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A Comparative Study of Dyeing Effluent before and after Treatment using Reverse Osmosis Plant

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Abstract: The Investigator has made and attempts to study the impact of dyeing effluent containing both the inorganic and organic pollutants even after the treatment using RO plant. The effluent include oils, greases, metallic wastes, suspended solids, phenols, toxins, acids, salts, dyes, cyanides, DDT. Many of which are not readily susceptible to degradation and causes serious water pollution problems. In general it increases the TDS, hardness of water, and heavy metal resent in the effluents from dyeing units are percolated in and around the Tirupur District. Maximum amounts of dyes are used in the textile processing, due to the incomplete absorption of dyes and washing operations. The effluent volume is high and the dyestuffs are highly structured polymers and are very difficult to decompose biologically. The most obvious impact of the discharge of dyeing effluent is the persisting nature of the color. It is stable and fast, difficult to degrade, toxic, rendering the water unfit for its intended use. Dyestuffs can reach the aquatic environment, primarily dissolved or suspended in water, since the conventional treatment of wastewaters from textile mills and dyestuff factories are unable to remove most of the azo and other dyes effectively. The resulting dye effluents may contain some components and dyeing that coluld is toxic, carcinogenic and mutagenic to aquatic life. Ecological and toxicological problems due to the discharge of dyeing wastewaters, in natural water bodies, have been one of the most important water pollution problems in various dyeing units in and around Tirupur District.

Keywords- dyeing effluent, solar evaporation, zero liquid discharge,black kadappa tank.

Introduction

Tirupur dyeing Industry produces every type of dyes and pigments. India is the second largest exporter of dyestuffs and intermediates developing countries, after China[1]. The textile industry accounts for the largest consumption of dyestuffs, at nearly 80%. The textile industries are to satisfy the ever-growing demands in terms of quality, variety, fastness and other technical requirements[2]. The Indian textile industries now predominantly use synthetic organic dyes like direct dyes, processing dyes, reactive dyes, etc[3]. The large variety of dyes and chemicals used in and attempt to make more attractive popular shades of fabrics for a competitive market render them very complex. During the last decade, environmental issues associate with dyestuff production and application have grown significantly and are indisputable among the major driving forces affecting the textile dye industry today[4]. Considerable amounts of dyes have noticed in these textile wastewaters, due to their incomplete use and washing operations. The dyes disposed off, can be found in dissolved state or in suspension in the wastewater. These dyestuffs are highly structured

Polymers and are very difficult to decompose biologically. The most obvious impact of the discharge of

dye colored effluent is the persisting nature of the color[5]. It is stable and fast, difficult to degrade, toxic, rendering the water unfit for its intended use. The color removal is also not adequate by the conventional chemical and biological treatment. Such dyestuffs can reach the aquatic environment, primarily dissolved or suspended in water, since the conventional treatment of wastewaters from textile mills and dyestuff factories are unable to remove most of the azo and other dyes effectively[6]. The resulting dye effluents may contain some components or moieties that coluld be toxic carcinogenic or mutagenic to aquatic life. Ecological and toxicological problems due to the discharge of textile wastewaters, in natural water bodies, have been one of the most important water pollution problems[7]. Most of such dyes, being openly sold in the markets have no information regarding their chemical nature, purity, toxicity or possible mutagenicity[8]. Unlimited and uncontrolled use of such dyes can lead to grave consequences in terms of human health and ecological balances Central Pollution Control Board has listed the dye and dye intermediates industry as one of the heavily polluting industries. Many of the dyes used by textile industries are known carcinogens, and teratogen Dyes are introduced into the environment through industrial effluents of these industries[9]. There are ample evidences of their harmful effects. Most of the dyes, used in textile industry are known only by their trade name, while their chemical nature and biological hazards are not known. The aim of this study was, thus to assess the possible risk of hazard due to these dyes and the effluents containing these dyes, to health of textile dyeing workers and the environment. The dyes were used in their crude form and no further purification was attempted, because we wanted to test the potential danger that they represent in actual use[10].

