55. IMPACT OF LEATHER INDUSTRIES ON GROUNDWATER IN TAMIL NADU WITH SPECIAL REFERENCE TO VELLORE DISTRICT

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ABSTRACT

Tanning industry is a one of the traditional business industry in India. The leather and leather based industries can emphasize to be the world's one of the largest industrial sector based upon a by-product. Leather and leather goods are vital role in the foreign exchange earnings. Tannery process unit is very important factor for enhancing the quality in leather production. On the other side, during this processes large quantum of toxic waste is disposed into the nature which invites vital threat to the environment at large. It leads to the contamination of water resources (both surface and ground water), soil resources and other flora and fauna. The rate of environmental degradation reflected by the decline of agricultural productivity and the quality of natural resources like water, soil, etc has decline at very high rate. The main focus of this paper is to emphasize the impact of leather industry on groundwater source in the study area. This study is descriptive in nature, simple statistical tools are used and the major finding will be addressed in this paper.

KEYWORDS

Leather Industry, Heavy metals, Groundwater and Surface water.

INTRODUCTION

Leather sector plays a vital role in the development of economy. It plays a vital role in large export earnings, creation of jobs and favorable conditions for its sustainable economic growth. Leather industry is known as one of the high export earners across the world . On the other side, tanning industry is impose high pollution especially disposing huge volume of effluents both organic and inorganic substance, at the same time it also dispose sludge. Heavy metals are major contributors to inorganic pollution. It is naturally found in industrials wastes discharge into water bodies and landfills. The uncontrolled and non-stop disposal of these toxic waste into water bodies, which leads to polluting ground water and disturbing food chains through agricultural production and consumption of groundwater. Industrial growth is boosting economic growth of the country but actually this means destroying the surrounding environment. In industrial areas, soil and groundwater gets contaminated by the industrial operations. There are zinc, cadmium, lead and copper are most common heavy metals found in industrial effluent. This effluent discharge without any treatment may cause adverse impact on human health.

Rapid growth of Industrialization and urbanization result to deterioration in groundwater quality which causes pollution . The tanneries contaminate the groundwater quality with the radius of around 7 km from industrial area. In the past few decades, the groundwater is being polluted, which leads to health problems. Tanning process requires a huge amount of freshwater along with various chemicals. The water required for tanning the 10 kg of raw skin needs around 350 litres of freshwater. The scarcity of groundwater is increasing day-by-day owing to the extraction of groundwater for tanning and other purpose through tube wells and bore wells .

STATEMENT OF THE PROBLEM

Fresh and safe waters are available in Groundwater sources for human consumption. Safe drinking water is primary one of every human being. Contamination of groundwater has been increasing everyday in general and in particularly to surrounding of industrial area. The economic development is mainly recognized to the high success attained in industrial development. Unfortunately they have been generation of large amount of solid and liquid wastes. These wastes when it is discharged into the nearby water sources and land, it leads to reduce the quality of the soil and water, which resulted poor agricultural productivity. The present study focused mainly the impact of industrial effluents on groundwater sources.

OBJECTIVE OF THE STUDY

- To know the status of groundwater in the study area.
- To examine the impact of leather industry on groundwater sources in the study area.

RESEARCH METHODOLOGY

This study is based on secondary data source. Secondary data's were collected from various sources i.e. journal, newspaper, books, electronic sources, and from various institution like WHO, CPCB, TNPCB, GWCB, FAO, Tamil Nadu Water and Drainage board etc. The data which is relevant to the study have been collected. Statistical Tools like correlation analysis and diagrammatic representation have been used for analysis purpose.

