Present scheme of Treatment of Textile Waste Water at Common Effluent Treatment Plant, Jodhpur and Proposed suggestions to be implemented for improvement in quality and enhancement in quantity

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ABSTRACT

The Textile dyeing and manufacturing industry is the major producer of waste water that contains persistent substances such as 15% unfixed dyes, predominantly 60-70% azo dyes. These unfixed dyes are a major environmental concern due to their persistence and potential toxicity. In this paper, the present conventional treatment scheme of Textile CETP of Jodhpur has been reviewed and analysis of waster was performed at each treatment unit of plant for period of 10 days from 20/6/2024 to 29/6/2024. The capacity of Textile CETP is 18.5 MLD and the plant is working satisfactory up to tertiary level for 12 MLD -14 MLD, but if the quantum of the water is to be increased than few alterations and up gradations are to executed. Similarly for the 100% reuse of treated water the CETP have to be taken to Zero Liquid Discharge with installation of Ultra filtration, Reverse Osmosis and MVRE for removal of Total dissolved solids. The proposed suggestions appears to be highly promising for 100% reuse in process and in supply in agriculture activities. This work offer a sure sought of relief in pollution generated from Textile units and will will reduce pollution load on river Jojari and will a step towards the preservation & conservation of environment

Keywords - Textile, dyes, common effluent treatment plant, Zero liquid discharge, parameters, reuse, primary treatment, secondary treatment, tertiary treatment

1.0 Introduction

Jodhpur is an industrial hub for Textile and in ancient times people use to do the works of tie dyeing , Bandhej dyeing and pot dyeing in their houses thus evolution of Textile industries of the city took place from gaining the tag of Small scale & Medium scale units from Tiny units. At present there are around 350 units of Textile in nearby areas of Jodhpur city and around 2000 units of Textile in Marwar region of Western Rajasthan including Pali Balotra, Bithuja and Jasol.One demerit of this sector is Pollution generated from this sector and looking towards the rapid industrialization and need for treatment of waste water generated from Textile a Trust was constituted by industrialists of Jodhpur in the name of Jodhpur Pradushan Niwaran Trust in 1998

1.1 Present Process

At present there are about 303 Textile beneficiary members. The alkaline primary treated effluent from member units is received via RCC conduit pipe networks CETP. The total installed capacity of plant **18.5 MLD** reserved for Textile units. The CETP operated by Jodhpur Pollution Control and Research Foundation is responsible to treat effluents as per the prescribed limits by RSPCB, CPCB and NGT.For waste water treatment of Textile industries, Common effluent treatment plant of 18.5 MLD Textile is operational up to tertiary level at Sangariya ,Jodhpur.

The existing plant is designed up to tertiary level and is capable of treating 18.5 MLD of trade effluent up to the parameters of Inland surface water discharge.

In preliminary treatment, the effluent from Textile member units is received at CETP through closed conduit RCC pipe line. The alkaline effluent is neutralized by dosing of HCl/ before bar screen. The neutralized effluent passes through Screen chamber and Grit Chamber and effluent is then passed to Equalization tank.

In primary treatment, equalized effluent is pumped to mixing channel for dosing of various chemicals like ferrous sulphate, hydrated lime, poly aluminum chloride/aluminum hydrated chloride and polyelectrolyte dosing for purpose of coagulation and pH adjustment and thereafter to clariflocculator.

In secondary treatment, the clarified water is sent to aeration tank for biological treatment. From biological treatment the treated water flows in Secondary clarifier . The biological treatment is based on Activated sludge process .Clear effluent from Secondary clarifier is collected in Treated water Tank

In tertiary, there are 9 sets of Pressure Sand filter and Activated carbon filter for filtration. The Textile CETP is treating 10 MLD-12 MLD effluent and 1 MLD is being reused at CETP in chemical preparation, decanters washing & floor washing in CETP premises & 1-2 MLD is being supplied to member units. Remaining water is being discharged to river Jojari

2.0 Materials and Methods

The present study was carried out at Jodhpur Pollution Control & Research Foundation, Plot No. SP-1, Sangaria Industrial Area , 2nd Phase, Sangaria ,Jodhpur. Geographical area of Jodhpur is 22,850 Km^2. The district stretches between 26° 29' to 27° 37' at North Latitude and between 72° 55' to 73° 52' at East Longitude. Jodhpur is the second largest city in the state of Rajasthan. The city's population and density by the census of 2011 is 1,033,918 and 13,000 / Km^2 respectively.

The Common Effluent Treatment Plant(Textile) of Jodhpur Pradushan Niwaran Trust situated at Plot No.SP-1, Sangaria Industrial Area, 2nd Phase , Sangaria operated and maintained by SPV **'Jodhpur Pollution Control and Research Foundation**.

