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IMPACT OF DYEING INDUSTRIAL EFFLUENT ON GROUNDWATER QUALITY IN AND AROUND AYYAMPETTAI

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Abstract - *Dyeing and printing of textile being a traditional industry of Kancheepuram town, a good number of textile industries along with dyeing and printing clusters have come up in the area. The dyeing units in Kancheepuram municipality and the surrounding villages are under constant threat of ground water contamination with chemicals of dyes. The present study evaluates the groundwater quality in and around Ayyampettai, Kancheepuram town of Tamil Nadu with reference to drinking and irrigation purposes. Ten groundwater samples were collected from various parts of the dyeing industrial region and the samples were analyzed with standard analytic methods. The results show that, the groundwater quality in the present study area can be categorized under 'good' for irrigation purpose and 'average' for drinking purpose. Access to safe drinking water supply is one of the basic needs of society and hence a comprehensive plan of action is sought to curb groundwater contamination in the studied region.*

***Key Words*:** Dyeing,Groundwater,Parameters, Quality Analysis, Potable ,Irrigation

1.INTRODUCTION

Water is very essential for human survival. It is an essential ingredient for animal and plant life too. Kanchipuram which has a traditional history of dyeing is located on the northern bank of the river "Vegavathy". Actually, dyeing is a process of adding color to textile products like fiber, yarns. It is normally done in a special solution containing dyes and particular chemical materials. Dye is a colored substance that has an affinity to the substrate to which it is being applied. Dyes can be removed by process called "Stripping". There are nearly 40 dyeing industries in Ayyampettai and Muthailpet villages of Kancheepuram. The ground water get contaminated due to impact of dyeing industrial effluent which has biodegradable nature of the dyes along with strong presence of toxic trace metals, acids, alkalis and carcinogenic aromatic amines.

1.1 STUDY AREA

Kanchipuram town is located at a distance of 76Km from Chennai on the northern bank of the river Vegavathi, a tributary of the river Palar in TamilNadu, India. It is situated at 12°50' north latitude and 79°42' east longitude, (Fig - 1). Kanchipuram District is made up of hardrocks and sedimentary formations overlaid by alluvium and laterite. The average rainfall of the district is 1212mm and occurs mostly due to the north – east monsoon and also not having any perennial rivers.

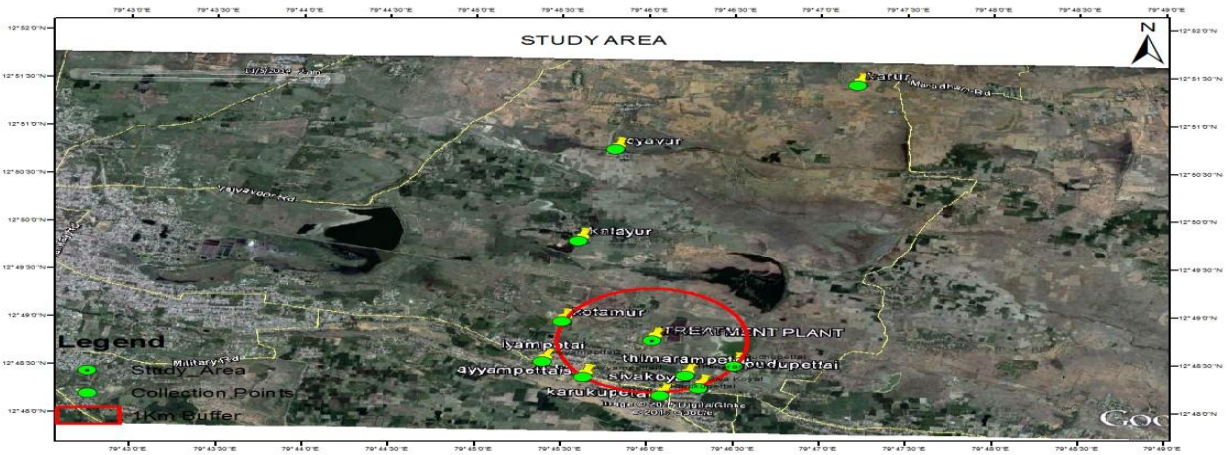

Fig -1: Location of the groundwater samples collected

Table -1: Groundwater Sample Sites

Sample	Source	Location
A	BW	Kaliyanur
B	BW	Olaiyur
C	BW	Karur
D	BW	Kuttamur
E	BW	Siva Temple (Ayyampettai)
F	BW	Thimmaiyan Pettai
G	Tap water	Rani Amman temple
H	BW	Kurrukkupattai
I	Tap water	Pudupettai
J	BW	Satya nagar, Ayyampettai

