



J. Environ. Nanotechnol.  
Volume 3, No.2 pp. 182-187  
ISSN (Print) : 2279-0748  
ISSN (Online) : 2319-5541  
doi : 10.13074/jent.2014.03.143078

## Geo Chemicals and Water Quality Assessment in Ground Water in and around Iyankulam Pond due to the Discharge of Tannery Effluents in Dindigul

K. Kanthasamy<sup>1</sup>, A. Pandia Rajan<sup>2\*</sup>, M. Muthumari<sup>3</sup>, S. Philip Arockiaraj<sup>4</sup>,  
M. S. Dheenadhayalan<sup>5\*</sup>

<sup>1,2\*,4,5\*</sup>Department of Chemistry, GTN Arts College, Dindigul, TN, India.

<sup>3</sup>Department of Botany, GTN Arts College, Dindigul, TN, India.

Received : 14.04.2014 Accepted : 22.05.2014

### Abstract

The ground water quality is very much affected in and around the Iyankulam Pond due to the discharge of domestic and industrial waste water from the surrounding areas. The present study was undertaken to evaluate the extent of pollution of ground water in and around Iyankulam Pond located in Palani Road at Dindigul. Water is polluted by four kinds of substances viz., traditional organic waste, waste generated from industrial processes, chemical agents for fertilizers and pesticides for crop protection and silt from degraded catchments. About 68 tanneries are in Dindigul, they are located within 1 km distance from the pond. Several tanneries have been in existence for thirty to forty years. The effect of effluents is from tanneries. The effluents have also affected the health of livestock and humans. When cattle drink the water drawn from local wells or feed them on the grass, they become sick. The humans are also prone to epidemic diseases, like cholera, jaundice and malaria. Summing up the problem, an old woman said 'can you purify cancerous blood in the human body. This is the condition of the soil and water in this village, due to the effects of tannery effluents. The study was carried out to assess the magnitude of the pollution problem at Iyankulam Pond. The aim was to analyze and understand the toxic effects of tannery effluents, sewage water on agriculture. A public well in the study area, which were once an important source of drinking water for the whole village is considered as a deep pit with polluted water. Hence the polluted water is subjected to water treatment. Using RO system.

**Keywords:** Ground Water, Surface Water, Pollution.

### 1. INTRODUCTION

#### 1.1 The Interaction of Ground Water and Surface Water

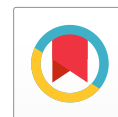
Leather is one among the major foreign exchange earner in India. Although tanning industries exist for a long time, the problem of environmental

\*A. Pandia Rajan Tel. : 9677973559

E-mail: [chempandian@gmail.com](mailto:chempandian@gmail.com);

pollution receives serious consideration only in recent years. The pollutants from the large number of tanneries in the country have caused considerable damage in drinking water supply and irrigation, untreated wastewater when allowed to stagnate as in being done in most cases, gives rise to odour nuisance, unsightly appearance, creating water pollution (Baskar, 1992).

A total number of 2161 tanneries are located in India and spread across the states of Tamilnadu, West



Bengal, Maharashtra, Punjab, Karnataka, Andhra Pradesh, Bihar and Uttar Pradesh. There are about 568 tanneries located in Tamilnadu. Among these Dindigul is an important centre for leather processing with 61 tanneries. The minimum effluent produced during leather processing is 2500 to 5000 liter per 100 kg of hides. For every 100 kgs of skin tanned, 3200 liters of freshwater is used. The effluent discharged from tanneries contains high value of pH, EC, chlorides, sulphide, sulphate, carbonate, chromium, BOD, COD, oil and dyes. Because of the heavy tannery pollutants, it was not suitable for cultivation and hence the income of the people of this area has been completely lost. Because of the heavy tannery pollution, the fauna and flora of the land to a radius of 6 kms are already affected (Apparao and Karthikeyan, 1990).