Table 1 - Departments of JPCRF

Sr. no	Departments
01	Administration
02	SCADA(Supervisory Control And Data Acquisition)
03	Accounts
04	Sludge Handling
05	18.5 MLD CETP
06	Inward Section
07	Store
08	Material Handling
09	Laboratory
10	Conveyance System

I have visited all departments regularly along with care in charges of all departments collect all information related to their daily work schedule.

The key to receive waste water generated from their member units and to treat the waste water according to norms and parameters as prescribed by Rajasthan State Pollution Control Board. It was observed that the maximum flow is received during morning and evening hours which are regulated by SCADA system at CETP. The CETP is equipped with inlet and outlet flow meters for regulation of flow and pH meter are also provided at inlet and outlet for measurement of pH.

Online Continuous Emission & Monitoring System is also provided that reflects data of 4 parameters namely pH , Total Suspended Solids, Biological Oxygen Demand and Chemical Oxygen demand and all the data are continuously transmitted to servers of Rajasthan State Pollution Control Board & Central Pollution Control Board.

Table 2 – Daily Performed Tests at Labortaory of CETP

S.No	Type of Test	Method of Testing
1	Total Suspended Solids (TSS)	As prescribed by APHA
2	Biological Oxygen Demand	As prescribed by APHA
3	Chemical Oxygen Demand	Open Reflux Method As prescribed by APHA
4	Lead, Iron	Spectrophometer
5	Nitrogen (TKN, Ammonical Nitrogen)	As prescribed by APHA

The above mentioned parameters are tested as per the given procedure by American Public Health Association.

3.0 Results and Discussion

The analysis results shown in Table 3 & Table 4 reflects the quality of treatment done at CETP.

The samples of Inlet and Outlet of Textile CETP were collected by composite sampling and 8 parameters (pH , BOD , COD, TSS ,Ammoical Nitrogen , Total Kjehdal Nitrogen, Lead and Iron) were analyzed for a period of 10 days.

The day wise averages of parameters of Inlet is computed in Table 3 & parameters of final outlet is computed in Table 4 whereas quality of treatment & percentage removal is presented in Fig 1 & Fig 2

Table 3 – Average Inlet parameters received at CETP through closed conduit pipelines

Day	COD	BOD	TSS	ph
20 June	1210	400	1200	9.9
21 June	1200	390	1250	9.7
22 June	1180	410	1300	9.5
23 June	1150	500	1350	9.8
24 June	1180	420	1310	9.3
25 June	1250	450	1350	9.2
26 June	1250	430	1380	9.5
27 June	1240	450	1320	9.3
28 June	1200	400	1300	9.7
29 June	1205	60.180	284.390	144.710

Table 3 – Average Inlet parameters received at CETP through closed conduit pipelines

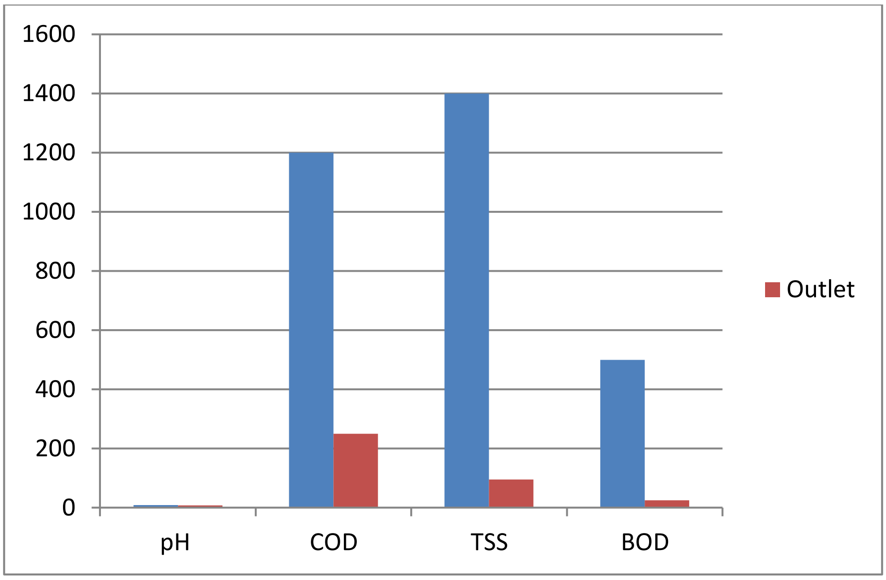
Day	Ammonical Nitrogen	TKN	Lead	Iron
20 June	65	145	1.821	2.145
21 June	72	134	2.125	1.789
22 June	61	124	1.58	2.547
23 June	54	140	2.25	1.985
24 June	50	132	1.981	2.566
25 June	72	121	1.821	1.892
26 June	42	115	2.100	1.789
27 June	55	127	1.821	2.148
28 June	62	135	1.598	2.364
29 June	45	140	2.45	2.487