REVIEW OF LITERATURE

Shankar (2015), he revealed that the tanning industry requiring about 30 – 35 litres of water per kg of leather to processed, and it is generating approximately 680 million litres of effluent discharged every day. In India, it was estimated that 2000 – 3000 tons of chromium released into the environment from tanneries. India is highly polluted area due to discharge of treated effluent discharge into the open place that does not meet the standard limits. The CETP (Common Effluent Treatment Plant) receive huge amount of effluent water from large scale tanning industries, it helps to removal partially the quantum of chromium and other chemical substance but it is still unfit for reuse due to high level of many ions. CETP generates large quantity of solid waste as sludge from wastewater treatment. Vasanthan et. al. (2018), they assessed that the ground water quality only depends on surrounding environmental conditions, but in most of the regions in Vellore district does not have quality water when it is compare to BIS (1992) permissible limit due to untreated waste water discharge into river and land by industries. Vellore district is having the clusters of leather tanning units. Tanneries require huge amount fresh water and chemicals during the leather processing, 1 kg leather require 50 to

150 litres of freshwater. Small tannery unit has produce around 3 to 4 tons of leather per day which require 1 lakh litres of freshwater, which is an around 2,500 peoples' demand can fulfill. Even a single tannery establishment can cause groundwater pollution around 7 – 8 km radius. The researcher stated that the quality of groundwater and soil in Ambur Taluk are unfit for drinking as well as irrigation purposes.

Sridhar S.G.D., et. al. (2013), opined that the tanneries is one of the cause pollution to surface as well as groundwater due to high level of chemicals usage such as chloride, sulphate, chromium, vegetable oils, dyes and lime. A large amount of water is used during the tanning practice in the leather industries. India had 1,200 tanneries; more than 75 percent of leather processing industries are located in Tamil Nadu. It is the one of the major caused by high salinity is disposal from industries and it also includes huge amount of solid waste such as unused hides and skins. These untreated wastes are discharge during the rainy season and its affect in groundwater around a radius of 7 km.

Analysis of the Data

Table No.1 - Time Series Data of Rainfall in Vellore District

Year	Vellore District		
	Actual (in mm)	**Normal (in mm)**	**Deviation (in mm)**
2010-11	1011.9	916.4	10.42
2011-12	991.5	1030.3	-3.78
2012-13	1004.1	1030.3	-2.54
2013-14	760.7	936.2	-18.7
2014-15	750.8	936.2	-19.8
2015-16	1275.4	936.1	36.0
2016-17	585.08	936.2	-37.50
Mean	911.3	960.2	-5.1
SD	228.2	48.3	23.7

Source: Statistical Hand Book of Tamil Nadu, Govt. of Tamil Nadu, Chennai. (2018)

From the Table No.1, it is shows that the rainfall (in mm) from the period of year 2010-11 to 2016-17, majority rainfall about 1,275.4 mm during 2015-16 and lowest rainfall around 585 in the year 2016-17. Hence, the success rate of rainfall depends upon monsoon and nature, but most of the industries discharge their wastes during the rainy season it leads to many water – borne diseases spreading and groundwater quality also decreasing.

The groundwater level is fluctuating during year from 2010-11 to 2018-19, majority of 8.85 meter depletion of groundwater in the year 2014-15, 8.78meter groundwater drop during 2013-14, 8.65 meter and 8.64 meter in the year 2015-16 and 2017-18 respectively. Hence, almost groundwater level has decreased due to many reasons such as decreasing rainfall, global warming, excess use of groundwater by the of human beings, extraction for irrigation purpose and finally requirement of industries. Leather industry is one of the water-intensive industries. Cluster of leather industry located in major places at Vellore district such as Ambur, Vaniyambadi, Pernambut, Ranipet, Walajah and Melvisharam.

Table No.2 Source of Area Irrigated (in Acres) in Vellore District

Year	Tube Wells / Bore Wells	Open Wells (Sole Irrigation)
2010-11	33752.55	183036.9
2011-12	32574.36	186094.7
2012-13	32361.94	173762
2013-14	34678.8	177696.7
2014-15	27575.08	173606.4
2015-16	38220.78	161901.1
2016-17	36675.33	153075

Source: Department of Economics and Statistics, Chennai, (2019)

From Table No.2, it is clearly highlights that the area irrigated through groundwater sources like Tube wells/ Bore wells and Open wells from 2010-11 to 2016-17. The Tube wells/Bore wells source of area irrigated is next to open wells source. The majority of 38,220 acres of land irrigated through Tube wells/Bore wells source during the 2015-16 and about 1,86, 094 acres of land irrigated through open wells during the year 2011-12. Hence, after the establishment of manufacturing industries, agricultural activities require a large amount/quantum of fresh water to produce agricultural productivity.

