conditions. It prevents the corrosion in the pipes by forming a thin layer of scales and reduces the entry of heavy metals from the pipes to the water (Praharaj, et al., 2002). The hardness of water is an important consideration in determining the suitability of water for domestic and industrial uses. Hard water will precipitate soap and lathering does not take place satisfactorily. Calcium content was 264 in lake water, 184 in bore well water and 204 in well water and these levels were seemed to be within the permissible for drinking purpose, whereas, its low level was noticed only in pond water. The presence of bicarbonates of calcium and magnesium indicate temporary hardness, which can be removed by boiling. Hard water is generally believed to have no harmful effect on human being. Cardiovascular diseases were reported to continue more to the areas of soft waters than to those having hard water (Crawford, 1972). Maximum value of hardness is observed in winter and minimum in

summer (Pandhe, et al., 1995). Vijayaram, et al. (1989) found that the concentrations of total hardness, chlorides, calcium, magnesium and sulphates were 2 to 20 times higher in the ground water of Tiruchirappalli city, Tamil Nadu due to the presence of tanneries.

Calcium is most important cation in the study of water quality. Hardness of water as calcium carbonate is an important measure of pollutant. Calcium is one of the nutrients required by the organism and at low concentration calcium has no hazardous effect on human health calcium is an essential constituent of human being. The low content of calcium in drinking water may cause rickets and defective teeth; it is essential for nervous system cardiac function and in coagulation of blood. Being an important contributor to hardness in water it reduces the utility of water for domestic use (Purohit and Saxena, 1990).

Geologically, Magnesium rich minerals are associated with basic and ultra basic rocks and ultramafic rocks of igneous and metamorphic percentage. Magnesium content was noticed to be optimum in lake water (17) and well water (31) and these contents were noticed to be very low in pond water and low in bore well water (21). It is predicted from the study that there is no harmful effect due to the presence of magnesium content. Magnesium is present above 200mg/l, it may produce gastrointestinal irritation. Magnesium is moderately toxic element if its concentration in drinking water is high. Calcium and Magnesium are of great neurochemical importance. Symptoms of cathartic and diuretic action are observed if excess of these ions are consumed (Brian and Berry, 1997). They are also the source of the hardness. Increasing trend of magnesium could be noticed from the tannery effluent in Nagpur by Srinivas, et al. (1984) and reported that the presence of calcium, magnesium and bicarbonates in excess makes water unfit for irrigation since its application increase problems of soil salinity and its permeability detrimental to crop plants. Iron content of lake, pond, bore well and well waters were recorded to be 0.03, 0.62, 0.04 and 0.08, respectively. These values were found to be within the permissible limit for drinking water purposes. Among these waters, bore well water contained the iron content below the desirable limit.

Generally, surface water contains < 1mg/l of Fe. Some ground water contains much higher level of Fe. The iron value > 2mg/l imparts bitter astringent taste to the water (Maiti, 2002). Concentration of Fe above the safe limit could lead to liver, lung, kidney, brain, heart, muscle and respiratory disorders (Lark, et al., 2002). Free ammonia content was found to be 0.08 and 0.16 in lake and pond waters, respectively and these values were found to be nil in bore well and well waters. It is predicted that the bore well and well water are free of ammonium pollution compared to lake and pond waters. Wetzel (1983) stated that ammonia is generated by heterotrophic microbes as a primary end product of decomposition of organic matter either directly from proteins or from the organic compounds. Nitrite value was seemed to be 0.01 and 0.08 in lake and pond waters, respectively and nitrite content was absent in bore well water and well waters. It is predicted from this result that it is free of nitrite content in bore well and well waters. It is concluded that bore well and well waters of Sengilikuppam village are found to be suitable for drinking purpose.