Table 4 – Final Outlet parameters of Treated water from CETP(Textile)

Day	COD	BOD	TSS	ph
20 June	200	28	79	7.8
21 June	195	25	85	7.3
22 June	220	29	98	7.9
23 June	198	30	97	7.0
24 June	210	19	85	8.0
25 June	225	22	99	7.5
26 June	255	31	105	7.2
27 June	195	25	98	7.6
28 June	230	30	81	8.0
29 June	248	29	94	7.1

Table 4 – Final Outlet parameters of Treated water from CETP (Textile)

Day	Ammonical Nitrogen	TKN	Lead	Iron
20 June	15.8	41	0.001	0.146
21 June	17	35	NT	NT
22 June	19	39	NT	NT
23 June	21	52	0.038	NT
24 June	19.8	49	0.188	NT
25 June	15	45	0.024	NT
26 June	14.5	42	0.043	NT
27 June	11.2	56	NT	NT
28 June	16.5	48	0.002	NT
29 June	14.8	50	0.248	NT



Graphical Represtanation of Treatement Quality

4.0 Conclusion & Suggestions

Jodhpur is an industrial hub for Textile and in ancient times people use to do the works of tie dyeing , Bandhej dyeing and pot dyeing in their houses thus evolution of Textile industries of the city took place from gaining the tag of Small scale & Medium scale units from Tiny units.

This industry generates huge employment and gives ancillary employment as well which includes manufacturing of frames , design , stitching activities etc. Therefore this industry generates multidisciplinary employment.

One demerit of this sector is Water Pollution generated from this sector which not affects on the adjoining river bodies but also affects the water bodies located far the point of source of solution.

Although looking towards the need of treatment of waste water from Textile, the CETP situated at Jodhpur is treating the water received and performing well up to tertiary treatment , but the need of the day is Zero Liquid Discharge or use of the treated water in irrigation purpose with proper irrigation plan.

For achieving Zero Liquid Discharge we propose following up gradation in existing treatment scheme with installation of ZLD facility.

(i) Installation of Pre- Dissolved Air Flotation (DAF)- Pre-DAF systems are designed to remove suspended solids (TSS), Organic matter, and oils and greases (O&G) from a wastewater stream. Contaminants are removed using a dissolved air-in-water solution produced by injecting air under pressure into a recycle stream of clarified DAF effluent. This recycle stream is then combined and mixed with incoming wastewater in an internal contact chamber where the dissolved air comes out of solution in the form of micron-sized bubbles that attach to the contaminants. The bubbles and contaminants rise to the surface and form a floating bed of material that is removed by a surface skimmer into an internal hopper for further handling and Clear effluent flows out of the DAF. Sludge generated from DAF shall be collected in existing Primary Sludge sump and shall be pumped to the existing Decanter and proposed Filter press for further treatment.

(ii) Modification of existing Aeration Tank

(iii) Modification of one aeration tank with Moving Beds Bio Reactor (MBBR) with Oxic tank- The Moving Bed Bio-film Reactor (MBBR) is based on the bio-film carrier elements. Several types of synthetic bio-film carrier elements have been developed for use in activated sludge processes. These bio-film carrier elements may be suspended in the activated sludge mixed liquor in the Reaction Tank by air from the diffusers in aerobic reactors and by means of propeller mixers in anaerobic and anoxic reactors. The carrier elements are retained by suitably sized sieves or plates.These processes are intended to enhance the activated sludge process by providing a greater biomass concentration in the Aeration Tank and thus offer the potential to reduce the basin size requirements. They have also been used to improve the volumetric nitrification rates and to accomplish the de-nitrification in Aeration Tank by having Anoxic Zones within the bio-film depth.

(iv) Construction of additional Secondary Settling Tank- Secondary Settling tank with tube modules is used for clarification. It uses multiple tubular channels sloped at an angle of 60°and adjacent to each other, which combine to form an increased effective settling area.It captures the settleable fine floc that escapes the clarification zone beneath the tube settlers and allows the larger floc to travel to the tank bottom in a more settleable form. The tube settler's channel collects solids into a compact mass which promotes the solids to slide down the tube channel.

Clear effluent from the Secondary Settling Tank shall be collected in proposed post – DAF feed sump.

