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Studies on the Physico-Chemical Parameters of Bore and Well Waters in the Sathur Village and Pond And Canal Waters in Arcot Town of Vellore District, Tamil Nadu

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Abstract: The present study was attempted to see the water quality in canal and pond waters of Arcot town and well and bore well waters of Sathur village of Arcot taluk, Vellore district by analyzing the physico-chemical characters (APHA, 2000) since these waters are suspected to be polluted due to the presence of tannery industries around these waters. Result of the present study indicated that the high levels of physico-chemical parameters such as appearance (brownish), odour (objectionable), Turbidity (30), TDS (2219), Electrical conductivity (3170), Total hardness (670) and total iron (1.45) recorded in the canal water of Arcot town more than that of acceptable limit as prescribed by WHO (1984) showed its deleterious effects for drinking purpose and this may be due to the dilution of tannery effluent discharge into the water bodies by direct or indirect means. Result of the pond water of Arcot town and bore well and well waters of Sathur village indicated that the fluctuation levels of physico-chemical parameters were found to be within the acceptable limit. However, the TDS content in well water (1603) and bore well water (1345) of Sathur village and in pond water (1276) of Arcot town showed that these two areas are under alarming in condition. Low level of fluoride content present in canal water (0.2) and pond water (0.2) of Arcot town and waters of Sathur village (0.6) showed its harmful effects for dental caries. It is therefore suggested that industrial wastes should be treated to the desired quality so as to render them innoxious or less harmful before their disposal into water bodies and that standard of effluents quality should be laid for abatement of pollution in the interest of public health and fisheries wealth.

Keywords: Physico-Chemical Parameters, Canal, Pond, Well and Borewell Waters.

1. INTRODUCTION:

Water is a prime necessity of life and the precious gift to nature to all living organism. Water is aptly described as the mother of life. It is represented as not only H2O, but water in the form of rain, rivers, lakes, groundwater and seawater is very abundant and covers more than 72% of the surface of water. Water is essential for digestion, dissolving nutrient and distributing then to the cells regulating the body temperature and its activities. 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 of 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 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) in water and soil have been extensively reviewed by many investigators (NAS, 1974; Steven, *et al.,* 1976; Synder, *et al.,* 1977; Towill, *et al.,* 1978; Taylor and Parr, 1978; Langard and Norselth, 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 $8^0$05 and $13^0$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 surrounding area of Vellore District, Tamil Nadu.

2. MATERIALS AND METHODS:

Description of the Study Area: The present work was concentrated to collect the water samples from Arcot town and Sathur village of Vellore district (Fig.1). The sampling area of Arcot is located 25 km away from the Vellore city in latitude 12^0 56'N and longitude 79^0 24'E. Total population of Arcot municipality is around 55,955 and Sathur village is around 5.032. It is encircled with 240 tannery industries along with ceramic, refractory, boiler auxiliaries and

chromium chemicals, etc. Water samples for the present study were collected from the canal carrying tannery sludge water and pond (Fig.4) as they have the chance of getting the dilution of tannery effluents.

Another sampling area of Sathur village is located 30 km away from vellore city and 5 km away from Arcot town. The well water and bore water (Fig.2) collected for the present study are mainly used both for drinking and irrigation purposes. Although it is 5 km away from Arcot town, it is so necessary to see the water qualities of both the bore well and well waters. The above water samples were collected during months period of September and October,2019. Physico-chemical parameters of the water were determined using standard methodology as prescribed by APHA (2000).

3. RESULTS AND DISCUSSION:

For the present study, water samples collected from well and bore well in Sathur village of Arcot town of Vellore District were analyzed for 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, NO_2, Cl, F, SO_4, PO_4, and Tidy's test contents 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 (WHO 1984). The present study is aimed to see the influence of tannery effluent discharge in canal, pond, well and bore well waters of Arcot taluk, Vellore district.

Appearance of canal water was brownish in colour whereas, the pond water of Arcot town and bore well water and well water of Sathur village were seemed to be clean and colourless. Colour or appearance may 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 (Yuxing and Jian,1999). The odour was none in Arcot pond water and Sathur village bore well and well waters. Whereas, the odour was objectionable in Arcot canal water. When the odour is objectionable it indicates that the water has become deterioted.