Fig -2: Sample from Tap Water-PuduPettai

2. METHODOLOGY

Ten representative groundwater samples were collected in the dyeing industrial areas of ayyampettai village of Kancheepuram town during December 2014. The locations of the groundwater sample sites were listed in table 1 and Fig 2. The samples were analyzed for the parameters turbidity, electrical conductivity (EC @ 25°C), total dissolved solids (TDS), pH , alkalinity, sulphate (SO_4), chloride (Cl), nitrate (NO_3), total hardness (TH), calcium (Ca), iron (Fe), magnesium (Mg), sodium (Na), faecal coliform bacteria count (F.Coli.), biochemical oxygen demand (BOD5 and chemical oxygen demand (COD) by standard analytic methods (APHA, 1995). All the groundwater samples were found to be colorless and odourless. The temperature of the groundwater samples was found about 30°C.

3.RESULTS AND DISCUSSION

All the samples are satisfied with colour, odour, turbidity.TDS, Electrical conductivity ,pH,Total and Phenolphthalein Alkalinity as $CaCO_3$,Total Hardness, Calcium, Magnesium, Sodium, Pottasium, Iron, FreeAmmonia, Nitrite, Nitrate, Chloride, Flouride, Phosphate as per BIS 10500:2012 except samples B, F, J. All The samples are not satisfied with BOD, COD Tidy 'Test 4-hrs as O_2 as per BIS 10500:2012 (Table 2 and Table 3). The samples collected at B is not satisfying colour, turbidity, Total Alkalinity, Total Hardness, Iron, Flouride and Sulphate. Turbidity, colour, Total Alkalinity,Iron are not satisfied for the samples collected at F and J. Free Ammonia and Nitrite are not satisfied in C and Phosphate in E. (Table 4).

Table -2: Quality Standards As Per BIS-10500:2012

BIS 10500:2012	Acceptable Limit	MaximumPermissible Limit
Physical Examination		
Appearance	-	-
Color (pt.co-scale)	5	15
Odour	Agreeable	Agreeable
Turbidity NT units	1	5
Total Dissolved Solids mg/l	500	2000
Electrical Conductivity micro mho/cm	-	-
Chemical Examination		
pH	6.5-8.5	6.5-8.5
Ph. Alkalinity as $CaCo_3$ mg/l	-	-
Total Alkalinity as $CaCo_3$ mg/l	200	600
Total Hardness as $CaCo_3$ mg/l	200	600
Calcium as Ca mg/l	75	200
Magnesium as Mg mg/l	30	100
Sodium as Na mg/l	-	-
Potassium as K mg/l	-	-
Iron as Fe mg/l	0.3	0.3
Manganese mg/l	0.1	0.3
Free Ammonia as NH_3 mg/l	0.5	0.5
Nitrite as NO_2 mg/l	-	-
Nitrate as NO_3 mg/l	45	45
Chloride as Cl mg/l	250	1000
Fluoride as F mg/l	1.0	1.5
Sulphate as SO_4 mg/l	200	400
Phosphate as PO_4 mg/l	-	-
Tidy's Test 4 hrs. as O_2 mg/l	-	-
BOD	-	-
COD	-	-
Biological Examination		
FAECAL CALIFORM	-	-

Table -3: Quality Standards For Effluent Irrigation As Per Is: 3307-1965

SL.NO	PARAMETERS	LIMIT AS PER IS:3307 – 1965 (mg/l)
1.	BOD	500
2.	PH	5.5 TO 9
3.	TDS	2100
4.	OIL AND GREASE	30
5.	CHLORIDES	600
6.	BORON	2
7.	SULPHATES	1000
8.	% OF Na wrt, TOTAL CONTENT OF Na, Ca, Mg & K.	60%
9.	ARSENIC	0.2
10.	CYANIDE	0.2