From the table No. 3 shows that the groundwater quality in Vellore District from the 2000 to 2018, samples well water was collected from various Taluks such as Walajahpet, Vellore, Vaniyambadi and Ambur, selected well tannery vicinity in every January and June in each year. Major Parameters such as Total Dissolved Solids (TDS), Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), Chlorine (Cl), Sulphate (SO4), Electrical Conductivity (Ec) and Hardness (HAR). These are the very important parameters for consumption of water. Water has capability to dissolve a range of inorganic and organic salts or minerals such as calcium, chlorides, sodium, magnesium, potassium, sulfate, bicarbonates, etc. These minerals produced un-wanted taste and colored (brownish) in the water. In Figure – 2, the water with high TDS value indicates that water is highly mineralized. As per BIS 2012, the permissible limit for TDS is 500 mg/l to 2000 mg/l which approved for drinking purpose. The concentration of TDS in this study was observed in the range between 321 mg/l to 4072 mg/l. The mean TDS concentration in Vellore District was found to be Walajahpet and Vellore taluk is within limit of BIS standard and Ambur and Vaniyambadi taluk is beyond the limit. High values of TDS in ground water are generally not dangerous to human being, but high concentration of these may affect persons who are suffering from heart diseases and kidney. Water containing high solid may cause constipation and laxative effects.

BIS 2012	PPParameter	TDS	Ca	Mg	Na	K	Cl	SO4	pH	EC	HAR
Year	Permissible	500 – 2000	75 – 200	3 0 -100	4 5 - N o	1.2 – 10	2 5 0 -1000	200 - 400	6.5 - 8.5	300 - 700	200 -600
	Taluk	**TDS**	**Ca**	**Mg**	**Na**	**K**	**Cl**	**SO4**	**pH**	**EC**	**HAR**
2000	Walajahpet	1062	100	84	173	4	326	106	8.4	1960	600
	Walajahpet	691	50	48.6	127	20	167	43	8.9	1150	325
	Vellore	1150	52	28.8	340	16	358	67	8.6	2020	250
	Vellore	1351	48	97.2	294	45	709	50	8.4	2450	520
	Vaniyambadi	1922	96	48	552	35	922	77	8.2	3310	440
	Vaniyambadi	2305	80	213.84	472	5	1134	173	8.2	3820	1080
2005	Walajahpet	978	128	32	184	4	262	103	7.9	1640	450
	Walajahpet	1392	128	80	179	106	333	77	7.8	2400	650
	Vellore	1410	56	68	334	55	553	187	8.4	2310	420
	Vellore	1662	24	78	428	94	532	154	7.8	2630	380
	Vaniyambadi	1549	20	114	409	5	553	134	8.5	2540	520
	Vaniyambadi	1547	16	109	414	5	553	130	8.2	2460	490
2010	Walajahpet	556	42	29	115	21	138	113	8.3	850	223
	Walajahpet	812	66	34	186	8	266	103	8.2	1340	305
	Vellore	1464	64	85	315	55	620	154	8.3	2590	510
	Vellore	1514	120	61	345	6	479	240	8.8	2580	550
	Vaniyambadi	2487	166	163	478	6	1064	346	7.9	4000	1087
	Vaniyambadi	2092	168	126	370	4	837	204	8.2	3340	940
	Ambur	1675	26	145	400	4	659	102	8.6	2980	661
	Ambur	1769	56	146	380	3	723	204	8.9	3130	740
2015	Walajapet	888	62	30.375	239	4	287	62	8	1600	280
	Walajapet	1705	184	53.46	304	70	525	101	7.3	2860	680
	Vellore	1380	80	65.61	290	52	493	130	7.7	2330	470
	Vellore	1716	184	58.32	336	63	709	133	7.8	3020	700
	Vaniyambadi	1911	104	174.96	357	4	822	120	7.7	3520	980
	Vaniyambadi	2957	260	279.45	414	0.1	1560	134	8.2	5430	1800
	Ambur	3334	460	230.85	449	0.1	1773	163	8.2	6150	2100
	Ambur	3444	600	170.1	452	5	1773	173	7.5	6380	2200
2018	Walajapet	2912	360	267.3	313	10	1773	86	7.6	5390	2000
	Walajapet	663	60	20.655	150	5	216	71	7.6	1130	200
	Vellore	1817	84	72.9	430	21	588	365	7.9	2940	115
	Vellore	840	84	48.6	145	0.1	0.73	153	7.3	1450	410
	Vaniyambadi	363	22	21.87	78	0.1	82	43	7.9	630	145
	Vaniyambadi	321	30	30.375	25	0.1	67	44	7.8	175	200
	Ambur	1150	46	65.61	239	11	269	229	7.8	1840	385
	Ambur	4072	380	194.4	830	0.1	2162	444	7.8	7110	85
	Mean	1635	125	99.31	320	20.7	674	144	8.0	2818	663

