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The Physico – Chemical Analysis of Ground Water in and around Dindigul Due to the Discharge of Sewage and Industrial Effluents

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Abstract

The present study is carried out pollution problem at Savariyar Palayam Pond in dindigul district. The aim to analyze the toxic effects of tannery effluents and sewage water nearby Savariyar Palayam in Madurai Road at Dindigul District. The 68 tanneries in dindigul, they are located within 2 km distance from the pond. The tanneries effluents are discharged in to ponds, thereby polluting the ground, water sources and cultivable land. The Pollution due to tannery effluent 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. The discharged- effluents from the processing units are stored in large lagoons Pollution occurs as the dissolved salts percolate into the surrounding water and soil.

Keyword: Industrials effluent, sewage water, ground water, TDS, P^H, physicochemical.

Introduction

In recent years, the growth of industry, technology, population, and water use has increased the stress upon both our land and water resources[1]. Locally, the quality of ground water has been degraded. Municipal and industrial wastes and chemical fertilizers, herbicides, and pesticides not properly contained have entered the soil, infiltrated some aquifers, and degraded the ground-water quality[2]. Other pollution problems include sewer leakage, faulty septic-tank operation, and landfill lea hates[3].

Many natural processes and human activities affect the interactions of ground water and surface water[4]. The purpose of this report concerned to Savariyar Palayam pond in Dindigul district is to present our current understanding of these processes and activities as well as limitations in our knowledge and ability to characterize them[5]. Traditionally, the district is known for locks and leather. Agro processing industries offer good scope for development among the non-traditional industries[6]. The demand based industries such as dehydrated fruit manufacture, paper cone Manufacture, leather goods manufacturing, PVC pipe manufacturing, plastic textile and automobile parts, cattle feed poultry feed manufacturing, fruit/vegetable processing near Oddanchatram and oil extraction in Nilakottai are prominent[7]. Natham and Palani taluks are having adequate supply of tamarind, guava and mango. There are 22 Biscuit factories, 2 Dhal Mills, 7 Fire Works, 6 Flour Mills and 3 Oil Mills[8]. One Rice Bran Oil Factory at Dindigul and One Coconut Produce (Coconut mill and Coconut powder) manufacturing factory at Batlagundu are also available[9]. The number of chemical based industries is increasing in Dindigul day by day. There is no proper treatment of discharge of wastewater from the isolated industries[10].

Scope and objectives for the study: The quality of water in the Savariyar Palayam pond in Dindigul District is to be studied due to the continuous discharge of sewage and industrial effluents in to the pond with out any treatment[11]. 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[12].

Objective: i. To Study the Physico–Chemical parameters in the savariyar Palayam Pond in Dindigul District. ii. To evaluate the ground water quality in the wells and bore wells around the Pond. iii. To treat the contaminated ground water using Reverse osmosis technology in order to reduce the total dissolved solids (TDS) in the ground water.

Field Survey: Chemical Industries like tanneries and houses are located in the western side of the pond. The discharge of wastewater from the industries and sewage from the houses flow into the low-lying areas and finally collected in the pond[13]. The wastewater and sewage are highly polluted and affects the ground water around the pond at a alarming rate. The pond water is highly salty and becomes unfit for human consumptions. The polluted water in the pond percolates into the ground around 5km in and around the Pond. The investigator during survey- observed that the ground water is used for drinking purposes. The ground water quality is badly

affected also the lands near the pond are mostly barren and unfit for cultivation[14]. The pond and the ground water quality cause many water born diseases. The high total dissolved solids in the pond water and ground water are the reasons for salty taste of the water. In order to find the pond water pollution and the ground water pollution, water samples were collected from 9 different locations in and around the pond. During the survey the investigator found that the people had very good drinking water before 25 years. Study of water quality in the pond and the ground water sources are very useful for the people. They want proper treatment using Reverse osmosis technology will help the people to get portable water in the study area.