Scope and Objectives of the Present Study

Tirupur is located in Tamil Nadu. The effect of effluent from Dyeing industry at Tirupur, are discharging through the drain into the water resources. The ground water gets highly polluted[11]. During the rainy season the rain water collected in the water resources which are the main source of ground water to the wells, bore wells located in and around the Tirupur District. During the rainy season the rain water mixed with Dyeing effluent and seepage into the ground water and reaches the wells& bore wells. In turn the quality of water is affected[12]. It makes the water hard with high TDS and unfit for drinking, domestic and agricultural use. Hence an attempt has been made to find the impact of dyeing effluent on ground water and also to know the quality of dyeing effluent before and after the treatment using RO plant[13].

- To evaluate the physio-chemical parameters of dyeing Industry effluent.
- To analyse the ground water quality parameters in the water resources in and around the dyeing units.
- To find the quality of effluent water before and after the treatment using RO Plant.
- To Recommend suitable remedial measures for the treatment of polluted ground water using reverse osmosis technology.

Materials and methods

Pollution one of the major and critical issue is the of pollution of the rivers Noyyal and Nallaru originating and flowing in the Kongu region.Its a bigmenance troubling the people and the Kongunadu region as a whole. And also its disgrace with not just people all over India but all over the world constantly visiting Tirupur for industrial activity[14]. The river flows with natural antibiotic minerals. As like the many other hazardous changes due to the lifestyle changes and change in culture, the Noyyal is also down to the way to dead. The neglect of the government and the concerned people is making the Noyyal a drainage water channel like many other life giving rivers. The Nallaru another river in Tiruppur area is also facing the same plight due to the huge concentration of cloth dyeing factories dumping their industrial wastes into the rivers[15].

However from 2004 onwards, efforts by local volunteers organization Siruthuli have been trying to conserve the water resource. Aggrieved by the pollution, a Writ petition was instituted in W.P.No.29791 of 2003 by Noyyal River Ayacutdars protection Association (NRAPA) now represented by its President A.P.Kandasamy. A interim final order was passed in this writ petition on 22.12.2006. And an appeal was preferred by Tiruppur Dyeing industries owners association before Hon'ble Supreme Court of India, in which an order was passed on 06.10.2010 granting three months time to achieve Zero Liquid Discharge status and payment of fine. And further three months time was granted to payment of fine in a petition filed by Tiruppur Dyeing industry owners association before Hon'ble Supreme Court of India. And a Contempt petition was filed before Hon'ble High Court of Judicature at Madras in Cont.p No.1013 of 2010 by NRAPA, in which closure of

all dyeing and bleaching units was ordered on 28.01.2011, till the units achieve Zero Liquid Discharge status and satisfy TamilNadu Pollution Control Board (TNPCB)