The pollution of this wastewater sample was well above the BIS (Bureau of Indian Standards) permissible limit and it was not at all suitable for any use by human being. In order to mitigate the problem posed by pollution from tanneries a common effluent treatment plant has been established by the Government of Tamilnadu in Association with TALCO (Tamilnadu Leather Development Corporation) and Dindigul Tanner's association. The treatment process includes physical (screening, sedimentation, flocculation and filtration), chemical (precipitation, coagulation and disinfection) and biological (anaerobic lagoon and aerated lagoon).

It involves many physical, chemical, and biological processes that take place in a variety of physiographic and climatic settings. For many decades, studies of the interaction of ground water and surface water were directed primarily at large alluvial stream and aquifer systems.

It is established that a single tannery can cause the pollution of groundwater around the radius of 7–8 km (Ansari *et al.* 1999). Chromium present in effluent is primarily in the less toxic trivalent form ( $\text{Cr}^{3+}$ )

but when this effluent is discharged into the soil, due to varying environmental conditions,  $\text{Cr}^{3+}$  is oxidized to toxic hexa valent form, which seldom remains as  $\text{Cr}^{6+}$  (Anderson, 1999; Selvakumar and Manoharan, 2002; Srinivasa Gowd *et al.* 2005; Thangarajan *et al.* 1999; Mondal and Singh, 2005). Several authors have reported about the presence of contaminants in soils (Wu, 1980) and waters (Kolpin *et al.* 1998) in various part of the globe and also in India (Srinivasa Rao *et al.* 1997; Elango *et al.* 2003). Contamination of the groundwater by domestic, industrial effluents and agricultural activity is a serious problem faced by developing countries.

Interest in the relation of ground water to surface water has increased in recent years as a result of widespread concerns related to water supply; contamination of ground water, lakes, and streams by toxic substances (commonly where not expected); acidification of surface waters caused by atmospheric deposition of sulfate and nitrate; eutrophication of lakes; loss of wetlands due to development; and other changes in aquatic environments. As a result of the interaction water and surface water around Y.M.R.Patti iyankulam Pond in Dindigul District have expanded to include many other settings, including headwater streams, lakes and wetlands. Issues related to water management and water policy were presented at the beginning of this report. The following sections address the need for greater understanding of the interaction of ground water and surface water with respect to the three issues of water supply, water quality, and characteristics of aquatic environments.

## 1.2 Precipitation and Dissolution of Minerals

Precipitation reactions result in minerals being formed (precipitated) from ions that are dissolved in water. An example of this type of reaction is the precipitation of iron, which is common in areas of ground-water seeps and springs. At these locations, the solid material iron hydroxide is formed when iron dissolved in ground water comes in contact with oxygen

dissolved in surface water. The reverse, or dissolution reactions, results in ions being released into water by dissolving minerals. An example is the release of calcium ions ( $\text{Ca}^{++}$ ) and bicarbonate ions ( $\text{HCO}_3^-$ ) when calcite ( $\text{CaCO}_3$ ) in limestone is dissolved.

## 2. SCOPE AND OBJECTIVES OF THE STUDY

The quality of water in the Iyankulam Pond in Dindigul District are to be studied due to the continuous discharge of sewage and industrial effluents in to the pond, with out any treatment. Due to the percolation, the pond water seep in to nearby water sources like bore well and well are completely polluted. Hence the study of ground water quality around the pond is polluted.

### 2.1 Objectives

- To Study the Physico– Chemical parameters in the Iyankulam Pond in Dindigul District.
- To evaluate the ground water quality in the wells and bore wells around the Pond.
- To treat the contaminated ground water using Reverse osmosis technology in order to reduce the total dissolved solids (TDS) in the ground water.

## 3. MATERIALS & METHODS

Tanneries and houses are located around the Iyankulam Pond. It is located on Madurai road of Dindigul. The Pond is in the Municipal limit. People living in and around the pond are depending on ground water and well water. People are using the around pond as a swimming pool. The pond water and the ground water were taken for the study.

During the monsoon and post monsoon seasons, many industries discharge the industrial effluents without any treatment in to the pond. Many Houses are continuously discharging waste water in to the pond. The polluted pond water seep into the ground

water, Due to percolation the polluted water the quality of ground water in and around the Iyankulam Pond is affected very much. The ground water is saline and unfit for drinking purpose. But the people have to depend on the ground water only. On seeing the suffering of the people in and around the pond a sincere and serious attempt was made to find the ground water quality and also to suggest a suitable remedy for water treatment of using water reverse osmosis technology.