Material and Methods

Location of the Study Area: Dindigul is inland district of Tamil Nadu. It lies between 10.3° arid 10.48° of North latitude and 77.15° and 78.20° of East longitude. The district has exclusive hilly and rocky areas with undulating plains covered mostly by red soil. North East Monsoon benefits Dindigul with a mean annual rainfall of 42.66%. The mean sea level is 280.11 meter. Groundwater in Dindigul area is highly polluted due to industrial effluents from the local tanneries and sewage.

Choice of the Study Area: Tanneries and houses are located around the Savariyar Palayam 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.

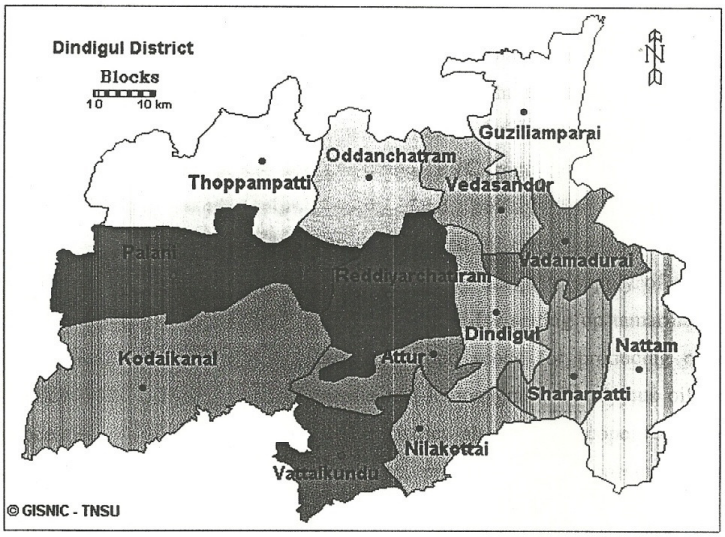


Figure-1

Profile of Water Bodies: The Savariyar Pond is located on Madurai. of Dindigul District (Municipal limit).

Ownership :	This pond comes under municipal limit
Area :	1.25 hectare
Capacity :	0.0200 million cubic meter
Location :	Madurai road
Encroachment :	Semi – 15
	pucca – nil,
	others – 09