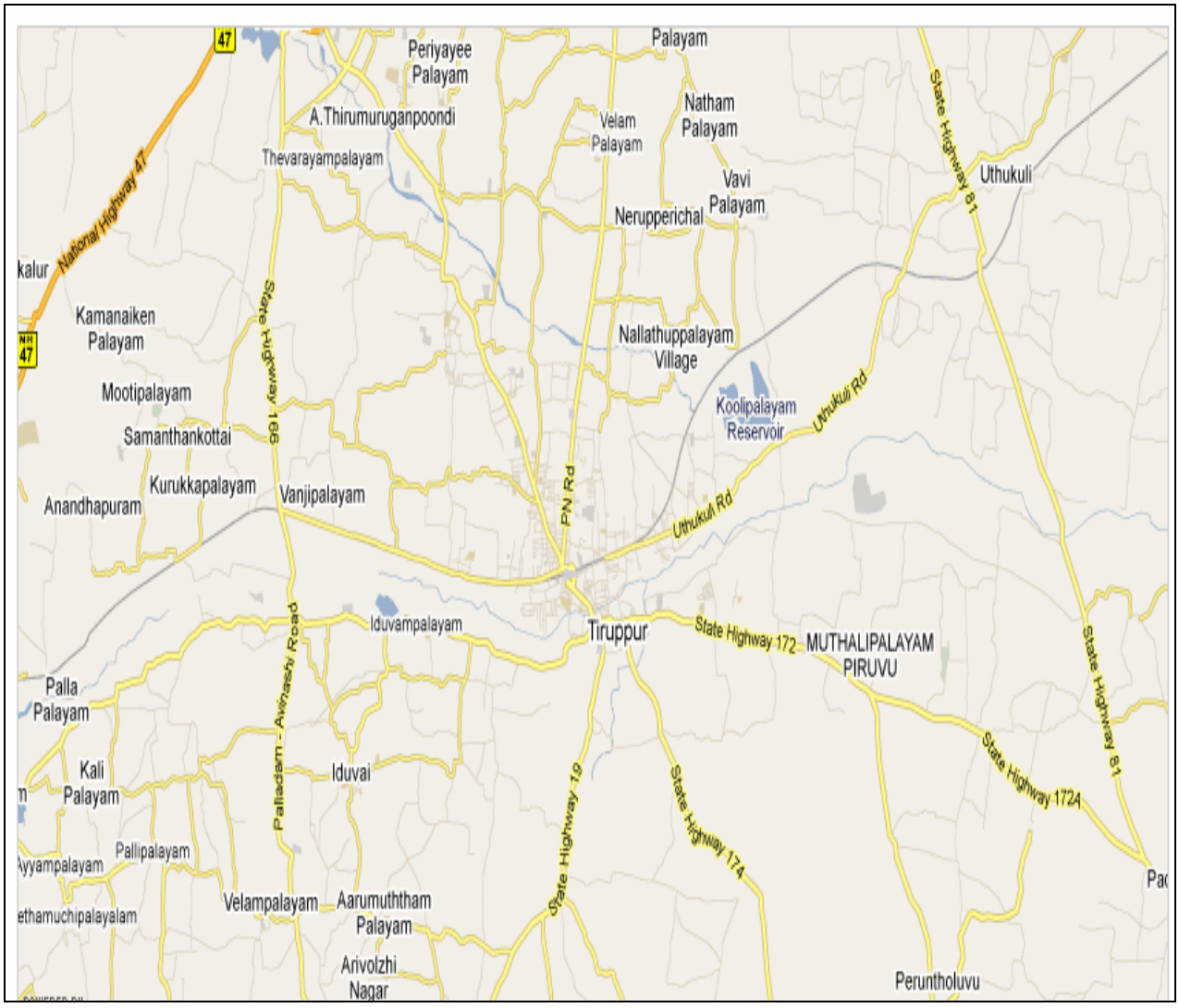
Geography

Periyar River, the Cheyyar River and the Kanchimanadhi are the tributaries to the river. They all have their origins in the Western Ghats. Periar flows out of the Siruvani hills and the Kovai Kutralam, a landmark waterfalls. Chaadiaar or Cheyyar River flows through Chaadivayal and later along with the other rivers join up at Kooduthurai to become Noyyal River. After running through a distance of 160 km, Noyyal joins with river Cauvery at Kodumudi in Erode District. The place is also called Noyyal. Apart from these three rivers, there are numerous rivulets that also join Noyyal. But most of these rivulets carry water only during the rainy season and therefore are not perennial. According to the available sources, the number of rivulets are 34. The river has a valley fill (made of alluvial kankar soil) over a stretch of 25 km and a depth of 198 ft (60 m).

It extends from the origin of the river at Kooduthurai (in Madhvarayapuram, 30 km west of the city) to the Ukkadam Tank on the city border. The fill absorbs water like a sponge. Only when the absorption reaches a saturation point does excess water flow to the suburbs and the city. The river has 23 check dams. Most are located between Kooduthurai and Tirupur, 52 km east of Coimbatore city. Decades ago, it irrigated 3550 square kilometres. Noyyal revival over 40 km will enable irrigation of 165 square kilometres, according to Siruthuli.

Map Tirupur

Tirupur Map offering directions to any destination in Tirupur TN. Find Tourist Attractions, Train and Bus stations in Tirupur TN.



Tirupur

Tirupur is a textile city located on the banks of Noyyal River. It is the administrative headquarters of the Tirupur district. It forms a part of the ancient Kongu Naduregion of South India, where its people were the first to establish territorial state. Tirupur is a textile hub and a vast generator of employment for unskilled temporary workers.