Table -4: Analytical Results of Groundwater Samples

PARAMETERS	A	B	C	D	E	F	G	H	I	J
COLOR	-	YELLOW	-	-	-	-	YELLOW	-	-	TURBID
ODOUR	-	-	-	-	-	-	-	-	-	-
TURBIDITY	3	30	1	1	3	34	1	2	2	24
TDS	1300	1688	557	1282	940	2100	1000	1200	1686	1300
EC	2800	4100	1159	2700	2000	4600	2200	2500	4100	2800
P^H	7.71	7.30	7.68	7.63	7.02	7.01	8.14	7.34	7.36	7.11
PH. AL	0	0	0	0	0	0	0	0	0	0
TOTAL AL	472	736	336	440	352	720	328	408	416	424
TOTAL HARDNESS	280	528	124	272	240	384	296	424	736	448
Ca	64	116	28	60	52	84	64	92	160	99
Mg	29	57	13	29	26	42	33	47	81	48
Na	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-
Fe	0	2.08	0.26	0	0.65	2.34	0	0.26	0	2.08
MANGANESE	0	0	0	0	0	0	0	0	0	0
FREE AMMONIA	0	0	2	0	0.5	0.1	0	0	0.3	0
NITRITE	0	0	0.4	0	0	0	0	0	0	0
NITRATE	30	40	10	28	20	42	20	20	40	24
CHLORIDE	480	600	106	464	236	744	300	368	800	388

FLUORIDE	1	1.6	0.6	0.4	0.2	0.8	0.2	0.6	0.6	0
SULPHATE	200	550	130	180	220	300	225	250	350	300
PHOSPHATE	0	0	0.4	0.4	2.4	0	2.8	0	0.4	2
TIDYS TEST	0.6	0.7	0.7	0.6	0.7	0.7	0.7	0.6	0.7	0.8
FAECAL COLIFORM	60	0	80	40	60	0	60	0	0	80
COD	37.1	45.8	29.2	56.4	62.8	9.3	30.5	46.4	35.5	27.8
BOD	12.4	15.2	6.9	17.4	20.9	3.1	7.4	15.5	12.3	9.3

The bar charts have been given only for the parameters which were not satisfied the permissible limits for all the samples collected from different sites (Chart 1 to 4).