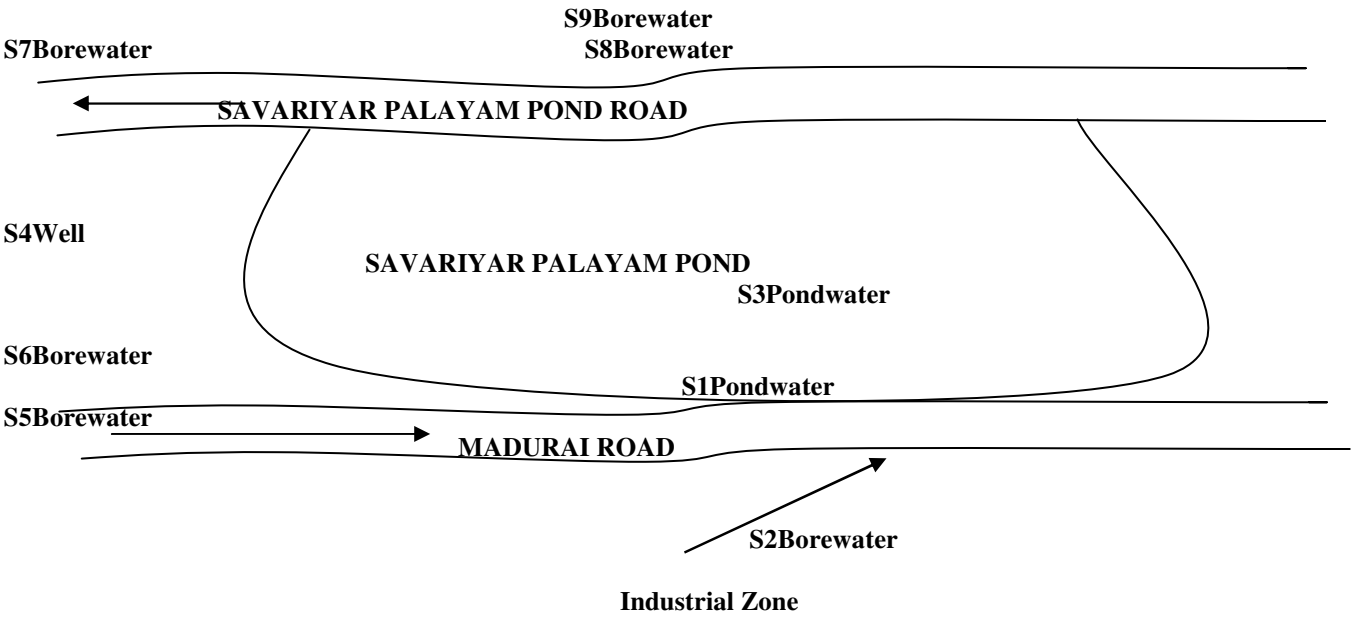


Figure-2
Places Where the Water Samples Were Collected

Contamination of the Savariyar Palayam Pond in Madurai Road: 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 Savariyar Palayam 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 and suggest a suitable remedy for water treatment of using water reverse osmosis technology.

Method of Sampling and Analysis of Water Quality Parameters: Water samples from the Savariyar Palayam Pond and the wells and bore wells on all directions in and around the Pond were collected from the sampling sites in a clean polythene bottle. Dissolved oxygen (D.O) was analyzed immediately after collection at the site using DO meter. Water samples were brought to the laboratory for analyzing the physico-chemical characterises of water. Areas where the samples were collected are shown in the figure II. Samples were analyzed by as per standard methodology. The samples were collected during pre monsoon months. The results are tabulated I and II

Results and Discussion

The results of various water samples for the various physico-chemical analyses from various sites in, the study area are presented and discussed. The various physico–chemical analysis of ground water quality, sewage and various industries including tanneries, gives the over all picture of the physico-chemical parameters of all the samples the given table.

Sensitive Parameters: TDS, hardness, calcium, magnesium, chloride and pH are taken as sensitive parameters to indicate the water pollution by industrial effluent from various sources.

Table-1
Variation of physical parameters in different water sample

Parameters	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	Permissible limit
Turbidity NT	30	9	8	7	6	6	7	8	6	1
Total Dissolved Solids Mg/L	8142	7196	7020	6700	6720	6400	6200	5200	4200	500
Electrical Conductively Micromhos	12010	17210	10500	10120	10200	9560	9200	3600	7400	-

Table-2
Variation of Chemical Parameters in different water sample

Parameters	SI	S2	S3	S4	S5	S6	S7	S8	S9	Permissible limit
P^H	7.3	7.4	7.6	7.8	7.4	7.2	7.4	7.5	7.4	7.0 - 8.5
Turbidity NT	30	9	8	7	6	6	7	8	6	1
Total Hardness	2100	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_2	0.12	0.17	0.16	0.14	0.13	0.11	0.14	0.13	0.12	-
Nitrate as NO_3	0.12	0.11	0.10	0.9	0.8	0.7	0.6	0.5	0.3	45
Chloride as Cl	3700	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_4	182	172	112	154	140	138	130	120	118	200