Nitrite poisoning causes fish mortality resulting in converting hemoglobin to form methamoglobin as indicated by Boyd (1990). The acceptable limit of NO_3 is 45-100. In excessive amounts it contributes to the illness of infant methemoglobinemia and to prevent this disorder a limit of 10mg dm^3 of nitrate nitrogen is imposed on drinking water (Agarwal, 2005). Nitrate represents the end product of oxidation of nitrogenous matter and its concentration is a presence of nitrification activities under progress in water (Singh,2002). The permissible limit of nitrate is 45-100. Nitrate content was seemed to be below slightly than the permissible limit in bore well (40), well (41), lake (58) and pond waters (26) of Sengilikuppam village. Nitrate is a prime plant nutrient and rising in its concentration might be expected to increase the eutrophication of waters (Goher, 2002). Nitrate is one of the several inorganic pollutants contributed by nitrogenous fertilizers, human and animal wastes and industrial effluents through the biochemical activities of micro organisms (Agarwal, 2005).

The permissible limit of chloride content is 200-1000. Chloride content was seemed to be within the permissible limit in lake water (845), bore well water (254) and well water (430). Chloride content in pond water (60) was below than the desirable limit. Chloride level in water is a useful measure in water sample. High level is not known to be injurious to fresh water organism. The acceptable limit of Cl is 200-1000. Chloride becomes more toxic when they are combined with other toxic substances such as cyanides, phenols and ammonia (Anonymous, 1976).

The pollution from the industrial effluent will be a source of chloride concentration in the industrial area. High chlorides indicate organic pollution particularly from domestic sewage. Discharge of industrial effluents in surface water bodies, presence of sodium and calcium, chloride in natural water and higher salinity are responsible for higher concentration of chloride in the area. Higher concentration of chloride is association with increased level of pollution (Umavathi, et al., 2007).

The permissible limit of fluoride is 1.0-1.5. Fluoride content was seemed to be within the permissible limit in pond water (14), bore well water (12) and well water (12). Fluoride content was seemed to be below the desirable limit only in lake water. It is predicted from these parameters that the pond, bore well and well waters are found to be fit for drinking purpose without causing any dental caries, whereas, the lake water has the effect of causing dental caries since its fluoride content has reached up to 0.8.

The result indicated that the low level of fluoride content in the water may cause dental fluorosis. Fluoride is also an important chemical constituent of the water. It is generally present in small quantities. Its occurrences in higher amount in the order of 1 mg/l is safe and effective in reducing the dental decays. The low concentration of fluoride below 0.5 mg/l causes dental caries and when present in higher concentration it causes dental and skeletal fluorosis, mottling of teeth, etc., (Agarwal, 2005; Prajapati and Raol, 2006). Gujarat is one of the most worst affected state amongst the 15 states of India reported as endemic for fluorosis (Jain, et al., 2000). Fluoride is often referred to as two-edged sword fluoride is very much essential for healthy growth of teeth. However, levels higher than 1.5 mg/l causes dental and skeletal fluorosis, decalcification, mineralization of tendencies, digestive and nervous disorders (Udhaya kumar, et al., 2006).

The permissible limit of sulphate (SO_4) is 200-400. The sulphate content in lake (334), bore well (182) and well (211) were found to be within the permissible limit. Where as, low content of sulphate was noticed only in pond water (43). The acceptable limit of S04 is 200-400. The presence of sulphate content in high salt water, sewage effluent, ceramic industry, etc. has been discussed in detail by many investigators (Saxena, 1987; Kaur et al., 1996; Srinivas, et al., 2002). High concentration of sulphate in the tanneries is also as a result of many chemicals containing sodium sulphate as a by-product of the manufacturer or chrome tanning powders containing high levels of sodium sulphate (Bosmic, et al., 2000). In the present study, phosphate content was noticed to be 0.12 in lake water 0.28 in pond water and nil values in both the bore well and well waters.

Generally, high content of PO_4 in the water may be attributed to the inlet of sewage and the detergents are the contribute factors for phosphates. The excessive phosphate concentration evokes an algal bloom in the water. Since, nitrate, nitrite and phosphate are nutrients for plankton growth, the water is rich in algal contents. The tidy's content was noticed to be 0.4 in lake water, 0.5 in pond water, 0.2 in bore well water and 0.2 in well water. Tidy's test is useful for testing organic pollution. The pollution may be due to sewage or industrial waste. When the organic load is high, the dissolved oxygen level in water decreased and affects the aquatic life. Sinha and Gaurav kumar Rastogi (2007) studied the physic-chemical characteristics of underground drinking water at Maradabad industrial area in India. This result indicated that the drinking water was found to be highly contaminated with reference to most of the parameters. Their study suggested that people dependent on this water are prone to health hazards of contaminated drinking water and some effective measures are urgently needed for water quality management.