(v) Installation of Post DAF- Post DAF is designed to remove suspended solids (TSS), Organic matter from a wastewater stream. Contaminants are removed using a dissolved air-in-water solution produced by injecting air under pressure into a recycle stream of clarified DAF effluent. This recycle stream is then combined and mixed with incoming wastewater in an internal contact chamber where the dissolved air comes out of solution in the form of micron-sized bubbles that attach to the contaminants. The bubbles and contaminants rise to the surface and form a floating bed of material that is removed by a surface skimmer into an internal hopper for further handling and Clear effluent flows out of the DAF.Sludge generated from Post DAF shall be collected in existing Primary Sludge sump and transferred to the proposed Filter press.

(vi) Installation of Thickener- Sludge Thickener is proposed to improve the concentration of sludge.

(vii) Installation of Centrifuge//Volute

4.1 Proposed Scheme of Treatment:

The effluent from the existing pre-treatment units i.e. Inlet Chamber, Screen Chamber, Grit Chamber and Equalization Tank, shall be taken to the proposed Pre- DAF unit and existing Clariflocculator. The Pre - DAF is proposed for the removal of suspended matter from the effluent. Effluent from the clariflocculator and Pre – DAF shall be further taken to the proposed MBBR & Oxic Tank and existing aeration tank for biological treatment. The effluent from the existing Aeration Tank(to be modified) and proposed MBBR shall be further taken to the existing secondary clarifier and proposed secondary settling tank with peripheral tubes for settlement of biomass. The settled biomass shall be re circulated back to the aeration tank. Clear effluent from the secondary clarifier and secondary settling tank shall be taken to the proposed Post DAF unit for removal of suspended solids. Treated effluent shall be further treated in PSF & ACF. Sludge from physio-chemical treatment and post DAF shall be taken to the existing Decanter and proposed Filter press while excess sludge from the biological treatment shall be pumped to proposed sludge thickener. From sludge thickener, thickened sludge shall be pumped to the proposed Centrifuge unit for dewatering of sludge before disposal.

4.2 Proposed Scheme of Installation of Zero Liquid Discharge Treatment :

a. Ultra filtration system - One number basket filter shall be provided at inlet of each UF stream making total four number basket filters with screening media containing 100 micron perforations (max. perforation).Associated equipment and arrangement necessary for automatic cleaning and discharge of screenings shall be provided. The material of construction shall be suitable for the potential severe environmental conditions and for operation in contact with the corrosive nature of the Effluent (if required to chlorinate before MF system).

b. Reverse Osmosis system - After UF filtration, water shall be amenable as feed to Reverse Osmosis unit. The RO system shall be independently fed by high-pressure pumps. The numbers of pressure vessels and the number of membranes in each pressure vessels shall be suitably determined so as to arrive at the desired outlet quality.Necessary RO high pressure pumps shall be provided for feeding each individual banks. After passing through the membranes the product water called permeate from all the vessels in the banks shall be piped to the common permeate sump. The reject from the 1ststage RO shall be considered as the feed to the 2nd stage RO. The rejects from 2nd stage RO shall be collected in the 2nd stage RO reject water tank / 3rd stage RO feed tank. Necessary degasser shall be provided for RO permeate. The rejects from 3rd stage RO as applicable shall be collected in the RO reject water tank and shall be fed to the Reject Management System (RMS)The Reverse Osmosis Plant shall consist of chemical dosing section followed by cartridge filtration; high pressure feed pumps and membrane vessels

c. Reject Management System (MVRE)- MVR is used to recompress the spent vapor to a higher pressure, or we can say it compress the low-pressure vapors equivalent to inlet steam pressure, resulting temperature rise. This means that the recompressed vapor can be used as the fresh supply of steam in conventional system. Heat of distilled condensate recovered in multistage flashing and exchanging its remaining heat for preheating of the feed product through plate type heat exchanger. Plate type Falling Film Evaporator is based on Plate type heat exchangers instead of conventional tube heat exchangers. Use of Plate Packs increases heating surface density to a much higher level and makes it compact in size and weight as compared to conventional evaporators. The shape of Plate Packs is specially developed for evaporation and condensing applications, which produces two types of flow ducts viz. tubular and corrugated. This design uses complete seam welding of Stainless-Steel plates and eliminates the use of seals and gaskets and improves overall heat transfer coefficient. Distributors are used to distribute feed material uniformly from top end of plate packs. Thus, feed material flows pack to pack in thin film form from the tube sides of Heat Exchanger and trickles down pack to pack. Concentrated feed and vapors produced in evaporation process exit together from the bottom of plate pack. This is then utilized in next effect.

4.3 Proposed Scheme of Treatment:

The filtrate from Activated Carbon Filter shall be taken to Ultra-Filtration system followed by the Reverse Osmosis system. RO permeate shall be reused or shall be used for recreational purpose.

All Filter backwash/ drain, UF backwash/UF reject water shall be collected and recycled back to the process.

RO rejects shall be sent to Reject Management system (RMS) to separate the left out moisture and recover the salt from the RO reject.

5.0 Acknowledgments

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