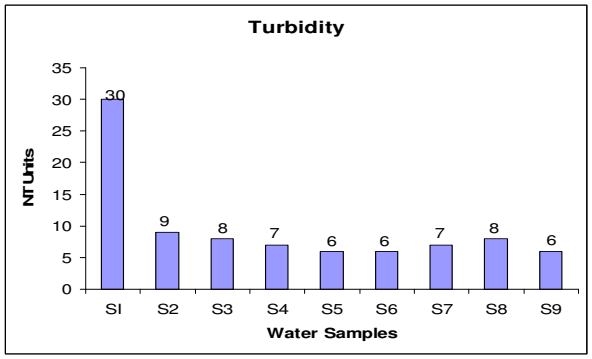


Figure-3.1

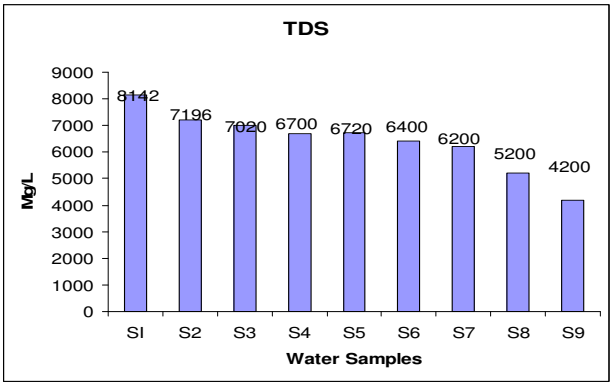
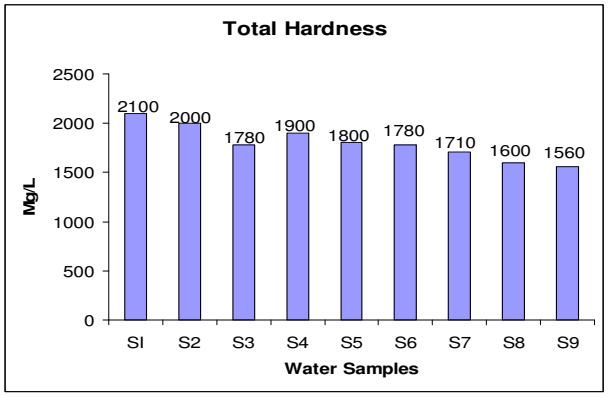


Figure-3.2



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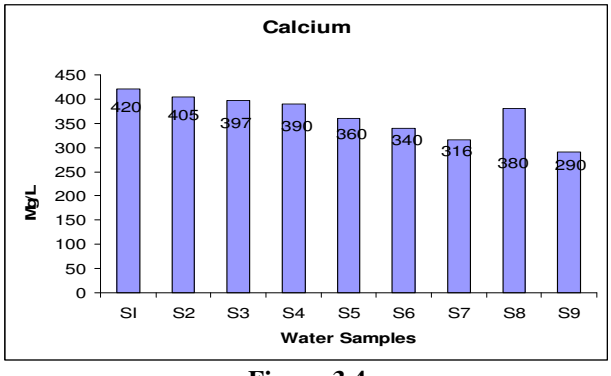

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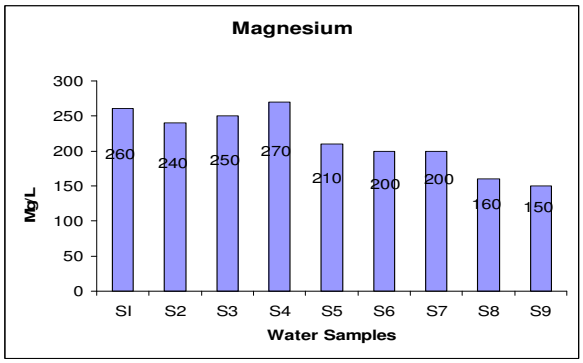

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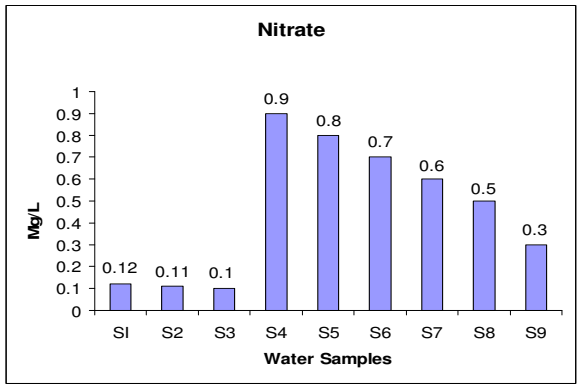