It is an important trade centre of India. Tirupur has gained universal recognition as the leading source of Hosiery, Knitted Garments, Casual Wear and Sportswear. Tirupur has emerged as the knitwear capital of the country in three decades.[1] Exports from Tirupur, which provides employment to over five lakh people has crossed the Rs.12,000 crore[2] mark last year.

Methods of Sampling

Dyeing effluent and treated water samples from RO Plant from the Study area were collected in clean PET bottles. Effluent water samples were brought to the laboratory for analyzing the physico-chemical characteristics of effluent and Treated water samples were analized as per APHA Procedure.

Method of Collection

Untreated Effluent

Un Treated effluent samples were collected before the pumping to the RO Plant. Treated effluent water samples were also collected from the RO plant output tank for analysis of water quality parameters.

Sample Container

Except for dissolved oxygen, for analysis of the parameters, we have to use two liter white, polythene container for sample collection.

Sample Collection

- Before filling, rinse sample bottle two or three times with the effluent water being collected.
- Fill the container full without leaving any air space. Even the handle of the container should be filled with water. Close the inner cap, place a polythene sheet (10cm X 10cm) in between the inner and outer caps and then tighten the outer cap. Place another polythene sheet over the outer cap and tighten the neck with a rubber band.
- The sample should reach the lab within 24 hours from the collection.

Result and Discussions

The Results of the various physico-chemical analysis of the dyeing effluent before and after the treatment using RO plant and the ground water samples collected at the study area are presented and discussed. Ground water samples were collected from the bore wells

Comparative Table-I

Physical and chemical analysis of the dyeing effluent before and after the treatment using RO System					
S.No.	**Physical Parameters**	**Standard -A**	**Dyeing effluent analysis S-1**	**Effluent after treatment with R.O. system S-2**	**Analysis of Ground water S-3**
1	Appearance		Blackish	Clear	Clear
2	Odour	Nil	Bad Smell	Colorless	Colorless
3	Tubidity % NT	1	660	2	2
4	Total	500	8903	149	923
5	Electrical	-	13093	220	1358
6	pH	6.5-7.5	7.03	7.57	7.22
7	Alkalinity pH	_	0	0	0
8	Total Hardness	200	1840	80	300
9	Calcium as Ca	75	368	16	53
10	Magnesium as	30	221	10	40
11	Sodium as Na	-	1600	12	142
12	Iron Total as Fe	0.1	3.58	0.07	0.33
13	Ammonia as	-	0.18	0.04	0.09
14	Potassium as K	-	450	3	33
15	Nitrite as No_2	-	0.3	0.01	0.02
16	Nitrate as **N03**	-	48	4	9
17	Chloride as CI	200	3200	44	232
18	Sulphate on	200	413	5	58
19	Fluoride as F	1	2.4	0.4	4
20	Phosphate as	-	6.25	0.06	0.08
21	Ticly's Test 4		1.88	0.12	0.2

Table -1

The Dyeing effluent analysis reveals that all the parameters are above the standard limit as per CPH EEO.

Comparative Table-II

Physical and chemical analysis of the dyeing effluent before and after the treatment using RO System					
S.No.	**Physical Parameters**	**Standard - A**	**Dyeing effluent analysis S-4**	**Effluent after treatment with R.O. system S-5**	**Analysis of Ground water S-6**
1	Appearance	_	Blackish	Clear	Clear
2	Odour	Nil	Bad Smell	Colorless	Colorless
3	Tubidity % NT	1	640	5	3
4	Total	500	9446	126	973
5	Electrical	-	13861	185	1430
6	pH	6.5-7.5	6.99	7.35	6.67
7	Alkalinity pH	_	0	0	0
8	Total Hardness	200	1800	60	380
9	Calcium as Ca	75	320	13	80
10	Magnesium	30	240	7	43
11	Sodium as Na	-	1800	12	120
12	Iron Total as	0.1	3.91	0.07	0.25
13	Ammonia as	-	0.24	0.04	0.05
14	Potassium as K	-	425	3	22
15	Nitrite as No_2	-	0.33	0.01	0.08
16	Nitrate as **N03**	-	48	4	13
17	Chloride as CI	200	3520	42	186
18	Sulphate on	200	561	6	99
19	Fluoride as F	1	2.4	0.4	0.4
20	Phosphate as	-	6.9	0.04	0.06
21	Ticly's Test 4		1.71	0.12	0.24