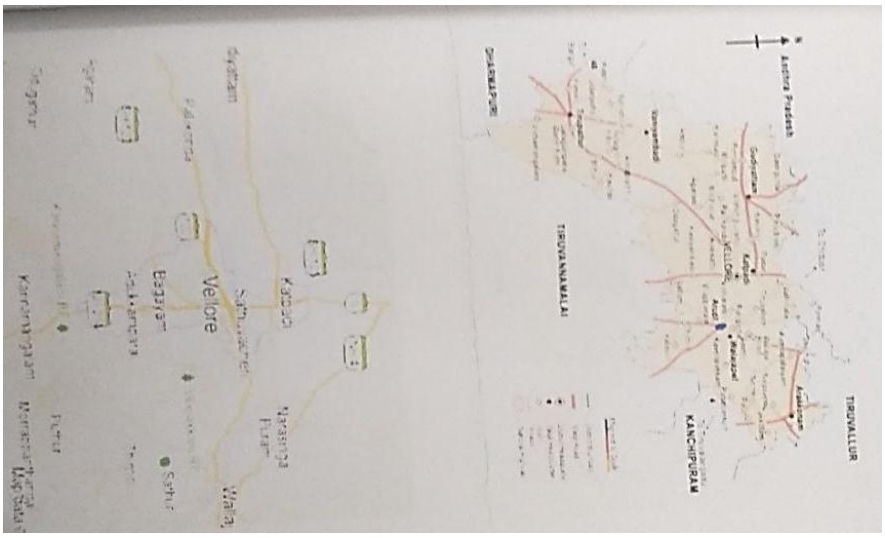

Fig. 1,2,3: Showing The Collection of Water Samples from Arcot Town and its Surroundings

Table 1: Result of the Physico-Chemical parameters of the bore well and well water samples from Sathur village and pond and canal water samples from Arcot town of Vellore District, Tamil Nadu.

S.No.	Parameters	Acceptable Limit WHO (1984)		Arcot (Canal)	Arcot (pond)	Sathur (Bore Well water)	Sathur (Well water)
	PHYSICAL EXAMINATIONS						
1.	Appearance	A	B	Brownish	C & C	C & C	C & C
2.	Odour	Unobjectionable		Objectionable	None	None	None
3.	Turbidity NTU	1	10±2.00	30±1.00	2±00	0	2±00
4.	Total Dissolved Solids mg/l	500	2000	2219±3.00	1296 ±2.00	1345±4.00	1603±2.00
5.	Electrical Conductivity (Mic mho/cm)	-	-	3170±4.00	1823±3.00	1921±1.00	2290±2.00
	CHEMICAL EXAMINATIONS						
6.	pH	6.5-8.5	6.5-8.5	7.15±0.2	7.23±0.1	6.96±0.00	7.02±0.00
7.	Alkalintiy pH as $CaCO_3$ mg/l	-	-	0	0	0	0
8.	Alkalintiy Total as $CaCO_3$ mg/l	200	600	340±00	252±2.00	324±1.00	320±2.00
9.	Total Hardness as $CaCO_3$ mg/l	200	600	670±0.2	396±00	772±1.00	820±2.00
10.	Calcium as Ca mg/l	75	200	208±1.00	110±1.00	270±00	276±00
11.	Magnesium as Mg mg/l	30	150	36±1.00	29±00	23±00	31±1.00
12.	Sodium as Na	-	-	-	-	-	-
13.	Potassium as K	-	-	-	-	-	-
14.	Iron Total as Fe mg/l	0.1	1.0	1.45±00	0.02±00	0.00	0.00
15.	Manganese as Mn	0.05	150	0.00	0.00	0.00	0.00
16.	Free ammonia as NH_3 mg/l	-	-	0.80±00	0.48±00	0.00	0.00
17.	Nitrite as NO_2 mg/l	-	-	0.07±0.01	0.03±00	0.00	0.00
18.	Nitrate as NO_3 mg/l	45	100	63±00	49±00	48±1.00	52±00
19.	Chloride as Cl mg/l	200	1000	655±2.00	378±1.00	312±1.00	495±3.00
20.	Fluoride as F mg/l	1.0	1.5	0.2±00	0.2±00	0.6±00	0.6±00
21.	Sulphate as SO_4 mg/l	200	400	387±1.00	174±2.00	201±00	196±00
22.	Phosphate as PO_4 mg/l	-	-	0.23±0,01	0.09±00	0.00	0.00
23.	Tidy's Test	-	-	0.6±00	0.5±00	0.2±00	0.3±00
24.	RC	-	0.2±	0.0	-	-	-
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 4. ± - Standard deviation

Turbidity was within the limit in Arcot pond water (2) and Sathur bore well (0) and well waters (2). Whereas, the turbidity level was found to be more than the acceptable limit (30). Increase of turbidity found only at Arcot canal water indicated that the water is under deteriorative condition and this may be due to the intrusion of tannery effluent discharge from the tannery industries in the canal water. This increase of turbidity content in the water, 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 around 2219 in Arcot canal water and in pond water, it was around 1276. Whereas, in Sathur village the bore well water was found to be 1345 and in well water it was found to be 1603. Among these four waters compared, the canal water of Arcot town was found to be above the acceptable limit. However, the TDS contents was found to be higher in Arcot pond water and Sathur village bore well and well waters, their levels fell within the acceptable limit.