Figure-3.6

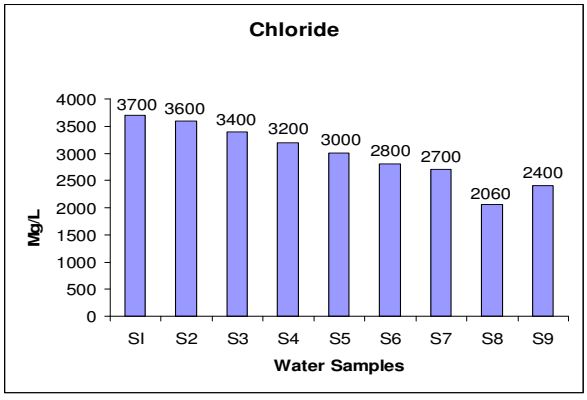

Figure-3.7

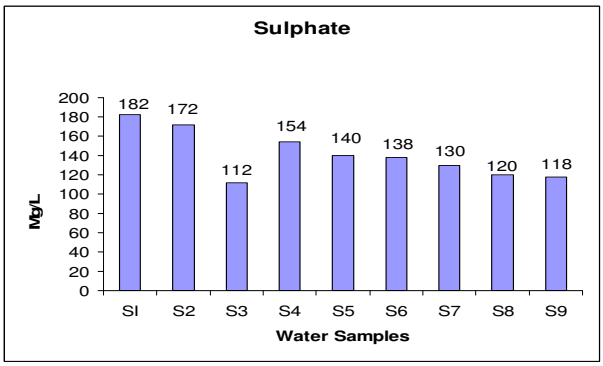

Figure-3.8

pH: The pH remained mostly alkaline in the premonsoon season study. The pH of the pond' water varies from rninimum of 7.2 to maximum of 7.8 Physical and chemical changes in water are dependent on pH variations of the water. In nature pH changes according to the seasons. And it is an index of water quality in ground water. It was observed that the pH of water was found higher at Pond and low at bore wells. The water pH decreased slightly with increasing distances from pond water. As per the standards of ground water quality for potability, all the water pH was within the permissible limit. The percolation of industrial effluent causes ground water pollution during premonsoon season. The pond water is mostly from sewage of domestic source. It consists of feces, urinal water, washings waste, garbage, rags and sludge from hospital, which are mostly alkaline in nature. But the pH of pond water is slightly lower than the corresponding borewell waters collected nearby the pond due to decomposition of organic constituents. The pH of borewell waters is slightly higher than the pond water. The pH of the wellwater reported high due to the seepage of ions present in the effluent. The ground water analysis reveals that there are variation in pH.

Electrical Conductivity: Electrical conductivity of water varies from maximum of 12010 Mic Siemens / cm to minimum of 7400 mic Siemens / em. Electrical conductivity is an important parameter to find the dissolved electrolytes in water. Conductivity indicates the presence of dissolved solids so that the conductivity of Pond water is high because the conductivity is directly proportional to dissolve solids.

Hardness: The degree of hardness in water varies from 1560 Mg/L to 2100 Mg/L during the analysis. The highest desirable limit prescribed by IS1 (1991) is 200 Mg/L for drinking purposes. The hardness of the samples is above the prescribed limit. Analysis reveals that the hardness is greater than 300 Mg/L. It means that the water is very hard. The, values (1600-210O Mg/L) are slightly higher than ISI level. The variation and increase of hardness of well water 1560 - 2100 Mg/L is unsuitable for drinking. Hardness prevents soap from lathering and increases the time for boiling the water. The cations like calcium and magnesium imparts hardness of water.

Total Dissolved Solids: Total dissolved solids varies from minimum of 4200 Mg/L to maximum of 8142 Mg/L. The higher level was recorded at pond shows the water level should be low. All water samples showed higher TDS values. In present study the total dissolved solids ranges from 4200 Mg /L to 8142 Mg/L during premonsoon season. The higher values may be due to low water level and various kinds of polluted ions present in the water. The desirable limits of TDS in drinking water are 500 Mg L.