Source: http://www.groundwatertnpwd.org.in/ (State Ground and Surface Water resource data centre - 2019)

Electrical conductivity (EC) of water is determines by the amount of dissolved solids. Pure water is not a good electric conductor rather a good insulator. Increase in ions application raise the EC of water. Generally, It is measures the ionic process of a solution that enables it to transmit current. According to BIS, EC value between 300 – 700 µS/cm. The current study indicated that Average EC value was 2818 µS/cm, it is clearly shows that drinking water of Vellore district was not considerable for drinking purpose due to high dissolved solids determines higher level of ionic concentration activity.

Chloride (Cl) is mainly acquired from the dissolution of salts of hydrochloric acid as table NaCO2, NaCl (Salt), and added through sewage, industrial effluent, sea water etc. Ground water bodies have high concentration of chlorides as compare to surface water. A chloride parameter plays a vital role in metabolism rate of human body and physiological processes also. High concentration of chloride damages growing plants as well as breaks the metallic pipes and structure. Magnesium is an important element for proper functioning of living organisms and found in minerals. Human body holds atleast 25g of magnesium which is 40 percent in tissues and muscles and 60 percent in bones. Calcium is very essential for human cell physiology and bones; human body contains about 95 percent of calcium in teeth and bones. The high calcium deficiency in human body may cause bones fracture, poor blood clotting etc. and the surplus of calcium produced cardiovascular diseases.

Generally, sodium is a silver white metallic element and it is less quantity in water. Appropriate quantity of sodium in human cell prevents many fatal diseases like headache, hypertension, kidney damages etc. Potassium (K) is essential for living organism functioning; it is found human as well as animal tissues and plants cells. The total amount of potassium in human body lies between 110g to 140g. Potassium is necessary for human body functions such as regulation of blood pressure, heart protection, nerve motivation and muscle tightening etc. Deficiency of potassium in human body may cause muscle weakness, depression, heart beat reduction etc .

PH is a necessary parameter in assess the acid – base balance of water. It is also the indicator of acidic or alkaline condition of water status. BIS standard pH level has maximum permissible limit lies between 6.5 to 8.5. The present study pH values were 7.3 to 8.9 which is most in the area wells in the range of BIS standards, and in few places pH value is above the range of BIS standard.

CONCLUSION

The quality of drinking water plays a vital role in building human health with a significant bearing on infant mortality rate, longevity and productivity. The groundwater is the one of the major source for both drinking and domestic purpose in Vellore District. Ground water is adversely affected in most of the area in Vellore district and only in few locations got moderately affected when compared with drinking water standards. From this study, it can be concluded that groundwater level and quality declined in and around tannery vicinity. The effluent from industries is without treatment discharge carelessly, it leads to ground water contamination. So, artificial recharge, implementation of treatment plants and rainwater harvesting can improve the groundwater quality in the study area. The implementation of advanced technology in the leather process and effluent treatment plants can solve the environmental problems to certain extent only and we can prevent further damage.

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