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 escalation level of TDS may cause harmful effects for irrigation and drinking purposes, once it is released into the land area 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 was 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 3170 in Arcot canal water and 1823 in Arcot pond water. The compared Electrical conductivity content was found to be around 1921 in bore well water of Sathur village and it was around 2290 in well water of Sathur village. Among these four waters compared, the electrical conductivity content was found to be more only at Arcot canal water. EC 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 canal 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 waters compared in four different water bodies like canal water, pond water, bore well water and well water, their levels noticed higher than the acceptable limit are objectionable only in the canal water carrying the sludge of tannery effluent discharge from tannery industries around Arcot taluk. It is noticed that the hike of physico-chemical parameters in canal water may cause harmful effects for drinking and irrigation purposes and also fisheries activities once it reaches either the water body like pond and lake or the land area by the process of seepage by direct or indirect means.

Hike of TDS content ranged between 1276-1603 in Arcot pond water and Sathur village bore well and well waters showed the edge zone for drinking purpose, since their levels were found to be exceeded than the desirable limit of 500 according to WHO. It is suggested according to these parameters that the release of tannery effluent discharge either into the canal or lake by direct means may be stopped. Total dissolved solids analysis has great implications in the control of biological and physical waste water treatment processes. The desirable and acceptable limit of pH are 6.5 to 8.5 in accordance with PHEEO/ BIS STD. In the present study, the pH levels were found to be within the acceptable range of 6.93-7.23. Among the four sampling waters collected from canal, pond, bore well and well compared, bore well water in Sathur village was shown to be slightly acidic.

The pH value of water is an important indication of its quality and it is dependent on the carbon dioxide, carbonate and bicarbonate equilibrium. 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 waste and domestic sewage affect pH (Saxena, 1987). WHO (1984) prescribed beyond pH 8.5, the water can affect the mucous membrane. According to Umavathi, et al. (2007) pH ranged 5 to 8.5 is best for plankton growth.

Alkalinity is a total measure of substances in water that have acid neutralizing ability. Alkalinity is not a pollutant. The content of total alkalinity as $CaCO_3$ was 340 in Arcot canal water, 252 in Arcot pond water and 324 in bore well and 320 in well water of Sathur village. These ranges were within the permissible limit of 200-600. Alkalinity is important for fish and aquatic life because, it protects or buffers against pH changes (Keeps 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, 1986). The permissible limit of total hardness as $CaCO_3$ is between 200-600. Total Hardness as $CaCO_3$ content was 670, 396,772 and 820 in Arcot canal and pond waters and Sathur village bore well and well waters, respectively. These levels were higher than that of permissible level as prescribed by WHO (1984). Among the four water samples analyzed, bore well water in Sathur village showed higher hardness.

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 harness 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. Hujare (2008) reported that total hardness was high during summer than rainy and winter seasons. Calcium content was 208 and 110 in canal and pond waters of Arcot town and 270 and 276 in bore well and well waters of Sathur village, respectively. Among these four water areas analyzed, pond water of Arcot town showed its acceptable limit as its level contained 110, whereas other areas like canal

water, bore well water and well water showed the exceeded permissible limit as their levels ranged between 208-276. The acceptable limit of Magnesium level is 30-150. However, the Magnesium level of the canal water and pond water of Arcot town and bore well water and well water of Sathur village were shown to be either within the limit or below the detectable limit.

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 confine 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 pollution. Calcium is one of the nutrients required by the organism and at low concentration calcium has no hazardous effect on human health and also 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. When 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. The same trend 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 in canal and pond water of Arcot town was found to be 1.45 and 0.02, respectively. Whereas, the content of Iron was found to be nil in both the waters of bore well and well waters of Sathur village. Among the Arcot town canal and pond waters compared, the canal water has exceeded its acceptable limit (1.45) and in pond water the iron content was seemed to be very poor up to 0.02. The permissible limit of iron is 0.1-1.0. These fluctuations may be due to the presence of inorganic load in the water at various levels. 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).

The recommended permissible limit of ammonia is 0.1. The Free Ammonia (NH_3) content was 0.80 and 0.48 in canal and pond water of the Arcot town, respectively and these values were higher than the permissible limit. Whereas, free ammonia content was not detectable in Sathur village bore well water and well water. It is predicted that the bore well and well water are free of pollution as far as the presence of free Ammonia is concerned. 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. The content of Nitrite (NO_2) was 0.07 and 0.03 in canal and pond water of Arcot town, respectively. Whereas, this content was not detectable in bore well water and well water of Sathur village. The Nitrate (NO_3) was 63 and 49 in canal and pond water of Arcot town and 48 and 52 in bore well and well water of Sathur village, respectively.