Turbidity: Turbidity of ground water varies from minimum of 6 NTU to maximum of 30 NTU. The presence of finely suspended matter does not settle. Hence it shows higher value of total dissolved solids. The presence of suspended matter may be due to the discharge of solid wastewater in the areas at Pond water.

Turbidity of the ground water ranges from 6 to 30 NTU units during analysis. The desirable limit prescribed by ISI (1991) is 5 NTU. All the samples show above the prescribed limit. It shows the water from all sites is not acceptable for drinking purpose

Chloride: The concentration of chloride level varies from minimum of 2400 Mg / L at Site S9 to maximum of 3700 Mg/ L at pond was recorded during the period of study. The chloride levels are found in variable amounts in water. The chloride content ranges from 2400 Mg/L to 3700 Mg/L. According to ISI 1991 the highest desirable limits of chloride concentration is specified as 200 Mg/L for drinking water. Chlorides values are compared with ISI limit and found that chloride imparts bad tastes to water. The increase of chloride ions 420 Mg/L to 703 Mg /L has indicated that discharging industrial effluent had polluted ground water quality. Analysis reveals that the chloride level is higher than prescribed limit.

Calcium: Calcium content was found to be maximum of 420 mg/L at borewell and minimum of 290 mg / L at site S9 during the period of study. Calcium is one of the most abundant substances in natural water Ragothaman. Clearly states that increase of calcium and contributes to hardness in water and thereby reducing the utility of water for domestic use. The domestic and industrial wastewater contains high amount of inorganic and organic pollutants and the present of calcium (33 to 116) mg/1 observed maximum in premonsoon period.

Magnesium: Magnesium content varied from 260 Mg /L at site S9 to 150 Mg /L at Pond. Values of magnesium level concentration were within the prescribed limit (30 Mg / L). In the present study the magnesium concentration varies from 19 Mg / L to 122 Mg / L. It is higher than the desirable range of 30 Mg /L as prescribed by the limit.

Nitrate: Nitrate level in water samples varies from 0.12 Mg / L to 0.3 Mg / L. The level showed that at site S9 the concentration is lower and at pond the concentration is very high.

Sulphate: The concentration of sulphate was observed maximum at borewell of 182 Mg/L and minimum at the Site S9 of 118 Mg /L. Sulphate contributes to the hardness of the water along with calcium and magnesium. The sulphate concentration varies from 118 Mg / L to 182 Mg/L. during analysis. The concentration of sulphate as per of the prescribed limit is 200 Mg/L.

Fluoride: The level of fluoride in water varies from 1.1 Mg/L to 0.2 Mg/L. Fluoride level was found higher at Pond and lower at site S9.The concentration of fluoride range was is from 1.1 to 0.2 Mg / L. The fluoride level are acceptable as prescribed by ISI 1991 is 1.0 Mg/L The presence of fluoride in ground water is more pronounced in the western side of catchments area. The

excess of fluoride level in water causes dental and skeletal flurosis.

Conclusion

The ground water quality is very much affected in the Savariyar Palayam Pond due to discharge of domestic industrial and waste water from the residential area located near the study area. About 68 tanneries are in Dindigul, they are located within 2 km distance from the pond. A state of severe pollution results from the cluster of tanneries in close proximity to each other. About 25 years ago, People did not feel the problem of effluents in the initial stages as tanning used natural materials, such as the bark of tamarind and Indian gooseberry trees. Now the number of tanneries in the dindigul area increased and competition among the tanners intensified. This led to the introduced of chemical processing of hides. The tannery wastes containing these chemicals were lot in to streams and open fields.

The effect of tannery effluents have damaged the environment and affected people's livelihood opportunities. The effect of effluents not only from tanneries but also- from various chemical sources" for example even hospital wastages and sewage water is affecting the ecology and health of the people in Madurai Road at Dindigul. The tannery industry effluent affects the human's 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 condition water present in this village, due to the effects of tannery effluents.

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