In a report of Government of Tamil Nadu it is stated that a water system head-work has to be virtually abandoned due to the high pollution level by tannery effluents. The water quality in and around Vaniyambadi, Ambur, Walajapet and Dindugal leave much to be desired. The need for tackling the tannery effluents on a serious footing has been raised from time to time (Tamil Nadu Leather Corporation, 1986). According to Dhulasi Birundha and Saradha (1993), the sewage of a tannery discharged after treatment of one ton hide is equivalent to public sewage of little town inhabited with 5000 people. The effect that leather tanning industry has on the open water bodies is very greater often quite detrimental. The presence of sodium sulphate, chromium and some tanning agents remove oxygen from water, give it an unpleasant odour and completely stop the self purification process in water bodies by killing the biota.

The tanning industry is a potential polluting industry of considerable importance. It is realized that the untreated waste waters when allowed to stagnate as is being done in most cases now, give rise to odour nuisance unsightly appearance besides creating ground water and surface water pollution. Ramaswamy and Sridharan (1998) studied the groundwater quality of Tamil Nadu in the premises of tanneries and observed that the total hardness, chlorides, calcium and magnesium were 3 to 28 times higher than the drinking water permissible limit prescribed by WHO(1993). The tannery effluent contains high concentration of metallic ions like chromium, potassium, sodium and magnesium and organic pollutants like oil, grease, tannin and lignin (Manonmani, et al., 1991). Khwaja, et al., (2001) discussed about the influence of wasted on the physic-chemical characteristics of the Ganga water and sediments vis-a-ris tannery at Kanpur (India) and revealed that in-crease values of parameters. Such as BOD, COD, Chlorine and total solids could be due to the domestic wastes just as much as to the tannery wastes. However, chromium is one parameter, which can primarily be identified to originate from the tanneries.

Sponza (2003) stated that the waste water (industrial effluents) causes soil and ground water pollution besides causing a number of adverse effect on agricultural produce, animals and health of people living in the neighbouring areas, since it contains waste chemicals and toxic heavy metals. An enormous increase in pollution due to discharge of effluents from industrial units into rivers and lakes is a matter of great concern in developing and developed countries which have water pollution problem due to industrial proliferation and modernization agricultural technologies, are now on the ways of combating the problems through improved waste water treatment technique. But, developing countries with lack of technical known how, weak implementation of environmental policies and with limited financial resources are still facing problems.

In Sengilikuppam village, result indicated that the levels of physico-chemical parameters such as turbidity (12), TDS (2457), EC (3510) and total hardness (9950) were recorded to be higher values than the permissible limit for drinking purpose. Other physico-chemical parameters were found to be within the desirable limit. The water of the lake was shown to be yellowish in colour. It is concluded from the study that the water is found to be not suitable for drinking purpose as some of the vital physic - chemical parameters were seemed to be higher values. In pond water, the result indicated that the appearance of the water was yellowish in colour and the content of TDS, EC, pH and other chemical parameters were seemed to below the desirable limit. The result of the bore well water indicated that TDS content (1111), EC (1587) and other chemical parameters were found to be within the permissible limit for drinking purpose. The result of the well water indicated that the contents of TDS (1666), EC (2380) and Total Hardness (640) were seemed to be higher than other water parameters.

It is concluded from this study that the bore water of Sengilikuppam village was found to be more suitable for drinking purpose since the colour of the water was seemed to be clear and colourless. Other physico-chemical parameters were found to be within the permissible limit compared to well water, lake water and pond water of Sengilikuppam village. It is suggested from this study that the well water of Sengilikuppam area may be protected from the intrusion of tannery effluent discharges into the open water since the colour of brownish is a symptom of water getting polluted slowly.

Acknowledgement: Authors are thankful to the Thiruvalluar university authority for proving facilities to carry out this work.

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