### 3.1 Treatment of Polluted Water using RO Plant

The polluted waters collected from the 9 sources are subjected to reverse osmosis treatment method. Water collected from the reverse osmosis plant after treatment was also collected in a clean polythene cans separately. Samples are taken to the laboratory for physical and chemical analysis.

### 3.2 Working of Reverse Ps, psos Treat,emt Plant

Stage No.	Filtration	Material	Benefit
1.	Sediment Filter	Polypropylene yarn wound	Removes visible impurities
2.	Sediment Filter	Polypropylene melt blown	Removes suspended particles
3.	Pre-RO' Carbon Cartridge	Silver impregnated Activated Carbon	Removes excess chlorine and organic impurities
4.	Reverse Osmosis	Thin Film composite (TFC) (0.001 micron)	Reduce TDS, hardness, pesticides, heavy metals like Arsenic, lead and mercury. Removes microorganisms like bacteria, virus, and protozoa cysts.
5.	Post-RO Carbon Cartridge	Silver impregnated Activated Carbon	Inhibits growth of bacteria, removes residual organic impurities are revives the original taste of water.

## 4. RESULTS & DISCUSSIONS

### 4.1 Variation of Chemical Parameters in different water sample

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	Permissible limit
pH	7.3	7.4	7.6	7.8	7.4	7.2	7.4	7.5	7.4	7.0 - 8.5
Turbidity NT	28	9	8	7	6	6	7	8	6	1
Total Hardness	1905	2000	1780	1900	1800	1780	1710	1600	1560	200
Calcium as Ca	420	405	397	390	360	340	316	380	290	75
Magnesium as Mg	260	240	250	270	210	200	200	160	150	30
Nitrite as NO <sub>2</sub>	0.12	0.17	0.16	0.14	0.13	0.11	0.14	0.13	0.12	-
Nitrate as NO <sub>3</sub>	0.12	0.11	0.10	0.9	0.8	0.7	0.6	0.5	0.3	45
Chloride as Cl	2970	3600	3400	3200	3000	2800	2700	2060	2400	200
Fluoride as F	1.1	1.1	0.9	0.8	0.7	0.7	0.5	0.3	0.2	1.0
Sulphate as SO <sub>4</sub>	182	172	112	154	140	138	130	120	118	200

Results are expressed in mg/L

### 4.2 Water Quality

The results of various water samples for the various physico-chemical analyses from various sites in the Iyankulam Pond are presented and discussed. The variation in the various physico – chemical characteristics of ground water quality by the seepage of the effluents from the sewage and various industrial

effluents, gives the overall picture of the physico-chemical parameters of all the samples.

### 4.3 Sensitive Parameters

Parameters like hardness, calcium, magnesium, chloride and Sulphate are taken as sensitive parameters to indicate the water pollution by industrial effluent from

various sources. It is observed that the values are higher compared the BIS Standards.

## 5. CONCLUSION

The ground water quality is very much affected in the Iyankulam Pond due to discharge of domestic industrial and waste water from the residential area located near the study area. There has been a notable change in the occupations of people over a period of 25 years. There was a time when every family depends on agriculture; but now, only few people pursue agricultural operations. The rest have shifted to non-agricultural pursuits, such as wood cutting, laboring in small and big industrial units, cart pulling, loading and unloading goods and charcoal making. The present study was undertaken to evaluate the extent of pollution of ground water in and around Iyankulam Pond located in Palani Road at Dindigul. Effluents from the tanneries are discharged in to streams, which drain into ponds, thereby polluting the ground, water sources and cultivable land. Pollution due to industries effluents is caused by variety of chemicals is used in the tanning industries, including lime, sodium chloride, sodium carbonate, ammonium chloride, sulphuric acid, tannins and dyes. All tanneries need a large amount of water for processing leather and depend on groundwater sources for their daily requirements. A state of severe pollution results from the cluster of tanneries in close proximity to each other. The aim was to analyze and understand the toxic effects of tannery effluents, sewage water and hospital, effluents on agriculture and the day to day life of people nearby Iyankulam Pond in Palani Road at Dindigul District. A public well in the study area, which was once an important source of drinking water for the whole village, is considered as a deep pit with polluted water. Contaminated water is treated using reverse osmosis system. Reverse osmosis plant with high capacity is used for water treatment. Almost all the samples collected from various sampling sites from S2 to S9 are subjected to water treatment using reverse osmosis plant. The treated water collected from reverse osmosis plant after treatment is analyzed as per the