Nitrite content poisoning causes fish mortality resulting in converting hemoglobin to form methemoglobin as indicated by Boyd (1979 and 1990). The acceptable limit of NO_3 is 45-100. In excessive amounts it contributes to the illness of infant methemoglobinemia. 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). 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). High concentration of Nitrate in drinking water is toxic (Umavathi, et al., 2007). Among the water samples of Arcot town and Sathur village compared the content of Nitrate was found to be more than desirable limit but, within the permissible limit.

The desirable limit of chloride is 200 and permissible limit of chloride is 1000. In the present study, the content of chloride was 655 and 378 in canal and pond water of Arcot town and 312 and 495 in bore well and well water of Sathur village, respectively. These levels present in these waters were found to be above the desirable limit and within the permissible 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 chloride is 200-1000. Chloride becomes more toxic when they 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. High concentration of chloride is association with increased level of pollution (Umavathi, et al., 2007).

Fluoride is also an important chemical constituent of the water. It is generally present in small quantities. Its occurrence in higher amount in the order of 1mg/l is safe and effective in reducing the dental decay. The fluoride content was 0.2 in both the waters of canal and pond of Arcot town and 0.6 in both the waters of bore well and well waters of Sathur village. Fluctuation level of fluoride content in both the water of Arcot town and Sathur village were found to be below the desirable limit.

This low level of fluoride (0.2-06) in the water samples may cause dental caries. The permissible limit of fluoride is 1.0-1.5. The low concentration of fluoride below 0.5 mg/l cause dental caries. 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). In the present study, fluoride content was very poor only at canal and pond well water of Arcot town compared to the bore well and well water of Sathur village as the fluoride content varies around 0.6 mg/l. 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 acceptable limit of sulphate (SO_4) is 200-400. The sulphate content was 387 and 174 in canal and pond waters of Arcot town and 201 and 196 in bore well and well waters of Sathur village, respectively. Results indicated that the content of sulphate in both the water of Arcot town and Sathur village was found to be within the permissible limit and there is no harmful effect due to the presence of these levels except in pond water of Arcot town. 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). The content of phosphate was noticed to be 0.23 and 0.09 in canal and pond waters of Arcot town, respectively. Whereas, the phosphate (PO_4) content was not detectable in Sathur village bore well and well waters. Among the canal and pond waters of Arcot town compared the phosphate content was found to be escalated only at canal water of Arcot town. Generally, high content of PO4 in the water may be attributed to the inlet of sewage from the drain of the city, which is rich in detergents 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 recorded to be 0.6 and 0.5 in canal and pond water of Arcot town and 0.2 and 0.3 in bore well and well water of Sathur village. 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 physico-chemical characteristics of underground drinking water at Moradabad industrial area in India. Their 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 wastes on the physico-chemical characteristics of the Ganga water and sediments vis-a-vis tannery pollution at Kanpur (India) and revealed that increase 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 countries 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.

Result of the present study indicated that the levels of physico-chemical parameters such as appearance (brownish), odour (objectionable), Turbidity (30), TDS (2219), Electrical conductivity (3170), Total hardness (670) and total iron (1.45) recorded in canal water of Arcot town showed higher values than that of acceptable limit as prescribed by WHO (1984). It is an indication that it may cause harmful effects to the lentic waters, well water and bore well water once it is released or by seppage into the land area with uncontrolled measures.

Result of the physico-chemical parameters of pond water of Arcot town and bore well and well waters of Sathur village indicated that the fluctuation levels of physic-chemical parameters were found to be within the acceptable limit. However, the TDS content in well water (1603) and bore well water (1345) of Sathur village and in pond water (1276) of Arcot town showed that these two areas are under alarming in condition. Low level of fluoride content present in canal water (0.2) and pond water (0.2) of Arcot town showed its harmful effects for dental caries. Fluoride content of 0.6 found in the water of Sathur village also indicates for the cause of dental caries. Result of the present work is in consistent with many of the investigators reported on the influence of tannery effluent in the surface and ground water and sediment in the areas of Vaniyambadi and Walajapet of Vellore district that Physico-chemical parameters were always high due to the influence of tannery effluent discharge (Parameswari, 2007; Dharani, 2007; Pavithra, 2008 and Siva Shankari, 2008).

It is concluded from this study that the increased level of physico-chemical parameters in the water samples of Arcot town may be due to the influence of tannery effluent discharge into the water. It may also lead to unsuitable condition for drinking water purpose and survival of aquatic organisms. The low level of fluoride content present in canal and pond waters of Arcot town and Sathur village showed its harmful condition for the cause of dental caries and also the level of TDS content found upto 1603 showed its harmful effects in water. It is therefore suggested that industrial wastes should be treated to the desired quality so as to render them innoxious or less harmful before their disposal into water bodies and that standard of effluents quality should be laid for abatement of pollution in the interest of public health and fisheries wealth.

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