Comparative Table-III

Physical and chemical analysis of the dyeing effluent before and after the treatment using RO System					
S.No.	**Physical Parameters**	**Standard - A**	**Dyeing effluent analysis S-7**	**Effluent after treatment with R.O. system S-8**	**Analysis of Ground water S-9**
1	Appearance	_	Blackish	Clear	Clear
2	Odour	Nil	Bad Smell	Colorless	Colorless
3	Tubidity % NT	1	680	3	2
4	Total	500	8235	156	1003
5	Electrical	-	12111	320	1475
6	pH	6.5-7.5	6.93	7.95	7.07
7	Alkalinity pH	_	0	0	0
8	Total	200	1720	192	320
9	Calcium as Ca	75	352	40	66
10	Magnesium	30	202	22	37
11	Sodium as	-	1605	36	142
12	Iron Total as	0.1	4.25	0.33	0.25
13	Ammonia as	-	0.35	0.06	0.05
14	Potassium as	-	313	8	27
15	Nitrite as No_2	-	0.34	0.02	0.08
16	Nitrate as **N03**	-	48	9	13
17	Chloride as Cl	200	3160	80	232
18	Sulphate on	200	459	22	114
19	Fluoride as F	1	2.4	0.4	0.4
20	Phosphate as	-	5.75	0.06	0.06
21	Ticly's Test 4		2	0.29	0.24

Table -2

- The Turbidity is 2 NTU where as the standard as per CPHEEO shows the acceptable limit is 0 NTU hence the water is rejected.
- The total dissolved solid value is 973mg/lit which lies above the acceptable limit 500mg/li. Hence it is rejected.
- The amount of Magnesium is 40mg/lit, which lies above the acceptance limit 30 hence the water is rejected.
- For Nitrate the permissible limit is nil but the observed value is 0.02mg/lit. So this water unfit is for drinking.
- For Phosphate also the permissible limit is nil. But the observed value is 0.08mg/lit. So this water is unfit for drinking.
- The amount of Chloride is 232mg/lit which lies above in the acceptable limit 200mg/lit.
- The permissible limit for ammonia are Nil. But the observed value of the sample of water is 0.09mg/lit So the water is unfit for drinking.

Table -3

Effluent Quality After The Treatment With R.O Plant

- The amount of total dissolved solids in this sample of water is 136mg/lit But acceptable limit is 500mg/lit. So the water is fit for use after treatment.
- The permissible limit for both Ammonia and phosphate are Nil. But observed value are 02 and Nil. So the water is fit for drinking purpose after treatment.
- The amount of chloride in the sample of water is 80mg/lit.but the acceptable limit is 200mg/lit. Hence the water is fit for drinking purpose after treatment.

Conclusion

The impact of effluent from Dyeing industry at Tirupur is at a dangerous level. The ground water gets highly polluted. During the rainy season the rain water collects in the pond which is a main source of ground water to the wells, borewells located in and around the pond. During the rain season the rain water mixed with dyeing effluent and seepage into the ground water and reaches the wells and bore wells. Hence the quality of water is affected. It makes the water hard with high TDS and unfit for drinking domestic and agriculture use. The pollution control board insisted for the treatment of the dyeing effluent using RO plant. In order to know the effectiveness of the treatment, an attempt has been made to carry out a comparative of study of the dyeing effluent before and after the treatment using RO plant. A study a has been made to analyse the physio-chemical parameters of the dyeing Industry effluent befor and after the treatment study was undertaken to analyse the ground water quality parameters in the water resources in and around the study area.

In the study area Dying effluent are discharged regularly. During rainy season water flows along with the effluent. The people used to take bath and wash their clothes in the pond water. The pond water percolate in to the ground and contaminate the ground water. The results of the various physio - chemical analysis of the dyeing effluent from a dying unit at Tirupur the treated water using RO plant and reveals that the dying effluent contains very high Total Dissolved Solids the ground water also contains high total dissolved which is above the standard acceptable limit.

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