procedure for water standard. The water becomes suitable for domestic purpose with a low TDS. People in the Study area were advised to go for RO. treatment plant to convert the well water and bore water for domestic use.

## ACKNOWLEDGEMENT

The authors are thankful to their concerned TWAD board and the management of the college for constant encouragement and financial support to promote such innovative solution for the environmental pollution problem.

## REFERENCES

- Anderson, R. A., Chromium as an essential nutrient. The chromium File No. 6. Intl Chromium Development Association(1999).
- Ansari, A. A., Singh, I. B. and Tobschall, H. J., Status of anthropogenic ally induced metal pollution in the Kanpur-Unnao industrial region of the Ganga plain, India, *Environ. Geol.*, 381 25–33(1999).  
[doi:10.1007/s002540050397](https://doi.org/10.1007/s002540050397)
- Apparao, B. V., Karthikeyan, G., Pollution due to tanneries of Dindigul, Gandhigram Rural Institute, Gandhigram, TamilNadu, 19-24(1999).
- Baskar, J. P., Devastation of Leather Tanneries in Tamil Nadu. *Development in Practice*, An Oxford Journal 2 (2), 274(1992).
- Elango, L., Kannan, R. and Senthil Kumar, M., Major ion chemistry and identification of hydro geochemical processes of groundwater in a part of Kancheepuram District, Tamil Nadu, India, *Environ. Geosci.*, 10, 157–166(2003).  
[doi:10.1306/eg100403011](https://doi.org/10.1306/eg100403011)
- Kolpin, D. W., Barbash, J. E. and Gillion, R. J., Occurrence of pesticides in shallow groundwater of the United States: Initial results from the national water quality assessment program, *Environ. Sci. Tech.*, 32, 558–566(1998).  
[doi:10.1021/es970412g](https://doi.org/10.1021/es970412g)

- Mondal, N. C. and Singh, V. S , Integrated approach to delineate the contaminated groundwater in the tannery belt: A case study. In: Proceeding of the 2nd Asia Pacific Association of Hydrology and Water Resources Conference, Suntec, Singapore, 2, 436–444(2005).
- Selvakumar, M. and Manoharan, R., Effect of tannery effluent in groundwater and its control – A case study at Dindigul, Proc. IGC, Dindigul(2002).
- Srinivasa Gowd, S., Krishna, A. K. and Govil, P. K., Environmental risk assessment and remediation of soils contaminated due to waste disposal from tannery industries: A case study of Ranipet industrial area, Tamil Nadu, India, *Geochim. Cosmohim. Acta.*, 69A, 427(2005).  
[doi:10.1007/s002540050193](https://doi.org/10.1007/s002540050193)
- Srinivasa Rao, Y., Reddy, T. V. K. and Nayudu, P. T., ground water quality in the Niva river basin, Chittoor district, Andhra Pradesh, India, *Environ. Geol.*, 32, 56–63(1997).
- Thangarajan, M., Subrahmanyam, K. and Srimannarayana, M., Preliminary assessment of groundwater pollution due to tannery effluents in Kodaganar river basin, Dindigul district, Tamil Nadu, India; In: Proceeding on International association of hydro geologists, hydrogeology and land use management, Bratislava, Slovak Republic, 629–632(1999).
- Wu, T. L., Dissipation of the herbicides atrazine and alachlor in a Maryland corn field, *J. Environ. Quality*, 9, 459–465(1980).  
[doi:10.2134/jeq1980.00472425000900030029x](https://doi.org/10.2134/jeq1980.00472425000900030029x)