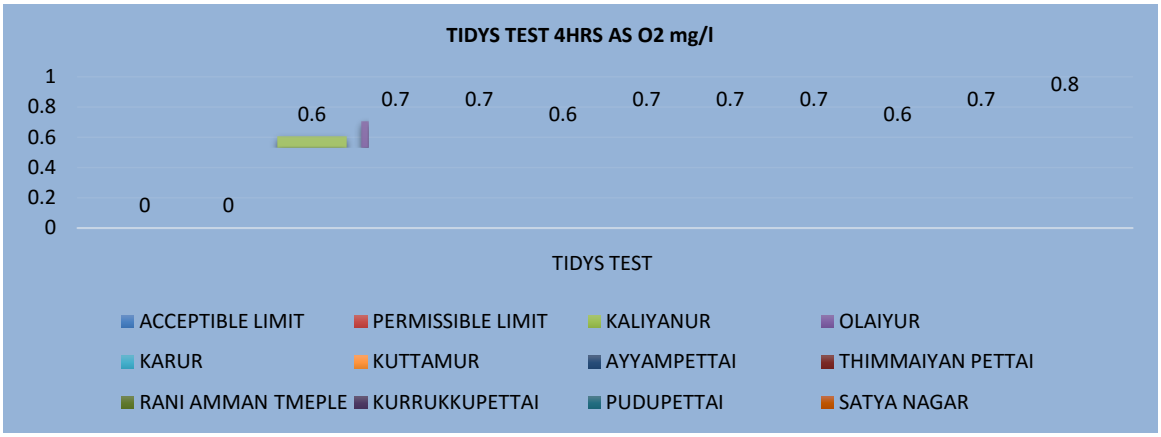

Chart1: TIDYS TEST 4HRS AS O2 mg/l

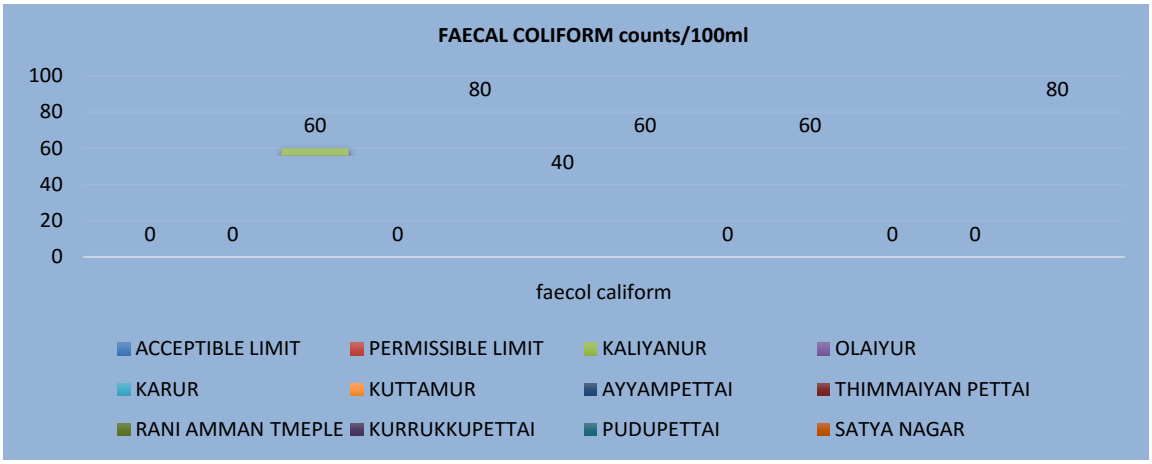

Chart2: FAECAL COLIFORM counts/100ml

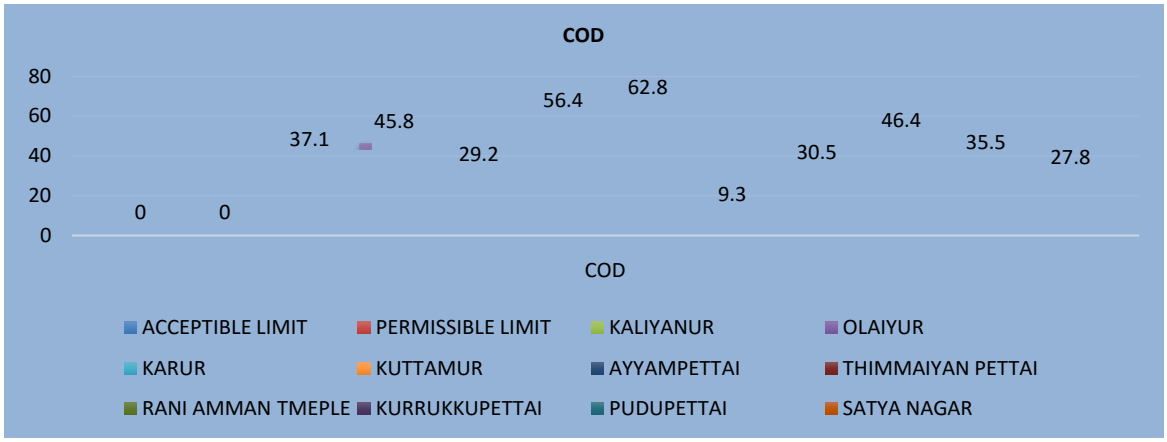

Chart 3: COD in mg/l

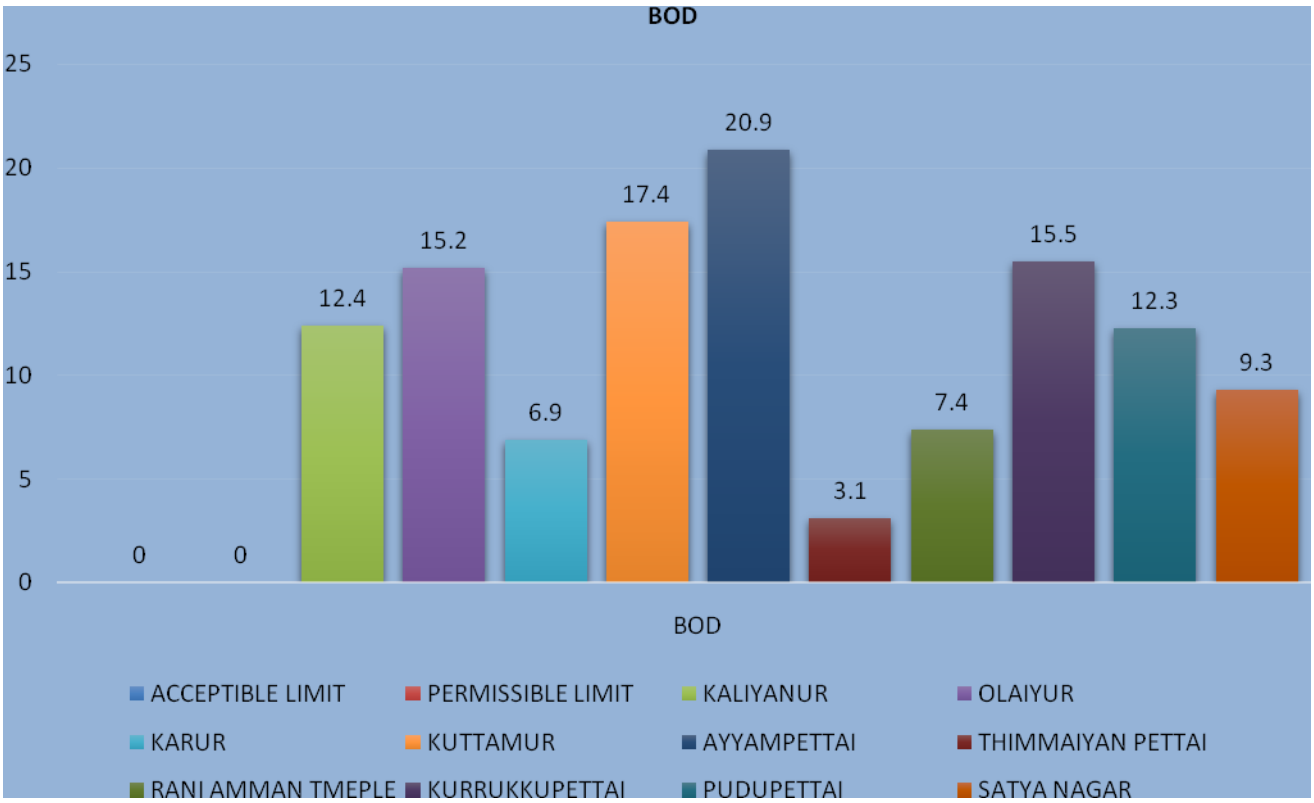

Chart 4: BOD in mg/l

Table -5: Water Quality Index Classifications

Sample	Quality
Kaliyanur [A]	Average
Olaiyur [B]	Poor
Karur [C]	Average
Kuttamur [D]	Average
Siva Temple (Ayyampettai) [E]	Average
Thimmaiyan Pettai[F]	Poor
Rani Amman temple [G]	Poor
Kurrukkupattai [H]	Average
Pudupettai [I]	Average
Satya near, Ayyampettai [J]	Poor

CONCLUSION

From the above discussions, it can be said that the quality of groundwater in the study area is fair or satisfactory for drinking purposes and good for irrigation purposes. All the samples contain high BOD and CODand samples A, C, D, E, G and J are bacteriologically contaminated. Also few have objectionable color, high content of turbidity, totalalkalinity, iron, sulphate and phosphate which shows the impact of dyeing industries.As per the quality standards, the sampling places are classified as average , poor and they are used only for irrigation but for drinking purposes after giving proper treatment (Table 5).

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